

申 报	系列：教师系列
	专业：经济学类
	职称：教授

业绩成果材料

（申报人的业绩成果材料包括论文、科研项目、获奖以及其他成果等）

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单位盖章：

核对时间：

华南农业大学制

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广东省教育厅

粤教高函〔2024〕9号

广东省教育厅关于公布 2023 年度广东省 本科高校教学质量与教学改革工程建设 项目立项名单的通知

各本科高校：

按照《广东省教育厅关于开展 2023 年度广东省本科高校教学质量与教学改革工程项目申报推荐工作的通知》等文件安排，经学校遴选推荐、省教育厅审核、公示等环节，现将 2023 年省本科高校质量工程建设项目立项名单予以公布，并就有关事项通知如下：

一、立项情况

确定立项建设省级实验教学示范中心 28 个、校企联合实验室 29 个、科产教融合实践教学基地 71 个、大学生社会实践教学基地 35 个、教师教学发展中心 5 个、课程教研室 167 个、现代产业学院 32 个、专项人才培养计划 62 项、高等教育教学改革项目 802 项。具体立项名单见附件。

二、项目管理

（一）本次公布项目均为省质量工程建设项目，建设项目经学校组织建设、校内结题并通过省教育厅统一组织项目验收后，正式认定为省级项目。

（二）项目正式实施前，请确保已对项目建设目标、建设举措、预期成果、建设进度安排等进行科学论证，论证专家应不少于5人，且至少有三分之一来自外校。论证后的目标、任务等将作为项目结题验收时的重要依据。

（三）项目日常管理由学校主管部门负责，学校应统筹做好项目中期检查、校内结题验收等工作。校内结题时，邀请校外评审专家人数不得少于专家总人数的三分之二。满足以下条件的项目，经学校正式申请，可以参与省教育厅统一组织的项目验收：

- 1.项目已完成立项时设定的主要建设任务和目标；
- 2.项目已取得标志性建设成果，且该成果已在教学实践中得到检验和有效应用；
- 3.已按照要求完成项目校内结题；
- 4.符合当年度省统一验收规定的其他条件。

各校质量工程建设项目管理情况，将作为学校下一年度项目立项限额的参考依据。

（四）项目实施过程中，其名称、建设内容（任务）、建设目标、建设周期、主要负责人、预期成果等发生重大变更的，需由时任项目负责人在发生变更后及时提出，经学校项目主管部门审核后由学校正式来函说明原因；擅自变更上述内容的，验收评定

时列为不通过。

三、其他事项

（一）2023 年度各校向省教育厅推荐并获得立项的项目，学校须将项目校内评审、推荐及论证相关材料妥善保存，留底备查。

（二）各校要统筹本校“冲补强”提升计划资金及自有资金对立项项目予以资助，项目获得学校资助情况将作为项目结题验收时重要考察因素之一。如项目建设中取得具有推广价值的优秀成果，请及时形成书面材料报省教育厅高教处。

联系人：李成军、窦月月，联系电话：020-37626882。

附件：2023 年度广东省本科高校教学质量与教学改革工程建设项目立项名单



公开方式：依申请公开

校对人：李成军

529	高等教育教学改革项目	华南农业大学	基于创新能力培养的电路实验教学改革研究与实践	王建华
530	高等教育教学改革项目	华南农业大学	基于新兽医人才培养的分子生物学课程改革与实践探索	沈永义
531	高等教育教学改革项目	华南农业大学	生成式人工智能背景下公共管理类课程教学模式创新研究与实践	张小娟
532	高等教育教学改革项目	华南农业大学	新林科视域下森林培育学知识图谱课程建设与教学模式创新	邱权
533	高等教育教学改革项目	华南农业大学	三产融合理论在茶叶生物化学中的应用	张钰乾
534	高等教育教学改革项目	华南农业大学	新时代高校思政课“问题链”教学模式研究 —聚焦习近平新时代中国特色社会主义思想概论课程	何艳玲
535	高等教育教学改革项目	华南农业大学	基于竞赛和创新方法提升大学生创新能力的实证研究	易欣
536	高等教育教学改革项目	华南农业大学	一流专业建设背景下风景园林规划设计课程教学改革研究	陈崇贤
537	高等教育教学改革项目	华南农业大学	基于真人图书馆的“就业创业+思政”融合课程体系改革研究 —以法学专业为例	李玮舜
538	高等教育教学改革项目	华南农业大学	低碳农业背景下基于一特两驱教学模式的环境土壤学课程体系构建	林庆祺
539	高等教育教学改革项目	华南农业大学	思政视角下国际金融课程教学改革与实践	周超
540	高等教育教学改革项目	南方医科大学	基于OBE理念的高精度医学胜任力数字评价体系的构建探索	陈戈煜
541	高等教育教学改革项目	南方医科大学	融合课程思政的有机化学课程教学综合改革实践	程魁
542	高等教育教学改革项目	南方医科大学	以科研素养与实践能力提升为导向的法医物证学第二课堂建设实践	陈雪冰
543	高等教育教学改革项目	南方医科大学	基于知识图谱的医学统计学课程混合式教学改革实践	关颖
544	高等教育教学改革项目	南方医科大学	生物医学工程学科背景下基于理论与实践相结合的机器学习课程教学改革探索	黄美燕
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547	高等教育教学改革项目	南方医科大学	“探究式—小班化”教学模式在护理伦理学混合式教学改革中的应用研究	李娟
548	高等教育教学改革项目	南方医科大学	基于教师成长需求的口腔医学教师教学发展体系构建与实践	凌朝辉
549	高等教育教学改革项目	南方医科大学	构建外科非技术能力培养的数字化情境模拟创新课程体系	李薇
550	高等教育教学改革项目	南方医科大学	基于临床诊断学一流课程建设的“双视角双环节”早期临床人文实践活动的设计、实施与评估	李晓丹
551	高等教育教学改革项目	南方医科大学	加强“智能+教育”融合，助力岗位胜任力培养 —构建超声医学本科多维立体教学模式的探索与实践	李颖嘉

高校金融类课程的思政建设价值、难点与路径

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摘 要:随着金融市场的不断演变和发展,高校金融教育必须适应新的需求,将思政教育融入课程中显得尤为重要。这不仅有助于培养具有正确价值观和社会责任感的金融人才,还能促进行业的可持续发展。然而,在实施过程中可能会遇到一些难点,如思政元素与金融课程的融合难度较大,学生参与度较低,资源整合不足以及评价体系不完善等问题。为了有效推进高校金融类课程的课程思政建设,该文建议采取一系列措施,包括根据金融类课程的特点设置合理的课程思政目标,深入挖掘金融类课程中的思政元素,创新教学方法和手段,加强师资队伍建设和完善评价体系等。通过这些举措,可以提高人才培养质量,为金融行业的健康发展提供有力支持。

关键词:课程思政;金融类课程;思政元素;金融人才;金融行业

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Abstract: With the continuous evolution and development of the financial market, it is imperative for financial education in higher education institutions to adapt to emerging needs. The integration of ideological and political education into the curriculum stands out as particularly crucial. This integration serves a dual purpose: cultivating financial professionals with sound values and a strong sense of social responsibility, while also propelling the sustainable growth of the industry. Nevertheless, challenges may arise in implementation, including the intricacy of harmonizing ideological and political elements with financial coursework, limited student engagement, resource integration gaps, and an imperfect evaluation system. To effectively advance the ideological and political construction of financial courses in higher education, this paper advocates a series of targeted measures. These include establishing well-defined ideological and political objectives tailored to the unique features of financial courses, and conducting a thorough exploration of the ideological and political components within them. Furthermore, the adoption of innovative teaching methods and techniques, along with the fortification of faculty expertise, are essential. Finally, the refinement of the evaluation system is pivotal. Through the implementation of these measures, the quality of talent cultivation can be enhanced, providing robust support for the sound development of the financial industry. This holistic approach will not only foster a generation of financially adept professionals but also contribute to the broader social and economic well-being.

Keywords: curriculum ideology and politics; finance courses; ideological and political elements; financial talents; financial industry

当今社会,金融行业的发展不仅关系到经济的发展,也关系到社会的稳定和发展。金融从业人员需要处理客户的财务,管理大量资金,他们的决策和行为对个人和社会产生深远影响。缺乏伦理和社会责任感的金融从业人员可能导致不道德行为,如欺诈、贪污、洗钱等,从而损害了金融市场的公平性和稳定性。高校作为人才培养的重要基地,应该承担起培养具有社会责任感的金融人才的责任。然而,一些高校在金融类专业课程教学中,往往只注重金融专业知识的传授,忽视了价值引领和职业素养的培养,这导致一些

学生对金融行业的社会责任和价值认识不清,缺乏正确的职业道德观念。课程思政是指“以构建全员、全程、全课程育人格局的形式将各类课程与思想政治理论课同向同行,形成协同效应,把‘立德树人’作为教育的根本任务的一种综合教育理念”^[1]。“其主要形式是将思想政治教育元素,包括思想政治教育的理论知识、价值理念以及精神追求等融入到各门课程中去,潜移默化地对学生的思想意识、行为举止产生影响”^[2]。它是高校教育的一项重要工作,旨在培养学生的思想政治觉悟,使他们不仅仅具备专业知识和技能,还

基金项目:国家自然科学基金青年科学基金项目“实物期权视角下中国企业在‘一带一路’沿线国家的投资价值:形成机制与影响因素研究”(72102075);广东省高等教育教学改革项目“思政视角下国际金融课程教学改革与实践”(粤教高函[2023]24号);广东省高等教育教学改革项目“数智时代下基于社会情绪和创新能力提升的课程教学改革——组织行为学为例”(粤教高函[2024]30号)

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能够树立正确的世界观、人生观和价值观。因此,将课程思政融入高校金融类课程建设,具有重要的现实意义和理论价值。

一 高校金融类课程的思政建设价值

(一) 高校金融类课程的思政建设有助于培养具有正确价值观的金融人才

金融行业的特殊性决定了从业人员必须具备高度的道德操守和职业素养,这不仅关系到金融行业的健康发展,也关系到整个社会的经济稳定。历史上的金融危机和一系列的金融丑闻表明,缺乏伦理和道德约束的行为会对整个金融市场产生毁灭性的影响^[3]。例如,2008年的次贷危机部分原因就是一些金融机构过于追求短期利润,忽视了对借款人和投资者的道德责任。通过在金融类课程中开展课程思政,可以帮助学生树立正确的价值观,明确职业责任和义务。这种教育方式的重要性在于,它可以引导学生理解金融行业的基本规则和职业道德,培养他们的风险意识和合规意识。同时,课程思政也可以帮助学生了解金融行业的社会责任,培养他们的社会责任感和公益意识。在当今社会,金融行业的复杂性和多变性日益凸显,这也增加了从业人员犯错的风险。因此,通过课程思政提高学生的职业素养,不仅有助于防范金融风险,也可以增强学生对金融行业的认同感和归属感,这对于培养具有正确价值观的金融人才具有重要意义。

(二) 高校金融类课程的思政建设有助于培养金融人才的社会责任感

随着经济的发展和全球化的推进,金融行业在现代社会中的地位日益重要。然而,近年来,金融行业也暴露出了许多问题和风险,如金融欺诈、市场操纵、风险失控等,给社会带来了严重的负面影响^[4]。这些问题不仅损害了金融行业的声誉,也对整个社会的经济稳定造成了威胁。因此,培养具有社会责任感的金融人才显得尤为重要。课程思政融入高校金融类课程建设可以通过强调金融职业道德、社会责任、法律法规等方面的内容,引导学生树立正确的价值观和职业观,增强他们的社会责任感和风险意识。例如,社会责任方面,可以引导学生了解金融行业的社会责任和义务,培养他们的公益意识和社会责任感。在法律法规方面,可以引导学生了解金融行业的法律法规和监管要求,培养他们的合规意识和法律素养。同时,课程思政也可以鼓励学生参与社会公益事业和金融服务实践,培养他们的社会责任感和实践能力。例如,可以组织学生参与金融志愿服务、金融扶贫等活动,让他们在实践中了解金融行业的社会责任和价值。

(三) 高校金融类课程的思政建设有助于提高学生综合素质

高校金融类课程的课程思政建设可从多方面提高学生综合素质。首先,金融类课程思政建设注重培养创新能力。金融行业变化快速,要求从业人员具备较强的创新能力。课程思政通过思想启蒙、教育引导,激发学生的创新意识和创新潜能,培养他们在金融领域具备创新精神和创新能力,提高学生的综合素质。其次,金融类课程思政建设注重思辨能力的培养。金融领域涉及复杂的经济、法律、政策等多方面知识,要求金融从业人员具备较强的思辨能力和逻辑思维能力。课程思政通过引导学生深入思考、独立分析问题,培养学生的思辨能力,使其具备较强的逻辑推理和问题解决能力,为学生综合素质的提高奠定基础。最后,金融类课程思政建设注重全球视野和国际竞争力。金融领域是国际化程度较高的行业,要求金融从业人员具备全球视野和国际竞争力。课程思政通过传递国际化理念,引导学生了解国际金融市场、国际金融规则和国际金融动态,培养学生具有较强的国际视野和国际竞争力,提高学生的综合素质。综上所述,金融类课程思政建设不仅强调传授金融知识,更注重培养学生的社会责任感、创新能力、思辨能力和国际视野,从而提高学生的综合素质,使其具备更强的适应能力和竞争力。

(四) 高校金融类课程的思政建设有助于促进金融行业的可持续发展

金融行业的可持续发展已成为全球共同关注的话题。然而,传统的金融类课程往往忽视了这方面的内容,导致学生对于金融行业的可持续发展缺乏了解和认识。课程思政融入高校金融类课程建设可以通过引入绿色金融、社会责任投资等方面的知识和理念,引导学生关注金融行业的可持续发展和社会责任。例如,在绿色金融方面,可以引导学生了解绿色金融的概念、原则和实践,培养他们的环保意识和可持续发展观念。在社会责任投资方面,可以引导学生了解社会责任投资的理念和实践,培养他们的社会责任意识和投资决策能力。同时,课程思政也可以通过强调风险管理、合规经营等方面的内容,提升学生的风险意识和合规意识,为金融行业的可持续发展做出贡献。例如,在风险管理方面,可以引导学生了解风险管理的概念、原则和方法,培养他们的风险意识和风险管理能力。在合规经营方面,可以引导学生了解金融行业的法律法规和监管要求,培养他们的合规意识和法律素养。

二 高校金融类课程的思政建设难点

(一) 融合难度较大

金融类专业课程本身的知识体系较为庞大,涵盖了金融领域的各个方面,如货币、信用、利率、金融市场、金融机构和货币政策等。这类课程具有较强的专业性和实践性,注重培养学生的理性思维和分析能力。而思政课程则更注重学生的价值观、道德观和思想政治素质的培养。两者的教学目标和教学内容存在一定的差异,在融合中,需要平衡专业性和思政性,以确保学生既能够获得必要的金融专业知识,又能够接受思想政治教育,这对教师来说是一个挑战。此外,金融类课程常常需要涉及多个学科领域,如经济学、法律、统计学等,这类课程的教师需要具备丰富的专业知识和技能,而思政课程的教师需要具备较高的政治素质和理论水平。两者的教师素质要求不同,要将思政要素融入这些学科,需要具备跨学科的能力和视野,才能将两者有效地融合在一起,这对于教师来说可能较为复杂。

(二) 学生参与度较低

高校金融类课程的课程思政建设中,学生参与度较低是一个普遍存在的问题。首先,金融类课程通常注重理论知识的传授和专业技能的培养,课程内容较为严密和繁重。学生面临课业压力较大,时间相对有限,因此在思政教育方面的积极参与度相对较低。其次,金融类课程通常侧重于数学、统计学等实用性较强的知识和技能^[5]。相较于这些实践性较高的内容,思想政治教育的教学内容较为抽象,学生可能缺乏对其重要性的认识,从而减少了参与的积极性。再次,现代社会信息发达,学生的知识获取途径多样化。在金融类课程中,学生可能更倾向于通过互联网、社交媒体等途径获取与课程内容相关的信息,而对传统的思政教育渠道产生抵触情绪,减少了参与的意愿。此外,金融类课程通常以讲授为主,互动教学相对较少。教学模式的单一和缺乏趣味性可能导致学生对课堂内容的兴趣不高,减少了他们的参与欲望。最后,学生的个体差异也是影响参与度的重要因素。一些学生可能因性格内向、自身兴趣偏向具体实践等,对思政教育课程的参与度较低。

(三) 资源整合不足

高校金融类课程的课程思政建设资源整合不足是一个复杂的问题,受到多种因素的综合影响。首先,高校内部存在专业分工和学科壁垒,这在一定程度上妨碍了思政建设资源的整合。金融类课程通常由不同学科的教师授课,包括经济学、数学、统计学等领域,导致教师 and 部门之间的合作和信息共享变得复杂。思政建设需要跨学科合作,但专业分工可能导致资源整

合不足。其次,缺乏明确的政策和指导也是一个重要问题。金融类课程的思政建设可能缺乏明确的政策支持和鼓励。如果学校领导层没有提出明确的指导方针,学校和教师可能没有动力主动投入资源进行思政建设。政策和指导的不明确性可能导致资源整合不足,因为没有足够的动力来推动这一进程。再次,资源有限性也是一个挑战。金融类课程的思政建设可能需要额外的教材、培训、研究支持等资源,而这些资源通常是有限的。学校可能需要在不同领域的思政建设之间竞争有限的资源,这可能导致资源整合不足的情况。最后,教师和管理者之间可能存在认知差异。有时教师和学校管理者对于课程思政建设的目标和重要性有不同的认知。这种认知差异可能导致资源整合不足,因为各方没有达成一致的共识,难以在思政建设方面形成共同的愿景和计划。因此,解决这一问题需要学校制定明确政策、加强跨学科合作、提供更多资源支持,并加强教师培训,以促进高校金融类课程的课程思政建设。

(四) 评价体系不完善

高校金融类课程的课程思政建设评价体系不完善体现在多个方面。首先,这些课程的评价体系通常缺乏明确的指标和标准,难以量化和客观地评估学生在思想政治教育方面的成果。思政建设评价过于主观,容易受到个体评价者主观偏见的影响,因此缺乏客观性和可比性^[6]。其次,金融领域具有独特的专业性和复杂性,需要特定的评价标准。然而,评价体系可能未能充分考虑金融领域的特定教育目标和要求。金融类课程需要培养学生的专业知识和技能,同时也需要强调道德和伦理价值观的培养,但评价体系可能未能平衡这两个方面的要求。再次,完善的评价体系应该包括反馈和改进机制,以便及时纠正问题并提高思想政治教育的质量。然而,金融类课程的评价体系可能缺乏这些机制,导致问题难以被及时发现和解决。这可能导致思政建设的滞后,不断积累问题。此外,金融领域是一个不断发展和演变的领域,与经济、科技和社会变革密切相关。评价体系可能未能与金融行业的最新趋势和需求相匹配,导致教育内容和方法与实际需求不符。师资力量也是一个关键问题,金融类课程需要具备丰富实践经验的师资力量,以便教授实际应用和案例分析。然而,评价体系未能考虑师资力量的充足性和专业性,这可能会对教育质量产生负面影响。最后,思想政治教育应该鼓励学生积极参与,思考和表达自己的观点。但评价体系可能未提供足够的机会和激励,以鼓励学生积极参与。这可能导致学生对思政教育缺乏积极性和主动性。

三 高校金融类课程的思政建设路径

(一) 设置合理的课程思政建设目标

高校金融类课程的课程思政建设目标应该紧密结合金融类课程的特点和思政教育的要求,注重培养学生的综合素质和社会责任感。具体而言,可以从以下几个方面来设置合理的课程思政建设目标:首先,课程目标应该注重培养学生的金融职业素养。金融行业是一个高度专业化、高风险性的行业,要求从业人员具备较高的职业素养和道德水平。因此,在金融类课程中,应该注重培养学生的诚信意识、风险意识、职业操守等金融职业素养,帮助学生树立正确的价值观和职业道德观。其次,课程目标应该注重增强学生的社会责任感。金融行业与社会经济发展密切相关,金融从业人员需要具备强烈的社会责任感和担当精神。因此,在金融类课程中,应该引导学生关注社会热点问题,了解金融行业的社会责任,培养学生的社会责任感和担当精神。最后,课程目标应该注重提高学生的综合能力。金融类课程不仅要求学生掌握基本的金融知识,还需要具备实践能力、创新能力等综合能力。因此,在课程思政建设中,应该注重实践教学环节,引导学生在实践中运用所学知识,提高学生的综合能力和竞争力。综上所述,高校金融类课程的课程思政建设目标应该紧密结合金融类课程的特点和思政教育的要求,注重培养学生的金融职业素养、增强学生的社会责任感和提高学生的综合能力。同时,也需要根据实际情况不断调整和完善课程目标,确保课程思政建设的实际效果。

(二) 挖掘金融类课程的思政元素

金融类课程中蕴含着丰富的思政元素,可以通过深入剖析金融市场的运行规律和特点、介绍金融行业的职业道德规范和职业操守、分析金融领域的案例、引入国家金融政策和法规以及介绍金融领域的创新和发展趋势等方式进行挖掘。具体可以从以下几个方面展开:首先,教师可以引导学生了解金融市场的公平、公正和诚信原则,让学生认识到这些原则是金融市场稳定和发展的基石。通过案例分析,可以让学生了解金融市场中存在的风险和挑战,引导学生树立正确的市场意识和风险意识^[7]。其次,教师可以介绍金融行业的职业道德规范和职业操守,引导学生了解金融行业的基本规范和道德标准。通过引入实际案例,可以让学生了解职业道德的重要性,培养学生的职业道德素养。再次,教师可以通过分析金融领域的案例,引导学生了解金融风险的危害和防范方法。通过讨论和分析,可以让学生深入了解金融风险的种类和形成原因,培养学生的风险意识和风险管理能力。最后,教师可以引入国家金融政策和法规,引导学生了解金融行

业的监管和治理机制。通过介绍相关政策和法规,可以让学生了解金融行业的监管体系和治理机制,培养学生的法治意识和规则意识。

(三) 创新教学方法和手段

创新教学方法和手段是高校金融类课程中进行课程思政建设的重要途径。通过引入案例分析、情景模拟、线上线下结合以及实践教学等方法,可以更好地将思政元素融入到金融类课程的教学过程中,提高教学效果和学生的学习体验。首先,案例分析。可以让学生通过对真实案例的分析,深入了解金融市场的运行规律和特点,同时培养学生的思辨能力和解决问题的能力。在案例分析中,可以引导学生挖掘案例中的思政元素,如职业道德、诚信经营等,让学生在实操中体验和理解这些元素的重要性。其次,情景模拟。可以创设真实的金融场景,让学生模拟实际操作,提高学生对金融知识和思政内容的实践应用能力。通过模拟股市交易、银行贷款审批等情景,可以让学生在实操中感受和理解思政元素,如风险管理、公平公正等。再次,线上线下结合。可以利用现代信息技术手段,将线上教学和线下教学相结合,提高教学效果和学生的学习体验。通过在线课程、网络互动平台等方式,可以让学生随时随地学习金融知识和思政内容,同时增加教学的趣味性和互动性^[8]。最后,实践教学。可以组织实践活动,让学生亲身体验金融领域的实际工作,加深对金融知识和思政内容的理解和掌握。通过实地考察、实习实训等方式,可以让学生在实际工作中感受和理解思政元素,如职业操守、团结协作等。总之,创新教学方法和手段可以更好地将思政元素融入到高校金融类课程中,提高教学效果和学生的学习体验,培养出具有高尚职业道德和良好思想政治素质的金融人才。

(四) 加强师资队伍建设

加强师资队伍建设是高校金融类课程中进行课程思政建设的重要保障。教师的思政意识和教学能力对于将思政元素融入到金融类课程的教学过程中至关重要,因此必须采取有效措施提高教师的思政意识和教学能力。首先,需要加强教师的思政培训。通过组织专题培训、研讨会等方式,让教师深入了解思政教育的内涵和价值,增强教师的思政意识和责任感^[9]。这些培训可以让教师更好地理解思政教育的目标和任务,掌握将思政元素融入到金融类课程教学中的方法和技巧。同时,还可以邀请专家学者进行讲座和指导,提高教师的思政理论水平和实践能力。其次,需要提高教师的教学能力。教学能力是教师的核心竞争力,也是将思政元素融入到金融类课程教学中的关键。可

以通过组织教学观摩、教学竞赛等方式,让教师互相学习、交流经验,提高教师的教学水平和能力。这些活动可以让教师了解最新的教学理念和方法,掌握有效的教学策略和技巧,提高教学效果和学生的学习体验。此外,还需要加强教师的实践能力。金融领域是一个实践性很强的领域,要求教师具备丰富的实践经验和实际操作能力。通过组织教师实践、挂职锻炼等方式,让教师深入了解金融领域的实际运作,提高教学的实践性和应用性。这些实践活动可以让教师更好地了解金融行业的发展趋势和实际需求,更好地将理论知识与实践相结合,提高教学的针对性和实用性。

(五) 完善评价体系

完善评价体系是高校金融类课程进行课程思政建设的重要环节。通过建立科学、全面的评价体系,可以更好地衡量学生的综合素质和能力,促进课程思政建设的深入开展。首先,需要将思政元素纳入评价指标,明确思政教育的目标和要求。在金融类课程的评价指标中,应该注重思政元素的融入,引导学生注重思政内容的学习和实践。可以增加思政元素的权重,让学生更加注重思政教育,提高思政教育的效果。同时,还需要明确思政教育的目标和要求,让学生清楚地了解思政教育的重要性和必要性,从而更好地发挥思政教育的引领作用。其次,需要注重过程评价,关注学生在学习过程中的表现和进步。在金融类课程的教学过程中,应该注重学生的表现和进步,通过课堂表现、作业完成情况、小组讨论等,及时发现和纠正学生的不足之处。同时,还需要关注学生的学习兴趣和动力,通过积极的教学方式和手段,激发学生的学习兴趣和动力,提高学生的学习效果和兴趣。此外,还需要采用多种评价方式,综合评价学生的学习成果和能力。在金融类课程的评价过程中,应该采用多种评价方式,如考试、论文、实践报告等,全面了解学生的学习情况和实践能力^[10]。这样可以更加客观地评价学生的学习成果和能力,提高评价结果的准确性和公正性。最后,需要建立有效的反馈机制,及时将评价结果反馈给教师和学生,引导教师和学生不断改进和提高。通过建立有效的反馈机制,可以让教师和学生及时了解学生的学习情况和教学效果,从而及时调整教学策略和方法,提高教学效果和学生的学习体验。同时,还可以让学生更加了解自己的不足之处,从而更加努力地学习和提高自己的综合素质和能力。

四 结束语

金融行业的发展对高校金融类课程的教学提出了新的挑战和要求。课程思政作为一种综合教育理念,将思想政治教育元素融入到金融类课程中,对于

培养具有社会责任感和正确价值观的金融人才具有重要意义。然而,高校金融类课程的课程思政建设面临着诸多难点,如融合难度大、学生参与度低、资源整合不足和评价体系不完善等。为了克服这些难点,高校需要采取一系列措施来推动金融类课程的课程思政建设。首先,需要设置合理的课程思政建设目标,紧密结合金融类课程的特点和思政教育的要求,注重培养学生的综合素质和社会责任感。其次,挖掘金融类课程中的思政元素,通过深入剖析金融市场的运行规律和特点、介绍金融行业的职业道德规范和职业操守等方式,将思政元素融入到教学过程中。此外,创新教学方法和手段,引入案例分析、情景模拟、线上线下结合以及实践教学等方法,可以提高教学效果和学生的学习体验。同时,加强师资队伍建设,提高教师的思政意识和教学能力,为课程思政建设提供重要保障。最后,完善评价体系,建立科学、全面的评价体系,可以更好地衡量学生的综合素质和能力,促进课程思政建设的深入开展。综上所述,高校金融类课程的课程思政建设具有重要的现实意义和理论价值,有助于提高金融类课程的教学质量和效果,培养出更多具有综合素质和社会责任感的金融人才,为金融行业的可持续发展作出贡献。

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国家自然科学基金资助项目批准通知

(包干制项目)

周超 先生/女士:

根据《国家自然科学基金条例》、相关项目管理办法规定和专家评审意见,国家自然科学基金委员会(以下简称自然科学基金委)决定资助您申请的项目。项目批准号: 72102075, 项目名称: 实物期权视角下中国企业在“一带一路”沿线国家的投资价值: 形成机制与影响因素研究, 资助经费: 30.00万元, 项目起止年月: 2022年01月至 2024年 12月, 有关项目的评审意见及修改意见附后。

请您尽快登录科学基金网络信息系统(<https://isisn.nsf.gov.cn>), **认真阅读《国家自然科学基金资助项目计划书填报说明》并按要求填写《国家自然科学基金资助项目计划书》(以下简称计划书)**。对于有修改意见的项目,请您按修改意见及时调整计划书相关内容;如您对修改意见有异议,须在电子版计划书报送截止日期前向相关科学处提出。

请您将电子版计划书通过科学基金网络信息系统(<https://isisn.nsf.gov.cn>)提交,由依托单位审核后提交至自然科学基金委。自然科学基金委审核未通过者,将退回的电子版计划书修改后再行提交;审核通过者,打印纸质版计划书(一式两份,双面打印)并在项目负责人承诺栏签字,由依托单位在承诺栏加盖依托单位公章,且将申请书纸质签字盖章页订在其中一份计划书之后,一并报送至自然科学基金委项目材料接收工作组。纸质版计划书应当保证与审核通过的电子版计划书内容一致。**自然科学基金委将对申请书纸质签字盖章页进行审核,对存在问题的,允许依托单位进行一次修改或补齐。**

向自然科学基金委提交电子版计划书、报送纸质版计划书并补交申请书纸质签字盖章页截止时间节点如下:

1. **2021年10月22日16点:** 提交电子版计划书的截止时间(视为计划书正式提交时间);
2. **2021年10月29日16点:** 提交修改后电子版计划书的截止时间;
3. **2021年11月5日16点:** 报送纸质版计划书(其中一份包含申请书纸质签字盖章页)的截止时间

4. 2021年11月25日16点：报送修改后的申请书纸质签字盖章页的截止时间。

请按照以上规定及时提交电子版计划书，并报送纸质版计划书和申请书纸质签字盖章页，未说明理由且逾期不报计划书或申请书纸质签字盖章页者，视为自动放弃接受资助；未按要求修改或逾期提交申请书纸质签字盖章页者，将视情况给予暂缓拨付经费等处理。

附件：项目评审意见及修改意见表

国家自然科学基金委员会

2021年10月12日

教育部司局函件

2025年度教育部人文社会科学研究 一般项目立项通知书

华南农业大学 周超同志：

您申报的《数字化转型赋能企业研发国际化：作用机制、影响因素与政策优化研究》项目，经专家评审和面向社会公示，现正式批准为2025年度教育部人文社会科学研究规划基金项目。

项目批准号：**25YJA630131**

立项时间：2025年11月29日

批准经费：**10**万元

立项后《申请评审书》即成为有约束力的协议，请您及项目责任单位按照《教育部人文社会科学研究项目管理办法》（教社科〔2006〕2号）承担相应责任并执行以下规定：

1.项目负责人要按照《申请评审书》填写的研究内容及研究计划开展项目研究，坚持正确的政治方向、价值取向、研究导向，弘扬优良学风，遵守学术规范，扎实开展研究工作，着力推出精品力作，确保项目按期保质保量完成。所有出版或发表的项目研究成果，须在显著位置标明“教育部人文社会科学研究项目”字样和项目批准号。

2.请按照《高等学校哲学社会科学繁荣计划专项资金管理办法》（财教〔2021〕285号）以及国家有关科研经费管理制度，合理合规使用经费，提高经费使用效益。

3.教育部人文社科研究项目自批准之日起，研究周期一般为3年，特殊情况可申请延期1-2年。须在规定日期前按照《教育部人文社会科学研究项目成果鉴定和结项办法》的规定程序和要求申请结项，并提交《教

育部人文社会科学研究项目终结报告书》及有关结项材料。

4.实施周期三年以上的项目须接受一次中期检查，请在项目管理平台按照相关提示提交中期检查表。教育部人文社科研究项目实行定期清理制，本年度立项的项目清理截止日为 2030 年 9 月 30 日。

5.确需对项目重要事项进行变更的，请通过“教育部人文社会科学研究管理平台·中后期管理系统”在线进行，不需提供纸质审批材料，审批结果以系统显示为准。变更审批按照如下规定执行：变更项目负责人或项目责任单位、改变项目名称、研究内容有重大调整、改变最终研究成果形式等事项，项目责任单位在系统中审核后，由我司审批；在研究方向不变、不降低预期目标的前提下，调整研究思路或研究计划，以及因身体原因或不可抗拒因素自行申请终止或撤销项目，项目责任单位在系统中审核后，提交我司备案；调整各类项目的课题组成员，不超过项目研究最长期限（5 年）的延期申请，由项目责任单位直接审批。

6.被终止项目的负责人 3 年内不得申报或者参与申报教育部项目，被撤销项目的负责人 5 年内不得申报或者参与申报教育部项目。被撤销或终止的项目，项目负责人所在高校负责追回已拨经费或已拨剩余经费，由学校计划内财务账户原渠道返回教育部账户。

7.根据评审专家意见，部分课题名称做了修改，请以立项通知为准。

以上规定，项目负责人及所在高校应严格遵守。如有异议，可以不接受资助（书面提出申请），立项协议自行废止。



广东省哲学社会科学规划专项小组

粤社科规专通〔2023〕31号

广东省哲学社会科学规划 2023 年度 青年项目立项通知书

周超同志：

经专家评审及省哲学社会科学工作领导小组审批，您申报的广东省哲学社会科学规划 2023 年度青年项目《人民币汇率双向波动背景下我国农业产业链的外汇风险评估与应对策略研究》获准立项，批准号：GD23YYJ26，资助经费 2.0 万元，第一次拨款 1.4 万元，预留经费 0.6 万元。请于 6 月 28 日前登录广东省哲学社会科学规划项目管理平台认真填写立项回执，并通过责任单位审核后提交省社科规划专项小组。

填写立项回执后，项目申请书即成为立项协议，对项目负责人及其所在单位具有约束力。项目负责人所在单位须对立项协议的履行承担保证责任。项目负责人及所在单位须了解和执行以下规定：

1.课题组须学习并遵守《广东省哲学社会科学规划项目管理办法》。对于出现违规行为的，省社科规划专项小组依据《广东省哲学社会科学规划项目管理办法》的相关规定进行处理。

2.立项项目经费不再追加。课题组如不接受，省社科规划专项小组将撤销该项目立项。而立项经费一经接受，课题组将不得以资助经费不足为由，擅自变更原设计的最终成果形式和内容。

3.项目经费分两次拨付，预留经费将在项目通过鉴定结项后拨付。拨款账号、开户行、户名如有变动，须以书面形式及时告知省社科规划专项小组，以便准确拨款。

4.项目研究过程中，如有变更项目负责人、延长完成时间、改变成果内容或形式、变更项目管理单位、变更或增补课题组成员、终止或撤销项目等重要事项，项目负责人或所在单位必须按要求填写《广东省哲学社会科学规划项目重要事项变更审批表》，及时报省社科规划专项小组审批。

5.项目成果的鉴定结项由省社科规划专项小组组织，实

行匿名鉴定制度。项目鉴定结项所需材料及装印要求，详见“广东社科规划”网站。

6.成果鉴定等级分为优秀、良好、合格和不合格四个等次。不合格者即未能通过结项，不予拨付预留经费。项目成果的最终鉴定等级均通过“广东社科规划”网站予以公布，并通知项目负责人所在单位。

以上规定，项目负责人及所在单位应严格遵守。如有异议，可不接受资助（在回执中注明），立项协议自行废止。

联系人：冯甜恬

电话：（020）83825078

地址：广州市天河北路 618 号广东社科中心 B 座 928

室

邮编：510635

广东省哲学社会科学规划专项小组

2023年6月28日



广东省哲学社会科学规划专项小组

粤社科规专通〔2025〕34号

广东省哲学社会科学规划 2025 年度 “构建中国哲学社会科学自主知识体系” 研究专项立项通知书

周超同志：

经审批，您申报的广东省哲学社会科学规划 2025 年度“构建中国哲学社会科学自主知识体系”研究专项《数字化赋能中国企业研发国际化的作用机制、影响因素与政策优化》获准立项，项目类别：“构建中国哲学社会科学自主知识体系”研究专项，批准号：GD25ST07，资助经费 3.0 万元，将分两次拨付至项目负责人所在单位账户，第一次拨款 2.7 万元，待通过结项鉴定后再拨付预留经费 0.3 万

元。

项目负责人及所在单位须了解和执行以下规定：

1. 课题组须学习并遵守《广东省哲学社会科学规划项目管理办法》《广东省省级财政社会科学研究项目资金的管理监督办法》。对于出现违规行为的，省哲学社会科学规划专项小组将依据相关规定进行处理。

2. 批准后的项目经费不再追加，课题组可以不接受。而一经接受，将不能以经费不足为由，擅自变更原设计的最终成果形式和内容。

3. 项目立项后，课题组须按申请书计划开展研究，聚焦知识创新、理论创新和方法创新，并深化对学术命题、学术思想、学术观点、学术标准、学术话语的学理性探索。研究过程中，如有变更项目负责人、改变成果内容或形式、变更项目管理单位、变更或增补课题组成员、终止项目或撤销项目、延期等重要事项，项目负责人或所在单位必须及时在广东省哲学社会科学规划项目管理平台申请变更，线上报省哲学社会科学规划专项小组审批。

4. 省社科规划项目成果为论文的，在公开发表时必须注明“广东省哲学社会科学规划项目（项目编号）”字样。成果（含阶段成果）为专著、研究报告的，未经省哲学社会科学规划专项小组组织专家鉴定或经鉴定但未获得通过，出版时不能标明“广东省哲学社会科学规划项目

（项目编号）”字样；如成果确实有先出版后鉴定结项的需要，必须先向省哲学社会科学规划专项小组提出书面申请，经批准后才能出版并标明“广东省哲学社会科学规划项目（项目编号）”字样；如未经鉴定或未向省哲学社会科学规划专项小组申请，自行出版并标明“广东省哲学社会科学规划项目（项目编号）”字样，省哲学社会科学规划专项小组不接受项目结项申请予以撤项处理。

5. 项目研究周期为3年，自立项通知书下达之日起计算。项目负责人及所在单位须在规定时间内向省哲学社会科学规划专项小组提交项目结项材料，在规定时间内不提交结项材料，将作撤项处理。结项所需材料、装印要求等具体事项，请登录广东社科规划网站“结项信息”栏目查看。

6. 成果鉴定等级分为优秀、良好、合格和不合格四个等次。通过结项的，将拨付预留经费。不合格即未能通过结项的，课题组需修改后半年内重新申请结项鉴定。仍不能通过的，将作撤项处理，不再拨付预留经费。

7. 被撤项的项目负责人五年内不得申报国家社科基金项目和省哲学社会科学规划项目。

以上规定，项目负责人及所在单位应严格遵守。如有异议，可不接受资助，立项协议自行废止。

联系人：冯甜恬，020-83825078

地址：广州市天河北路 618 号广东社科中心 B 座 928
室

邮编：510635

广东省哲学社会科学规划专项小组
广东省哲学社会科学规划领导小组办公室（代章）

2025 年 8 月 8 日

课题编号 2023GZQN25

广州市哲学社会科学发展“十四五”规划

2023 年度课题立项协议

甲方：广州市社会科学规划领导小组办公室/广州市社会科学界联合会

地址：广州市天河区龙口东路 363 号宝供大厦二楼

联系电话：020—89815149

法定代表人：曾伟玉

乙方：华南农业大学（单位）周超（课题负责人）

地址：广州市天河区五山路 483 号华南农业大学

课题负责人（签字）：周超

课题负责人手机号码：

课题负责人邮箱：

二〇二三年五月

一、经专家组评审、社会公示，报广州市社会科学规划领导小组审定，同意将乙方申请的课题《实现第二个百年奋斗目标新的赶考之路上需防范的重大风险研究：开放经济条件下我国农业领域的外汇风险》立为广州市哲学社会科学发展“十四五”规划2023年度羊城青年学人课题（课题编号：2023GZQN25）。本课题负责人周超，课题组成员廖婧琳、汪小雪、殷文瑜、陈沁雪。课题研究时间为2023年5月15日起至2025年5月15日。

二、该课题由甲方提供研究经费3万元。研究经费分两期下达：首期1.5万元，在协议书签订后拨付；后期1.5万元，在课题完成后，乙方向甲方提交结项申请和研究成果，由甲方组织专家鉴定合格后划拨。如乙方无故终止课题研究，按广州市社科规划课题管理办法的相关规定进行处理。

经费预算明细表			
序号	科目	预算金额 (万元)	预算支出内容
一	间接经费(小计)	0.9	/
1	管理费	0.18	
2	其他支出	0.72	
二	直接经费(小计)	2.1	/
1	资料费	0	
2	数据采集费	0	
3	会议费/差旅费/国际合作与交流费	1.5	
4	设备费	0	

5	专家咨询费	0	
6	劳务费	0.5	
7	印刷出版费	0	
8	其它支出	0.1	
总 额		3	

三、课题研究和结项要求

课题结项须满足以下基本条件之一：

1.以论文为最终研究成果的：论文至少发表1篇，为CSSCI扩展版来源或其他相同等级以上报刊文章；或者一般性论文至少发表2篇。

2.以研究报告为最终研究成果的：研究报告不少于2万字，课题成果的主要内容应获区级以上党委政府或市直有关部门吸收借鉴。

3.以专著为最终研究成果的：专著书稿字数不少于10万字，符合正式出版条件或已出版。

需提交的结项材料：①结题报告书；②课题申报书、课题立项协议复印件；③研究成果（论文或研究报告或专著书稿）；④佐证材料（职能部门采纳证明的复印件、期刊相关内容复印件等）。并发送以上材料电子版至广州市社科规划办邮箱gzsgbh@163.com。具体整理及装订要求参见结项当年广州市社科网公布的结项材料要求。

四、该课题的研究成果（在期刊发表或出版，或被相关部门采纳）应标注“广州市哲学社科规划 2023 年度课题”字样和课题编号。

五、课题组必须遵守《广州市哲学社会科学“十四五”规划课题管理办法》，认真开展课题研究，合理使用课题研究经费，保证恪守学术规范，不弄虚作假，保证取得预期研究成果。

六、《课题立项协议》一式三份，一份由甲方保存，一份由乙方保存，一份由乙方所在单位科研管理部门保存。

甲方：广州市社会科学规划领导小组办公室/广州市社会科学界联合会（盖章）

通讯地址：广州市天河区龙口东路 363 号宝供大厦二楼

市社科规划办/市社科联法定代表人或委托人（签字）：杨晓

日期：2023 年 5 月 15 日

乙方：华南农业大学（单位盖章）周超（课题负责人）

通讯地址：广州市天河区五山路 483 号华南农业大学

课题负责人所在单位法定代表人或委托人（签字）：刘雅红

日期：2023 年 5 月 15 日

任务书编号：2025A04J4601

广州市科技计划项目 任务书

项目名称：人民币双向波动背景下我国农业产业链的
外汇风险暴露特征及其影响因素

承担单位：华南农业大学

项目负责人：周超

计划类别：基础研究计划

专题名称：2025年度基础与应用基础研究专题

支持方向：青年博士“启航”项目

组织单位：华南农业大学

起止时间：2025-01-01 至 2026-12-31

主管处室：引进智力管理处（科技人才处）

广州市科学技术局制

二〇二五年

填写说明

1. 任务书甲方为广州市科学技术局；乙方为项目承担单位；丙方为项目组织单位。

2. 任务书基于项目申报书转换而成，请按照“广州科技GI（广州科技大脑）”提示在线填写核实，若存在不填写内容的栏目，请用“无”表示；任务书中的单位名称应为规范全称，并与单位公章一致。

3. 乙方与合作单位的合作协议自动从项目申报书中读取，如需变化调整，须待任务书签订后，按要求及时办理重大变更。

4. 乙方完成项目任务书在线填写，依次提交丙方和甲方审核确认后，按要求完成签章。具备电子签章条件的单位，在“广州科技GI（广州科技大脑）”完成任务书签署；不具备电子签章条件的单位，经与业务主管处室沟通对接后，可下载电子版项目任务书用A4纸双面打印装订签章，一式六份报甲方和丙方签章，其中甲方两份丙方两份，项目承担单位和项目负责人各一份。

5. 涉密项目请在“广州科技GI（广州科技大脑）”下载项目任务书模板，按保密要求离线填写报送。

6. 项目申报书是项目任务书填报的重要依据，未经甲方许可，乙方不得修改考核指标，调整主要研究内容。项目任务书将作为项目实施管理、验收结题和监督评估的重要依据。

7. 项目任务书中的“备注”，包括重要的必须补充的内容。

8. “广州科技GI（广州科技大脑）”是项目管理过程中重要通知和文书的电子送达平台，电子送达与书面送达具有同等法律效力。为确保电子送达渠道畅通，乙方和项目负责人应及时更新维护“广州科技GI（广州科技大脑）”的单位和个人信息。

9. 项目涉及科技伦理、科技安全（如临床研究、生物安全、信息安全等）和科技保密相关问题的，申报单位须严格执行国家有关法律法规和伦理原则，完成相关审查工作；项目负责人在项目任务书签订环节，须提供符合国家有关法律法规和伦理准则要求的审查

批准文件，项目承担单位负责审核批准文件的真实性和有效性。

广州市科技项目任务书2024-12-31

一、项目基本信息

项目 基本 信息	项目名称	人民币汇率双向波动背景下我国农业产业链的外汇风险暴露特征及其影响因素
	申请市财政科技经费	5(万元)
	研究期限	2（年）
项目 摘要	在人民币汇率双向波动日益显著和农业产业链供应链国际合作日益密切的背景下，本项目拟在区分农业产业链上游、中游、下游三个环节的基础上，首先，测度和分析我国农业产业链各环节的外汇风险暴露特征；然后，从产品策略、财务策略和运营策略三个维度分析创新能力、金融对冲和经营对冲等因素对我国农业产业链外汇风险暴露的影响。预计本项目可为增强我国农业产业链供应链安全和推动新阶段我国农业高质量发展提供新的经验和政策支持。	

二、项目单位情况

项目 承担 单位	单位名称	华南农业大学	统一社会信用代码	124400004554165634
	注册时间	1952-01-01	单位类型	高等院校
	注册地址	广东省广州市天河区五山路483号		
	办公地址 (联系地址)	广东省广州市天河区五山路483号		
	联系人	姓名	夏杰	
		手机号码	13711345768	
		电子邮箱	kjcgxk@scau.edu.cn	
	开户银行	广东广州工行五山支行		
	开户户名	华南农业大学		
银行账号	3602002609000310520			

注：如果办公地址（联系地址）等相关信息有变更，项目单位应当在变更之日起三个工作日内告知我单位变更后的地址。

三、项目负责人信息

姓名	周超	证件类型	身份证
证件号码		性别	男
出生日期		民族	汉族
国籍	中国	学历	博士研究生
学位	博士	学位授予国家 (或地区)	中国
职务	教师	职称	副高级
所学专业	公司金融与投资学	手机号码	
办公电话	020-85283551	电子邮箱	

四、项目经费信息

本项目总投入：¥（5）万元，其中，市财政科技经费：¥（5）万元，自筹经费：¥（0）万元。

经费下达计划			
资金来源	小计	市财政科技经费	自筹经费
2025	5	5	0
总计	5	5	0

（单位：万元）

注：本专题纳入“包干制”，市财政科技经费按市科技计划项目经费“包干制”相关规定执行。

五、预期代表性成果

项目负责人在项目实施期内，以该项目作为资助项目获得以下5种情形之一且经费使用符合规定的，由组织单位审核后通过验收。

（一）项目实施期内，以第一作者/通讯作者发表论文1篇或以上（须标注资助项目编号）；

（二）项目实施期内，以第一完成人申请或授权专利、软件著作权1项或以上；

（三）项目实施期内，获省级以上科技计划项目或人才项目支持1项或以上；

（四）项目实施期内，获省级以上科技奖励（含列入获奖团队成员名单）1项或以上；

（五）项目实施期内，获得职称晋升。

六、备注

专题补充约定条款：

甲方对未履行勤勉尽责义务的相关责任主体，自作出处理结论之日起，依照法律法规规定或任务书约定实施惩戒5年，取消相关责任主体申报市科技计划项目、申领市科技计划项目经费的资格。

预期代表性成果需在实施期内获得。

项目承担单位（乙方）及项目负责人承诺书

承诺书

本单位/本人作为广州市科技计划项目承担单位/项目负责人，将严格遵守广州市科技计划管理相关规定，严格履行自身责任，加强对项目组人员及合作单位的管理，在此郑重承诺：

（一）确保与本项目有关的全部材料真实、合法、有效，未侵犯其他方知识产权等权利，不存在多头申报、重复申报行为；

（二）严格遵守《广州市科技创新条例》《广州市科技计划项目管理办法》《广州市科技计划项目经费管理办法》《广州市科技计划科技报告管理办法》等相关规定，实施项目和经费管理；

（三）严格遵守国家、省、市关于科研诚信、科技伦理、科技安全（如临床研究、生物安全、信息安全等）和科技保密的有关法律、法规，相关政策以及各项规定，加强项目实施过程中的科研诚信、科技伦理、科技安全（如临床研究、生物安全、信息安全等）和科技保密管理，恪守科研道德准则。

如有违反，本单位/本人愿意接受相关部门做出的各项处理决定，包括但不限于终止项目、停拨经费、核减经费、追回经费，取消一定期限广州市科技计划项目申报资格，记入科研失信行为数据库，将不良行为向社会公开等。

项目承担单位：华南农业大学

日期：2024年12月25日

项目负责人：周超

日期：2024年12月24日

电子送达确认书

告知事项	1. 为便于本项目承担单位（受送达人）及时收到相关通知和文书，请受送达人知悉项目管理过程中重要通知和文书（如：项目验收结果通知书、配合结余资金审计通知书、项目终止通知书等）的送达方式是通过“广州科技GI（广州科技大脑）”平台（以下简称平台）电子送达。 2. 确认的送达方式适用于行政执法全过程程序。 3. 请受送达人在项目管理过程中及时、主动查看平台相应模块，以免错过相关通知和文书。 4. 此电子送达方式，以发送方设备显示发送成功视为送达。但接收方证明其到达平台的日期与发送方对应系统显示发送日期不一致的，以受送达人证明到达平台的日期为准。
电子送达	受送达人同意：“广州科技GI（广州科技大脑）”是项目管理过程中重要通知和文书的电子送达平台，电子送达与书面送达具有同等法律效力。为确保电子送达渠道畅通，受送达人同意“广州科技GI（广州科技大脑）”作为电子送达平台。 “广州科技GI（广州科技大脑）”网站地址：https://gzsti.gzsi.gov.cn。
受送达人确认	我单位已阅读本确认书的告知事项，接受并确认了上栏送达方式。 受送达人：华南农业大学 2024年12月25日
备注	

任务书签署

甲乙丙三方根据《广州市科技计划项目管理办法》《广州市科技计划项目经费管理办法》《广州市科技计划科技报告管理办法》等有关文件规定，以及有关法律、政策和管理要求，签署本任务书。	
签订地点：广州市越秀区	
广州市科学技术局（甲方）：广州市科学技术局 局项目经办人：陈良 联系电话：83124036 责任处室负责人：洪雪妍	
项目承担单位（乙方）：华南农业大学 二级部门：华南农业大学经济管理学院 项目负责人：周超 项目经费汇入账号 账户名：华南农业大学 账号：3602002609000310520 开户银行：广东广州工行五山支行	
2024年12月31日	
组织单位（丙方）：华南农业大学 项目经办人：夏杰	
2024年12月25日	
2024年12月27日	

广东省科学技术厅文件

粤科农字〔2024〕200号

广东省科学技术厅关于下达“百千万工程” 农村科技特派员第二轮重点派驻人员 名单和任务清单的通知

各有关地市科技局，各农村科技特派员派出单位：

为深入贯彻落实省委关于实施“百县千镇万村高质量发展工程”有关决策部署，进一步推动农村科技特派员下乡助力城乡区域协调发展，按照《广东省农村科技特派员科技助力百县千镇万村高质量发展行动计划（2023-2026）》《广东省科学技术厅关于落实“百千万工程”开展新一轮农村科技特派员重点派驻任务（2024-2026年）选派管理工作的通知》要求，在首轮农村科技特派员3年帮扶重点派驻任务即将到期的情况下，按照“镇村

发榜+地市组织选派+省级认定支持”的新型组织管理方式，第二轮共选派 2960 名农村科技特派员组建 984 个团队，“一对一”结对科技帮扶全省涉农县（市、区）辖内 984 个乡镇。现将“百千万工程”农村科技特派员第二轮重点派驻人员名单和任务清单印发给你们：

一、各地市科技管理部门、派出单位应按照《广东省科学技术厅关于落实“百千万工程”开展新一轮农村科技特派员重点派驻任务（2024-2026 年）选派管理工作的通知》（粤科函农字〔2023〕1649 号）、《广东省科学技术厅关于印发〈农村科技特派员助力“百千万工程”管理工作指引（2024-2026 年）〉的通知》（粤科函农字〔2024〕192 号）有关要求，做好本辖区、本单位农村科技特派员组织、管理、考核和验收相关工作。

二、各农村科技特派员团队应聚焦落实省委实施“百千万工程”决策部署，在省、市科技管理部门指导下，扎根基层一线，配合驻镇帮扶工作队开展科技帮扶工作，农村科技特派员团队纳入驻镇帮扶工作队（乡镇人民政府）统一管理，本轮帮扶任务周期为 3 年。

三、农村科技特派员承担重点派驻任务经费保障，按年度以科技支撑“百千万工程”专项资金下达到各地市，各地市科技管理部门要加强管理，压实责任，专款专用，提高资金使用效率，应将专项资金拨付到相关派出单位，用于开展科技帮扶工作。

附件：“百千万工程”农村科技特派员第二轮重点派驻人员
名单和任务清单



（联系人及电话：赵清泉，020-83163909）

810	KTP20240810	连南瑶族自治县 涡水镇	广东省林业科学研究院	郭文冰、龙永彬、曾明	山苍子特色产业关键技术开发与应用
811	KTP20240811	阳山县秤架瑶族 乡	华南农业大学（负责人、成员1）、广 东省农业科学院（成员2）	张晓萍、肖南、张曼	发掘地方文旅资源，提升地区农 产品加工技术和产业升级
812	KTP20240812	阳山县大岗镇	仲恺农业工程学院	梁关生、梁佳勇、谢勇	蔬菜、茶叶产业高效提质关键生 产技术的集成应用
813	KTP20240813	阳山县杜步镇	广东省农业科学院（负责人、成员 1）、华南理工大学（成员2）	胡晓丹、胡建广、李理	水稻玉米蔬菜轮作种植及新品种 引进示范与推广
814	KTP20240814	阳山县黄全镇	广东省农业科学院（负责人、成员 1）、广东省航空护林站（广东省林火 卫星监测中心）（成员2）	王振江、钟建武、林运通	蚕桑与特色农产品种养加工及森 林防灭火技术示范应用
815	KTP20240815	阳山县江英镇	广东科贸职业学院	刘延清、王慧蕾、李海华	江英镇特色农产品提质增效示范 推广
816	KTP20240816	阳山县黎埠镇	华南农业大学	张轶婷、陈日远、杨小龙	黎埠镇特色农产品高效、轻简 化、智慧化生产技术推广
817	KTP20240817	阳山县岭背镇	广东财贸职业学院	梁捷、朱婉宁、陈敏	漆艺非遗文创应用与推广
818	KTP20240818	阳山县七拱镇	华南农业大学(负责人、成员1)、广 东生态工程职业学院（成员2）	安静、周超、孙迎韬	七拱镇农产品产业增效及“农文 旅”产业发展模式探索
819	KTP20240819	阳山县青莲镇	华南农业大学	卢三妹、汤晓波、钟杨生	农文体旅融合产品的开发与推广
820	KTP20240820	阳山县太平镇	广东省农业科学院（负责人、成员 2）、广州华夏职业学院（成员1）	刘维、夏爱玲、巫浩翔	高端丝苗米新品种的推广与产业 化
821	KTP20240821	阳山县小江镇	华南农业大学	赵普艳、冯淑杰、宋建文	优质蔬菜新品种引进及产业化示 范与推广
822	KTP20240822	阳山县阳城镇	华南农业大学	刘辉、叶昌东、张程	农产品销售直播及文旅产业品牌 推广
823	KTP20240823	阳山县杨梅镇	广东科贸职业学院	黎宜斌、黄贺美、刘爱平	柑橘种植技术推广与农文旅融合 发展示范
十三、潮州市					

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1	中国农业产业链的外汇风险暴露特征及其影响因素	中国农村经济 出版年：2024 卷期：24 9 页码：121-141 文献号： 文献类型：	第一作者	T2类	华南农业大学 经济管理学院	CSSCI, 北大核心	无	无	CNKI 总引：12

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1	Does global diversification promote or hinder green innovation? Evidence from Chinese multinational corporations	TECHNOVATION 出版年: 2024 出版日期: JAN 卷期: 129 页码: - 文献号: 102905 文献类型: Article	第一作者	T2 类	华南农业大学 经济管理学院	SSCI	IF2-year=10.9 IF5-year=12.4 (2024)	管理学 1 区 Top 期刊: 是 OA 期刊: 否 (2025)	SCI 核心合集 总引: 11

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1	Global diversification, host-country environments, and corporate philanthropic giving: Evidence from Chinese multinational corporations	TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 出版年: 2022 出版日期: NOV 卷期: 184 页码: - 文献号: 122025 文献类型: Article	第一作者	T2 类	华南农业大学 经济管理学院	SSCI	IF2-year=12.0 IF5-year=12.0 (2022)	管理学 1 区 Top 期刊: 是 OA 期刊: 否 (2022)	SCI 核心合集 总引: 9

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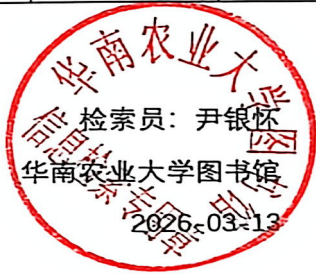
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1	Home country digital finance development and post-entry internationalization speed of emerging market SMEs: Empirical evidence from China	INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS 出版年: 2024 出版日期: JAN 卷期: 91 页码: - 文献号: 103016 文献类型: Article	第一作者	A 类	华南农业大学 经济管理学院	SSCI	IF2-year=9.8 IF5-year=9.8 (2024)	经济学 2 区 Top 期刊: 是 OA 期刊: 否 (2025)	SCI 核心合集 总引: 25

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1	Internationalization and donations allocated to domestic market: Evidence from emerging market SMEs	RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE 出版年: 2025 出版日期: MAR 卷期: 75 页码: - 文献号: 102787 文献类型: Article	第一作者	A 类	华南农业大学 经济管理学院	SSCI	IF2-year=6.9 IF5-year=6.6 (2024)	经济学 2 区 Top 期刊: 是 OA 期刊: 否 (2025)	SCI 核心合集 总引: 1

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1	Does investing in countries along the belt and road reduce firms' downside risk? Evidence from Chinese manufacturing firms	FINANCE RESEARCH LETTERS 出版年: 2023 出版日期: DEC 卷期: 58 页码: - 文献号: 104399 文献类型: Article	第一作者	A 类	华南农业大学 经济管理学院	SSCI	IF2-year=7.4 IF5-year=7.6 (2023)	经济学 2 区 Top 期刊: 是 OA 期刊: 否 (2023)	SCI 核心合集 总引: 2

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1	The effects of outward FDI and export on firm productivity in emerging markets: Evidence from matching approach	ECONOMICS LETTERS 出版年: 2020 出版日期: OCT 卷期: 195 页码: - 文献号: 109462 文献类型: Article	第一作者	B 类	华南理工大学 经济与金融学院	SSCI	IF2-year=2.097 IF5-year=2.009 (2020)	经济学 4 区 Top 期刊: 否 OA 期刊: 否 (2020)	SCI 核心合集 总引: 9

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1	实物期权理论视角下中国企业在“一带一路”沿线国家的投资价值	财贸研究 出版年：2025 卷期：36 1 页码：- 文献号： 文献类型：	第一作者	B 类	华南农业大学 经济管理学院	CSSCI, 北大核心	无	无	CNKI 总引：6

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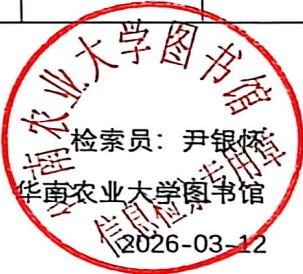
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1	Home country environment and the downside risk implications of multinationality: Empirical evidence from Chinese SMEs	JOURNAL OF MULTINATIONAL FINANCIAL MANAGEMENT 出版年: 2023 出版日期: SEP 卷期: 69 页码: - 文献号: 100810 文献类型: Article	第一作者	B 类	华南农业大学 经济管理学院	SSCI	IF2-year=2.9 IF5-year=4.3 (2023)	经济学 3 区 Top 期刊: 否 OA 期刊: 否 (2023)	SCI 核心合集 总引: 7

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1	CEO characteristics, multinationality and downside risk: evidence from Chinese multinational corporations	MULTINATIONAL BUSINESS REVIEW 出版年：2023 出版日期：MAR 20 卷期：31 1 页码：111-135 文献类型：Article	第一作者	B 类	华南农业大学 经济管理学院	SSCI	IF2-year=2. 2 IF5-year=3. 4 (2023)	管理学 4 区 Top 期刊：否 OA 期刊：否 (2023)	SCI 核心合集 总引：8

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1	How Does Capital Intensity Affect the Relationship between Outward FDI and Productivity? Micro-evidence from Chinese Manufacturing Firms	EMERGING MARKETS FINANCE AND TRADE 出版年: 2021 出版日期: NOV 14 卷期: 57 14 页码: 4004-4019 文献类型: Article	第一作者	B 类	华南理工大学 经济与贸易学院	SSCI	IF2-year=4. 859 IF5-year=3. 46 (2021)	经济学 4 区 Top 期刊: 否 OA 期刊: 否 (2021)	SCI 核心合集 总引: 14

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中国农业产业链的外汇风险暴露特征及其影响因素*

周 超^{1,2} 王家兴¹ 米运生¹

摘要：本文收集 2016—2022 年中国农业上市企业数据和人民币汇率波动数据，并根据人民币汇率双向波动特征构建不对称测度模型，在此基础上研究中国农业产业链的外汇风险暴露特征及其影响因素。本文发现：农业产业链各环节的外汇风险暴露在人民币汇率不同波动方向上呈现不对称特征；外汇风险暴露在农业产业链上中下游的分布呈递增趋势；农业产业链在人民币汇率贬值时呈现有利的外汇风险暴露；在人民币汇率升值时则呈现不利的外汇风险暴露，且主要体现在加工流通环节。本文进一步分析创新能力、金融对冲和经营对冲对中国农业产业链各环节外汇风险暴露的影响，发现：当人民币汇率升值时，要素供给环节企业的创新能力和金融对冲显著降低其外汇风险暴露，种植养殖环节企业的经营对冲显著降低其外汇风险暴露，加工流通环节企业的创新能力、金融对冲和经营对冲显著降低其外汇风险暴露；当人民币汇率贬值时，要素供给环节企业的经营对冲显著降低其外汇风险暴露，种植养殖环节企业的金融对冲显著增加其外汇风险暴露，加工流通环节企业的金融对冲和经营对冲分别显著降低和增加其外汇风险暴露。本文认为，在人民币汇率双向波动背景下，认识和防范中国农业产业链的外汇风险既要考虑人民币汇率双向波动特征，也要考虑农业产业链各环节的异质性。

关键词：农业产业链 外汇风险暴露 农业风险管理 人民币汇率

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一、引言

自 1971 年以美元为中心的布雷顿森林体系崩溃以来，世界各国汇率制度逐渐由固定汇率制转向浮

*本文研究得到国家自然科学基金青年科学基金项目“实物期权视角下中国企业在‘一带一路’沿线国家的投资价值：形成机制与影响因素研究”（编号：72102075）、广东省哲学社会科学规划青年项目“人民币汇率双向波动背景下我国农业产业链的外汇风险评估与应对策略研究”（编号：GD23YYJ26）和广州市哲学社会科学发展“十四五”规划 2023 年度羊城青年学人课题“实现第二个百年奋斗目标新的赶考之路上需防范的重大风险研究：开放经济条件下我国农业领域的外汇风险”（编号：2023GZQN25）的支持。感谢匿名审稿专家的宝贵意见，但文责自负。本文通讯作者：王家兴。

动汇率制。浮动汇率制下，一国货币的汇率主要由市场供求关系决定，汇率弹性显著增强。在开放的经济条件下，一国货币的汇率频繁波动会广泛影响该国经济的各领域，农业部门也不例外。农业是一国经济的基础，但具有显著的弱质性特征，抗风险能力弱（罗必良等，2008），因此，浮动汇率制下，与其他领域相比，深入分析人民币汇率波动对农业领域的影响尤为重要。

中国自1994年1月1日开始实施有管理的浮动汇率制度，并随后实行一系列人民币汇率形成机制市场化改革。例如，2005年7月21日中国人民银行发布《关于完善人民币汇率形成机制改革的公告》，决定实行以市场供求为基础、参考一篮子货币进行调节、有管理的浮动汇率制度；2006年1月4日中国人民银行决定通过引入询价交易方式和做市商制度，对人民币汇率中间价的形成机制进行改革；2015年8月11日中国人民银行决定做市商参考上日银行间外汇市场收盘汇率，向中国外汇交易中心提供中间价报价，进一步完善人民币兑美元汇率中间价报价，即“8·11”汇改。经过多次分阶段的人民币汇率形成机制市场化改革，中国有管理的浮动汇率制度日趋成熟，人民币汇率弹性显著增强。特别是“8·11”汇改以来，人民币汇率由过去以单边升值为主转变为双向波动的“新常态”。

在人民币汇率弹性不断增强的同时，中国农业领域对外开放程度稳步提升，农业市场主体参与全球分工的广度与深度不断提升，农业产业链供应链国际合作日益密切。据农业农村部的数据，2023年中国农产品贸易额已达3360.62亿美元，与2001年的279亿美元相比，增长了约11倍，年均增速约11.98%；同时，农产品贸易额的全球排名从2001年的第十一位跃升至2023年的第二位，其中，农产品进口额为2359.18亿美元，位居全球第一，农产品出口额为1001.45亿美元，位居全球第五^①。在此背景下，人民币汇率波动日益成为影响中国农业产业链不可忽视的风险因素。

党的二十大报告提出，要加快建设农业强国，加强重点领域安全能力建设，确保粮食、能源资源、重要产业链供应链安全。2023年中央“一号文件”进一步指出，要立足国情农情，体现中国特色，建设供给保障强、科技装备强、经营体系强、产业韧性强、竞争能力强的农业强国。农业产业链的外汇风险与农业产业链供应链的韧性和安全水平密切相关，事关农业高质量发展与农业强国建设。党的二十届三中全会进一步强调，要健全提升产业链供应链韧性和安全水平制度。农业产业链的外汇风险与农业产业链供应链的韧性和安全水平密切相关，事关农业高质量发展与农业强国建设。因此，深入研究农业产业链的外汇风险，对政府及农业企业认识和防范农业领域风险、确保农业产业链供应链安全以及推动新阶段中国农业高质量发展和农业强国建设均具有重要的理论意义和现实意义。

现有学者针对农业领域的外汇风险展开了一系列的研究。Schuh（1974）最早关注汇率波动对农业领域的影响，并认为汇率波动是影响农业相关领域的重要因素。现有国外研究主要关注汇率波动对农业领域宏观层面的影响。Pick（1990）分析了汇率波动对美国农业贸易流量的影响，发现有7个发达国家的汇率波动对美国农业贸易流量的影响不显著，而有3个发展中国家的汇率波动对美国农业贸易流量的影响显著。Cho et al.（2002）以1974—1995年10个发达国家的双边贸易流量为样本，探讨汇率不确定性对农业贸易增长的影响，发现汇率不确定性对农业贸易产生了显著的负面影响，且与其他部门相比，汇率不

^①资料来源：中华人民共和国农业农村部，<http://zdsccx.moa.gov.cn:8080/nyb/pc/index.jsp>。

确定性对农业贸易的负面影响更为显著。Gonzales and Varona (2023) 分析了 1980—2021 年秘鲁农产品进口的影响因素, 发现秘鲁索尔的实际有效汇率上升有利于农产品进口。Vatsa and Baek (2024) 运用新西兰 2000—2021 年农产品贸易的季度数据进行研究, 发现汇率波动可对农产品进出口产生显著的短期影响。

国内相关研究主要探讨了汇率波动对农业经济增长、农产品价格、农业贸易等宏观层面的影响。例如, 曹永峰 (2007) 研究中国 1980—2005 年人民币实际汇率与农业经济增长之间的关系, 发现人民币实际汇率升值对农业经济增长并未产生显著影响。刘艺卓 (2010) 研究 2005—2008 年人民币汇率波动对中国农产品进出口价格的影响, 发现人民币汇率变动对中国农产品进口价格具有较完全的传递, 而对国内农产品价格的传递则不完全。刘悦和刘合光 (2021) 基于 1992—2016 年中国食用油进口贸易数据, 研究人民币汇率变动对中国食用油进口量的影响, 发现人民币汇率变动与食用油价格负相关, 与食用油进口数量正相关。陈瑶雯等 (2023) 建立标准动态 CGE 模型, 利用 2020 年中国经济数据模拟人民币汇率贬值对中国出口产业结构的影响, 发现人民币汇率贬值会对农业进口量产生不利影响, 而对农业出口量产生有利影响。较少研究从微观农业企业层面探讨外汇风险问题, 仅黄祖辉和陈立辉 (2011) 利用 352 家涉外农业企业数据, 从企业竞争力视角研究中国农业企业外汇风险管理行为, 发现具有较强融资能力或技术优势的农业企业更倾向于使用运营策略应对外汇风险, 而具有较高国际化程度的农业企业更倾向于采用金融衍生工具应对外汇风险。

现有研究虽为中国农业领域外汇风险管理提供了一些有借鉴意义的研究成果, 但仍存在以下方面值得进一步研究。第一, 现有研究尚未考虑人民币汇率双向波动背景下中国农业领域的外汇风险问题。现有研究指出, 在汇率双向波动显著增强的情况下, 市场主体在汇率升值和贬值两个维度的外汇风险具有不对称性, 若忽视这种不对称特征, 将难以有效测度和管理外汇风险 (Koutmos and Martin, 2003)。

“8·11” 汇改以来, 人民币汇率双向波动不断增强。在此背景下, 有必要结合人民币汇率双向波动特征, 从不对称视角研究中国农业领域在人民币汇率升值和贬值两个维度的外汇风险。第二, 现有研究尚未从农业产业链视角研究农业领域的外汇风险。随着中国农业经济发展, 农业领域已初步形成上游要素供给、中游种植养殖、下游加工流通各环节分工协作、有机衔接的产业链 (周月书和王婕, 2017)。在中国农业产业链不断延伸和整合的背景下, 有必要从产业链视角研究农业领域外汇风险, 以便根据中国农业产业链各环节的异质性特征, 构建有针对性的外汇风险管理体系, 实现中国农业领域有效的外汇风险管理。第三, 现有研究主要从宏观层面分析中国农业领域的外汇风险问题, 鲜有研究以微观农业企业为研究对象。农业企业作为农业领域的重要市场主体, 直接参与国内外市场竞争, 是受汇率波动影响最直接的对象, 也是应对汇率波动的重要市场主体 (黄祖辉和陈立辉, 2011)。为实现中国农业领域外汇风险的有效管理, 有必要基于微观农业企业研究农业领域外汇风险。

为此, 本文考虑人民币汇率双向波动特征, 区分农业产业链上游要素供给、中游种植养殖、下游加工流通三个环节, 以农业企业为研究对象, 研究中国农业产业链的外汇风险问题。首先, 本文对人民币汇率双向波动背景下中国农业产业链外汇风险暴露的特征及其影响因素展开理论分析; 其次, 收集 2016—2022 年中国农业上市企业数据和人民币汇率波动数据, 构建模型进行计量分析; 最后, 根据研究结论提出政策启示。

本文的创新点或贡献体现在以下三方面。第一，本文根据“8·11”汇改以来人民币汇率双向波动特征，构建不对称模型测度中国农业产业链在人民币汇率升值和贬值两个维度的外汇风险暴露，可为人民币汇率双向波动背景下认识和管理中国农业领域的外汇风险提供新的思路和证据。第二，本文以产业链为研究视角，通过区分农业产业链上游要素供给、中游种植养殖、下游加工流通三个环节研究中国农业领域的外汇风险，有助于认识外汇风险在中国农业产业链的分布特征，并根据农业产业链各环节的异质性特征构建有针对性的外汇风险管理体系，最终提高中国农业产业链供应链的韧性和安全水平。第三，本文以微观农业企业为研究对象，从产品策略、财务策略和运营策略三个角度分别探讨企业创新能力、金融对冲和经营对冲等因素如何影响中国农业产业链各环节企业外汇风险暴露，不仅可为认识和管理中国农业领域外汇风险提供有力的微观基础，还可为有效管理中国农业领域外汇风险提供有针对性的政策启示。

二、理论分析

（一）农业产业链的基本构成

产业链是产业部门间在组织形式、空间布局与供需流动等方面的“对接机制”，是实现产业价值创造与增值的核心路径，对整个产业的发展起到了至关重要的作用（吴金明和邵昶，2006）。农业产业链是在现代农业发展理念指导下，将产业链概念应用于农业领域的一种新型产业体系。农业产业链以市场为基础，通过有效整合资金、土地、劳动力等生产要素，确保农产品生产、加工、运输和销售等环节的有机衔接（周月书和王婕，2017）。在促进农业产业融合经营、提高农产品附加值和农民收入、推动乡村产业振兴等方面，农业产业链发挥着不可忽视的作用（程华等，2019）。根据现有文献（唱晓阳和姜会明，2016；韩江波，2018；程华等，2019），农业产业链可划分为上游要素供给、中游种植养殖、下游加工流通三个环节。其中：上游进行初次价值创造并传递给中游；中游利用上游提供的生产要素进一步创造价值，将中间产品传递给下游；下游对中游提供的中间产品进行加工，制得最终产品，并进行产品的流通和最终销售。各环节之间存在着次序依赖关系，通过物质和信息的交换、传递，形成有机整体，并通过消费者价值认同的反向激励机制，实现产业链的价值增值（唱晓阳和姜会明，2016；韩江波，2018）。图1显示了农业产业链运作机制与各环节的具体构成。

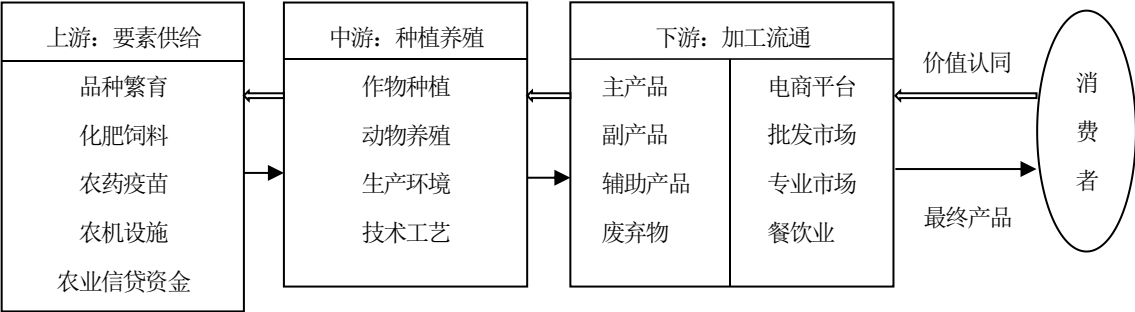


图1 农业产业链

注：单线箭头指农业产业链从上游到下游的要素传递机制，双线箭头指农业产业链从下游到上游的价值激励机制。

农业企业是农业产业链的重要参与者和管理者。一方面，农业企业通过参与农业产业链的各个环节，以获得更多的商业机会和竞争优势；另一方面，农业企业也可以通过管理和优化农业产业链，提高整个产业链的效率和效益，推动农业产业的可持续发展（韩江波，2018）。在实践中，农业企业在产业链中扮演供应商、生产商、销售商等角色，提供农产品或服务，并通过技术创新、管理模式创新等方式，优化产业链的运作和管理，提高整个产业链的竞争力和盈利能力（唱晓阳和姜会明，2016）。换言之，农业企业在农业产业链的运作、管理和发展中具有重要作用，农业企业与农业产业链之间是相互依存、相互促进的关系。由于中国农业现代化、产业化和组织化的发展仍处于初级阶段，农业产业链的组织模式以农业产业的龙头企业为主导（程华等，2019）。因此，本文以微观农业企业为对象研究中国农业产业链的外汇风险暴露问题。

（二）中国农业产业链的外汇风险暴露特征

外汇风险暴露是指汇率波动对经济主体的影响程度（Adler and Dumas, 1984）。外汇风险暴露主要有三个来源：一是交易风险暴露，指汇率波动对已形成的特定商业交易产生的影响；二是折算风险暴露，指汇率波动对外币资产和负债的影响；三是经济风险暴露，指汇率波动通过影响产品的价格、成本 and 市场需求，进而对市场主体产生影响（Martin and Mauer, 2003）。理论上，开放经济环境下，一国经济中的任一经济主体均会面临显著的外汇风险暴露。在人民币汇率双向波动背景下，中国农业产业链外汇风险暴露具有以下三方面的特征。

1. 农业产业链外汇风险暴露在人民币汇率不同波动方向上的不对称特征。农业企业是构成农业产业链的市场主体，农业企业在人民币汇率不同波动方向上的外汇风险暴露将决定农业产业链外汇风险暴露特征。现有研究指出，在汇率弹性显著增强的情况下，企业外汇风险暴露在人民币汇率不同波动方向上可能存在不对称特征。首先，企业进入或退出国际市场的行为存在不对称。例如，企业的竞争者通常在本币贬值时进行国际市场扩张，但在本币升值时却不愿意退出国际市场（Baldwin and Krugman, 1989）。企业进入或退出国际市场的行为差异将导致企业在本币贬值时因竞争者的增加而获得较小的收益增量，而在本币升值时因竞争者不退出市场而承受较大的收益损失。其次，企业存在不对称对冲行为。管理者会根据预期汇率波动方向改变对冲的时间和规模，且当预期外汇风险不利于企业时，更积极地采取对冲措施（Bodnar et al., 1998）。最后，企业存在不对称产品定价行为。例如，企业在本币升值时通常通过提高价格来降低汇率波动的不利影响，而在本币贬值时则极少对价格进行调整（Bodnar et al., 2002；鞠荣华和李小云，2006）。

“8·11”汇改以来，人民币汇率弹性显著增强，双向波动已成新常态。在此背景下，中国农业企业的外汇风险暴露将因上述原因在人民币汇率的不同波动方向上呈现显著的不对称特征。由于农业企业是构成农业产业链的市场主体，农业企业的外汇风险暴露不对称性将导致农业产业链各环节的外汇风险暴露在人民币汇率不同波动方向上呈现不对称特征。

2. 农业产业链外汇风险暴露的分布特征。汇率波动对商品价格的影响是导致市场经营主体外汇风险暴露的重要原因（Martin and Mauer, 2003）。根据产业链理论，上游环节的商品作为生产资料，构成下游环节产成品的成本（Gardner, 1975）。当上游产品价格发生变化时，这种变动会沿着产业链向

下游传递,进而导致下游产品价格发生相应变动(丁存振和肖海峰,2022)。在产业链各环节之间缺乏风险共担机制的情况下,上游在面临外部冲击所导致的价格波动时,该环节的市场主体会基于自身利益考虑而采取向下游放大价格波动的行为,从而导致最初的价格波动在到达产业链最后一个环节时被放大(辛贤和谭向勇,2000)。在这种情形下,汇率波动导致产业链上游的价格波动会向下游传递,并呈现外汇风险沿着产业链传递和放大的特征。

农业领域的价格冲击主要呈现由农业产业链上游向下游传导的特征,并且价格冲击能够由农业产业链上游向下游充分传导(Goodwin and Holt, 1999)。中国农业产业链仍处于初级发展阶段,产业化组织尚处于较低水平,各环节的市场主体之间缺乏紧密的联系,这导致中国农业领域未能真正形成风险共担、利益均分的产业链条,农业产业链各环节会基于自身利益考虑而采取向下游环节放大价格波动的行为(张利庠和张喜才,2011)。因此,当人民币汇率波动引起中国农业产业链上游生产资料价格波动时,农业产业链上游的价格波动会沿着产业链向下游传递和放大,从而导致农业产业链上中下游三个环节的外汇风险暴露呈现依次增大的特征。

3.农业产业链外汇风险暴露的利弊特征。人民币汇率升值,意味着以外币计价的中国农产品出口价格上升,以人民币表示的国外进口农产品价格下降,即中国农产品价格在国际市场变得相对昂贵,而进口农产品价格在国内市场则变得相对低廉(李小云和李鹤,2005)。这将削弱国内农产品在国际和国内市场上的竞争力,使得农产品出口量下降和进口量增加,从而导致国内农业企业收益下降。因此,人民币汇率升值会给农业企业带来不利影响。而当人民币汇率贬值时,以外币表示的中国农产品出口价格下降,以人民币表示的国外农产品进口价格上升,即国内农产品价格在国际市场变得相对低廉,而进口农产品价格在国内市场则变得相对昂贵(刘悦和刘合光,2021)。这将提高国内农产品在国际和国内市场的竞争力,使得农产品出口量上升和进口量下降,农业企业收益提高。可见,农业企业会受益于人民币汇率贬值。因此,农业产业链在人民币汇率贬值时呈现有利的外汇风险暴露,在人民币汇率升值时则呈现不利的外汇风险暴露。

但是,农业产业链不同环节的外汇风险转移能力存在差异,这将导致人民币汇率波动对农业企业的上述影响在农业产业链不同环节存在差异。通常,农业产业链上游、中游和下游的外汇风险转移能力依次降低,这使得人民币汇率波动引起中国农业产业链上游的价格波动会沿着产业链向下游传递和放大(张利庠和张喜才,2011),进而导致产业链上游和中游能够有效地向下游转移人民币汇率升值的不利影响。换言之,农业产业链在人民币汇率升值时的不利外汇风险暴露更多地体现在下游加工流通环节。

(三) 中国农业产业链外汇风险暴露的影响因素

本文从微观企业层面剖析影响中国农业产业链外汇风险暴露的关键因素,具体从产品策略、财务策略和运营策略三方面探讨。

1.产品策略:创新能力。产品策略包括产品差异化、产品定价等,是企业应对外部环境不确定的重要方式(Loy and Weiss, 2019)。企业创新能力是产品策略能否有效应对外部环境不确定性的关键(Goel and Nelson, 2021)。创新能力强的农业企业通过投资于专有技术或品牌声誉等领域,能够提

升产品附加值和产品差异化程度，从而建立独特而稳固的市场地位，降低客户对产品价格的敏感度（Miller and Reuer, 1998）。因此，创新能力强的农业企业能够更灵活地调整定价策略以应对市场变化带来的风险。换言之，当面临汇率波动时，农业产业链中创新能力强的企业能够通过灵活调整定价策略，有效地将汇率波动产生的影响传递给客户，减轻汇率波动带来的冲击，维持更稳定的盈利水平，从而降低农业产业链的外汇风险暴露。

2. 财务策略：金融对冲。金融对冲是指企业通过期货、期权和外汇市场进行外汇远期、掉期、外币拆借与套期保值等操作以规避外汇风险的行为，是企业进行外汇风险管理的重要财务策略。金融对冲对农业企业外汇风险暴露可能存在两种影响。一方面，风险管理理论认为，用于风险管理目的的金融衍生品是进行风险管理的重要工具（Froot et al., 1993；陈俊等，2023）。农业企业可通过金融对冲工具对外汇风险进行管理，从而降低其外汇风险暴露（Das and Kumar, 2023）。另一方面，在实践中，金融对冲工具不仅可用于外汇风险管理，还可用于投机活动（Chernenko and Faulkender, 2011）。若农业企业使用金融对冲工具进行投机活动，其外汇风险暴露不仅无法降低，反而可能会增加。因此，农业产业链中的企业合理使用金融对冲将有助于降低农业产业链的外汇风险暴露，而不合理使用则无法降低农业产业链的外汇风险暴露。

3. 运营策略：经营对冲。经营对冲是指企业通过投入要素改变、生产转移等方式调整经营策略以降低外汇风险的对冲方式（Triantis, 2000），是企业进行外汇风险管理的重要运营策略。现有文献指出，跨国经营是企业进行经营对冲的主要方式，企业可通过跨国经营在全球范围设立子公司或寻求海外供应商的方式提高经营弹性，从而在汇率波动时利用分布在全球各地的经营网络灵活调整生产要素投入和生产经营计划，以应对外汇风险并降低企业外汇风险暴露（Kogut and Kulatilaka, 1994）。然而，跨国经营的经营对冲效果依赖于跨国布局的合理性，以及经理人的经营对冲意识和能力（Belderbos et al., 2014）。若企业跨国经营所涉及的国家之间经济环境差异较小且关联性较大，或者经理人缺乏经营对冲意识和能力，那么，跨国经营将无法产生理想的经营对冲效果，甚至可能增加企业外汇风险暴露（Ioulilianou et al., 2021）。因此，企业若能够合理进行跨国经营，将会产生显著的经营对冲效果，降低农业产业链的外汇风险暴露；而不合理的跨国经营将难以达到预期的经营对冲效果，无法显著降低农业产业链的外汇风险暴露。

三、研究设计

（一）外汇风险暴露测度模型

现有研究主要通过现金流量法和资本市场法来测度企业面临的外汇风险暴露。现金流量法是通过测度企业经营现金流量变动对汇率波动的敏感程度来衡量企业的外汇风险暴露水平（Hodder, 1982）。现金流量法以企业财务信息为基础，但企业披露财务信息的最短时间间隔为季度，数据上的限制使得现金流量法在实际应用中较少得到采用，难以在大样本研究中推广。资本市场法是通过企业股票收益率对汇率波动的敏感程度来测度企业外汇风险暴露（Adler and Dumas, 1984；Jorion, 1990）。资本市场法的基本思想是公司价值变动反映了公司未来现金流的现值变动，因此，可将公司价值变动作为公

司现金流变动的代理变量。由于上市公司股价变动数据与汇率波动数据在时间上容易匹配,适合在大样本研究中推广,因此,资本市场法在实际应用中得到广泛使用。在构建测度模型时,Adler and Dumas (1984)最早提出单因子模型,直接将公司价值对汇率变动的敏感性作为企业外汇风险暴露程度。后续研究主要通过增加市场因子、Fama 三因子等控制变量构建多因子模型,或区分汇率波动方向构建不对称模型等方式提高测度的精确性(Koutmos and Martin, 2003; Krapl, 2017)。

“8·11”汇改以来,人民币汇率双向波动已成新常态。在此背景下,农业企业外汇风险暴露在汇率不同波动方向上可能存在显著的不对称特征。因此,有必要区分人民币汇率的不同波动方向来测度企业外汇风险暴露。考虑到资本市场法在测度企业外汇风险暴露时的优势,本文在Jorion (1990)的双因子模型的基础上,参考Koutmos and Martin (2003)和Krapl (2017)的模型,构建以下模型测度中国农业产业链各环节企业在人民币汇率不同波动方向上的外汇风险暴露:

$$R_{i,t} = a_{0,i} + a_{1,i}D_{1,t} \times R_{e,t} + a_{2,i}D_{2,t} \times R_{e,t} + a_{3,i}R_{m,t} + \varepsilon_{i,t} \quad (1)$$

(1)式中: $R_{i,t}$ 表示企业 i 于第 t 月的股票超额收益率,即个股收益率减去无风险收益率,其中,个股收益率为考虑现金红利再投资的个股月度回报率,无风险收益率根据复利计算方法将定期整存整取的一年期利率转化为月度利率得到。 $R_{e,t}$ 为第 t 月人民币实际有效汇率的收益率,即第 t 月与第 $t-1$ 月的人民币实际有效汇率之差与第 $t-1$ 月人民币实际有效汇率的比值。 $R_{m,t}$ 为第 t 月的市场超额收益率,即市场收益率减去无风险收益率,其中,市场收益率为考虑现金红利再投资的沪深 A 股市场回报率。 $D_{1,t}$ 和 $D_{2,t}$ 为用于区分汇率升值和贬值的虚拟变量,具体来看:若 $R_{e,t} > 0$, $D_{1,t}$ 赋值 1, $D_{2,t}$ 赋值 0; 若 $R_{e,t} \leq 0$, $D_{1,t}$ 赋值 0, $D_{2,t}$ 赋值 1。 $D_{1,t} \times R_{e,t}$ 的系数估计值 $\hat{a}_{1,i}$ 反映企业 i 在人民币升值时的外汇风险暴露水平, $D_{2,t} \times R_{e,t}$ 的系数估计值 $\hat{a}_{2,i}$ 反映企业 i 在人民币贬值时的外汇风险暴露水平。 $R_{m,t}$ 的系数估计值 $\hat{a}_{3,i}$ 反映企业 i 对市场波动的反应程度。 $a_{0,i}$ 为常数项, $\varepsilon_{i,t}$ 为随机扰动项。

在下文分析中,本文先对 $R_{i,t}$ 、 $R_{e,t}$ 、 $R_{m,t}$ 等变量的原始数据进行 ADF 检验,避免出现伪回归。然后,再对所有企业逐一进行 ARCH LM 检验。若检验发现企业存在条件异方差问题,则使用 GARCH 模型进行评估,否则使用 Newey-West 估计法进行估计。

(二) 外汇风险暴露影响因素分析模型

为了检验企业创新能力、金融对冲和经营对冲对农业产业链外汇风险暴露的影响,本文构建如下模型:

$$FXE_i^k = \beta_0 + \beta_1 RD_i + \beta_2 FH_i + \beta_3 OH_i + \bar{r} Controls_i + \varepsilon_i \quad (2)$$

(2)式中: FXE_i^k 为企业 i 的外汇风险暴露水平。当 $k=1$, FXE_i^1 为企业 i 在人民币汇率升值时的外汇风险暴露水平; 当 $k=2$, FXE_i^2 为企业 i 在人民币汇率贬值时的外汇风险暴露水平。 RD_i 为企业创新能力变量,其系数估计值 $\hat{\beta}_1$ 反映企业创新能力对企业外汇风险暴露水平的影响程度; FH_i 为金融对冲变量,其系数估计值 $\hat{\beta}_2$ 为企业金融对冲行为对企业外汇风险暴露水平的影响程度; OH_i 为经营对冲变量,其系数估计值 $\hat{\beta}_3$ 为企业经营对冲行为对企业外汇风险暴露水平的影响程度;

$Controls_i$ 为一系列控制变量, 包括企业规模 (MV)、成长性 (BM)、流动性 (QR)、财务杠杆 (LLR)、国际市场涉入程度 (POI) 和盈利能力 (PM)。 $\bar{r}$ 为一系列控制变量的待估参数, β_0 为常数项, ε_i 为随机误差项。

(三) 变量说明

1. 因变量。企业外汇风险暴露水平。本文以 FXE^1 和 FXE^2 分别表示企业在人民币汇率升值和贬值时的外汇风险暴露水平。企业在外汇风险管理中应秉持风险中性的理念以实现外汇风险暴露趋近于零, 因此, 本文参考 Dominguez and Tesar (2006) 的研究, 以 (1) 式中 $D_{1,t} \times R_{e,t}$ 和 $D_{2,t} \times R_{e,t}$ 的系数估计值的绝对值的平方根^①分别度量 FXE^1 和 FXE^2 。

2. 自变量。一是创新能力 (RD)。现有文献指出, 研发投入可以通过产生新知识和增强吸收现有知识的能力, 使企业形成创新能力 (李林木和汪冲, 2017)。鉴于此, 本文以企业研发费用与营业收入的比值衡量企业创新能力。 RD 值越大, 企业创新能力越强。二是金融对冲 (FH)。根据现有文献中广泛使用的方法 (Choi and Jiang, 2009), 本文通过查阅农业上市公司年报中披露的外汇衍生工具使用情况构建虚拟变量作为金融对冲的代理变量。若企业在 2016 年 1 月至 2022 年 12 月使用了远期外汇合约、货币互换合约、外汇期权合同以及货币掉期合约等外汇衍生工具, 则 FH 取值为 1, 否则取值为 0。三是经营对冲 (OH)。现有研究指出, 跨国经营是企业应对外汇风险采取的主要经营对冲方式 (Allayannis et al., 2001)。鉴于此, 本文以样本期内企业境外投资所涉及的东道国数作为经营对冲的代理变量。

3. 控制变量。一是企业规模 (MV)。本文以企业总市值的自然对数作为企业规模的代理变量, MV 值越大, 企业规模越大。二是企业成长性 (BM)。本文使用账面市值比, 即企业所有者权益与企业市值的比值作为企业成长性的代理变量, BM 值越大, 企业成长性越低。三是企业流动性 (QR)。本文使用速动比率作为企业流动性的代理变量, QR 值越大, 企业流动性越高。四是财务杠杆 (LLR)。本文以长期负债占总资产的比值作为财务杠杆的代理变量, LLR 值越大, 企业财务杠杆越高。五是国际市场涉入程度 (POI)。本文以海外收入占比作为企业国际市场涉入程度的代理变量, POI 值越大, 企业国际市场涉入程度越高。六是盈利能力 (PM)。本文以企业营业利润与营业收入的比值衡量企业盈利能力, PM 值越大, 企业盈利能力越强。

在下文分析时, 本文对 (2) 式进行最小二乘回归估计, 并通过 RESET 检验和求解方差膨胀因子 (VIF) 分别检验是否存在遗漏变量问题和多重共线性问题。

(四) 数据来源与数据处理

由于中国农业产业链的组织模式以龙头企业带动型为主导, 而农业上市公司是典型的农业龙头企业, 因此, 本文以农业产业链各环节农业上市公司的外汇风险暴露水平作为农业产业链外汇风险暴露水平的代理, 并以中国沪深两市 A 股农业上市公司为研究样本。本文以“8·11”汇改经过政策消化期之后的 2016 年为研究起始点, 研究区间设定为 2016 年 1 月至 2022 年 12 月。本文根据《农业及相关

^①使用平方根的处理方法能够避免截断误差及其可能导致的非正态分布误差 (He et al., 2021)。

产业统计分类（2020）》与企业营业执照中的经营范围^①将样本企业分别归入要素供给、种植养殖、加工流通等农业产业链环节。当某一企业涉及多个环节时，则根据营业执照中经营范围的首项业务确定其归属。

（1）式测度外汇风险暴露水平的数据来源有二：一是个股收益率、市场收益率、无风险收益率的原始数据均获取自国泰安数据库（CSMAR）^②的股票市场交易子数据库；二是人民币实际有效汇率来自国际清算银行官方网站^③，数据频率均为月度。

（2）式涉及变量的数据来源如下：构建金融对冲变量的数据通过查阅上市公司年报获取；构建企业创新能力、规模、流动性、成长性、盈利能力等变量的原始数据获取自 CSMAR 财务指标分析子数据库；构建财务杠杆变量的原始数据获取自 CSMAR 财务报表子数据库；构建国际市场涉入程度和经营对冲变量的原始数据获取自 CSMAR 海外直接投资子数据库。需要说明的是，本文在构建经营对冲变量时剔除了如下类型的跨国投资：一是成立于开曼群岛、维京群岛、英属维尔京群岛等“避税天堂”的海外关联企业；二是以纯粹进行投资管理或获取资源为目的的海外关联企业。为与外汇风险暴露水平测度的时间跨度一致，除金融对冲外，经营对冲、企业创新能力、规模、流动性、成长性、盈利能力、财务杠杆、国际市场涉入程度变量均取 2016 年 1 月至 2022 年 12 月的均值。

本文对所选样本企业做如下筛选：剔除股票收益率数据存在缺漏值的企业；剔除月度个股收益率数据量不足 30 的企业；剔除经营范围不明晰的企业。本文最终获得 305 家农业上市企业样本，其中，要素供给环节的企业样本数量为 85 家，种植养殖环节的企业样本数量为 55 家，加工流通环节的企业样本数量为 165 家。表 1 和表 2 分别展示了（1）式和（2）式中各变量的描述性统计结果。

表 1 (1) 式各变量描述性统计结果

变量	均值	标准差	最小值	最大值	样本量
市场超额收益率 ($R_{m,t}$)	0.001	0.054	-0.246	0.147	84
人民币实际有效汇率收益率 ($R_{e,t}$)	-0.001	0.012	-0.037	0.024	84
样本企业月度股票超额收益率 ($R_{i,t}$)	0.005	0.134	-0.748	2.010	23193
要素供给环节样本企业的月度股票超额收益率 ($R_{i,t}^E$)	0.004	0.129	-0.467	1.689	6234
种植养殖环节样本企业的月度股票超额收益率 ($R_{i,t}^P$)	0.002	0.139	-0.548	2.010	4081
加工流通环节样本企业的月度股票超额收益率 ($R_{i,t}^F$)	0.006	0.135	-0.748	1.581	12878

表 2 (2) 式各变量描述性统计结果

变量	要素供给环节			种植养殖环节			加工流通环节		
	中位数	均值	标准差	中位数	均值	标准差	中位数	均值	标准差
升值时外汇风险暴露 (FXE^1)	1.226	1.219	0.563	1.321	1.311	0.566	1.433	1.452	0.607
贬值时外汇风险暴露 (FXE^2)	1.131	1.173	0.558	1.185	1.216	0.539	1.134	1.180	0.555

^①资料来源：企业营业执照信息查询自国家企业信用信息公示系统（<https://www.gsxt.gov.cn/corp-query-homepage.html>）。

^②资料来源：国泰安数据库，<https://data.csmar.com>。

^③资料来源：国际清算银行，<https://www.bis.org>。

表2 (续)

创新能力 (<i>RD</i>)	0.025	0.028	0.024	0.007	0.011	0.011	0.006	0.014	0.023
金融对冲 (<i>FH</i>)	0.000	0.318	0.468	0.000	0.127	0.336	0.000	0.158	0.366
经营对冲 (<i>OH</i>)	1.000	2.471	4.407	1.000	1.509	2.395	1.000	1.303	2.004
企业规模 (<i>MV</i>)	22.725	23.056	1.370	22.609	22.878	1.104	22.779	23.035	1.236
企业成长性 (<i>BM</i>)	0.659	0.665	0.196	0.606	0.593	0.176	0.538	0.533	0.208
企业流动性 (<i>QR</i>)	1.253	1.761	1.796	1.138	1.696	2.094	1.324	2.022	2.277
财务杠杆 (<i>LLR</i>)	0.059	0.072	0.066	0.075	0.106	0.140	0.033	0.063	0.079
国际市场涉入程度 (<i>POI</i>)	0.014	0.163	0.244	0.000	0.078	0.172	0.000	0.076	0.188
盈利能力 (<i>PM</i>)	0.238	0.253	0.163	0.205	0.264	0.190	0.302	0.285	0.793

注：要素供给环节的样本量为 85，种植养殖环节的样本量为 55，加工流通环节的样本量为 165。

四、经验事实分析

(一) 中国农业产业链的外汇风险暴露特征

1. 外汇风险暴露的显著性分析。表 3 展示了基于 (1) 式测度的农业产业链各环节企业在 10% 置信水平下的外汇风险暴露显著性情况。

首先，在人民币汇率升值时，要素供给环节、种植养殖环节和加工流通环节中具有显著外汇风险暴露的企业占比分别为 10.588%、18.182% 和 23.636%；在人民币汇率贬值时，上述三个环节中具有显著外汇风险暴露的企业占比分别为 14.118%、16.364% 和 18.788%。这表明，农业产业链各环节在人民币汇率不同波动方向上的外汇风险暴露呈现不对称特征。其中，要素供给环节具有显著外汇风险暴露的企业占比在人民币汇率贬值时高于人民币汇率升值时，而种植养殖环节和加工流通环节具有显著外汇风险暴露的企业占比在人民币汇率升值时高于人民币汇率贬值时。

其次，无论是人民币汇率升值、贬值还是二者合计的情况，加工流通环节中具有显著外汇风险暴露的企业占比均最高，种植养殖环节次之，要素供给环节最低。上述结果表明，从外汇风险暴露在农业产业链的分布来看，随着农业产业链中生产关系的递进，外汇风险暴露呈增大趋势。

最后，农业产业链整体在人民币汇率升值与贬值时具有显著外汇风险暴露的农业企业占比分别为 19.016% 和 17.049%，且 32.787% 的农业企业至少在一种汇率波动方向上具有显著的外汇风险暴露。上述结果表明，农业产业链中同时受人民币汇率升值与贬值显著影响的企业占比为 3.278%^①，大部分农业产业链中的企业仅暴露于人民币汇率升值或贬值的单一波动方向。

表 3 农业产业链各环节中具有显著外汇风险暴露的企业占比

	样本数	汇率升值		汇率贬值		合计	
		企业数	占比 (%)	企业数	占比 (%)	企业数	占比 (%)
要素供给环节	85	9	10.588	12	14.118	19	22.353
种植养殖环节	55	10	18.182	9	16.364	17	30.909

^① $19.016 + 17.049 - 32.787 = 3.278$ (%)。

表3 (续)

加工流通环节	165	39	23.636	31	18.788	64	38.788
总和	305	58	19.016	52	17.049	100	32.787

注：“合计”统计的是至少在一种汇率波动方向上具有显著外汇风险暴露的企业数及其占比。

2. 外汇风险暴露的数值分析。表4展示了农业产业链各环节显著外汇风险暴露水平 $\hat{a}_{1,i}$ 和 $\hat{a}_{2,i}$ 的描述性统计结果。

首先，农业产业链整体的外汇风险暴露水平均值在人民币汇率升值与贬值时分别为-0.759和-1.970，中位数分别为-2.464和-3.317，表明农业产业链整体的外汇风险暴露水平具有不对称特征，且农业产业链整体受益于人民币汇率贬值，而受损于人民币汇率升值。农业产业链整体的外汇风险暴露水平绝对值的均值在人民币汇率升值与贬值时分别为4.459和3.908，表明农业产业链整体的外汇风险暴露水平在人民币汇率升值时大于人民币汇率贬值时，具有不对称特征。

其次，在人民币汇率升值时，要素供给、种植养殖、加工流通三个环节的外汇风险暴露水平均值分别为2.324、2.639和-2.341，中位数分别为3.547、3.283和-3.361；在人民币汇率贬值时，上述三个环节的外汇风险暴露水平均值分别为-2.767、-0.419和-2.112，中位数分别为-3.310、-2.560和-3.360。上述结果表明：要素供给环节和种植养殖环节的企业不仅受益于人民币汇率升值，还受益于人民币汇率贬值；加工流通环节的企业则更多地受益于人民币汇率贬值，而受损于人民币汇率升值。

最后，在人民币汇率升值时，要素供给、种植养殖、加工流通三个环节的外汇风险暴露水平绝对值的均值分别为3.553、4.126和4.753；在人民币汇率贬值时，上述三个环节的外汇风险暴露水平绝对值的均值分别为3.449、3.800和4.164。上述结果表明：无论人民币汇率升值还是贬值，加工流通环节的外汇风险暴露水平绝对值的均值均最大，种植养殖环节次之，要素供给环节最小；同时，各环节在人民币汇率升值时的外汇风险暴露水平均高于在人民币汇率贬值时的外汇风险暴露水平。上述结果进一步佐证了外汇风险暴露随着农业产业链中生产关系的递进而增大的趋势，同时表明农业产业链各环节受人民币汇率升值的影响程度更大，具有不对称特征。

表4 农业产业链各环节企业外汇风险暴露水平 $\hat{a}_{1,i}$ 和 $\hat{a}_{2,i}$ 的描述性统计分析

	汇率波动	最小值	中位数	最大值	均值	绝对值的均值	N+	N-
要素供给环节	升值	-3.534	3.547	5.643	2.324	3.553	7	2
	贬值	-5.552	-3.310	4.095	-2.767	3.449	1	11
种植养殖环节	升值	-7.434	3.283	7.703	2.639	4.126	9	1
	贬值	-5.052	-2.560	4.931	-0.419	3.800	4	5
加工流通环节	升值	-11.087	-3.361	8.838	-2.341	4.753	10	29
	贬值	-8.150	-3.360	7.379	-2.112	4.164	9	22
合计	升值	-11.087	-2.464	8.838	-0.759	4.459	26	32
	贬值	-8.150	-3.317	7.379	-1.970	3.908	14	38

注：“N+”“N-”分别代表外汇风险暴露显著为正和显著为负的企业数量。

综上所述，中国农业产业链外汇风险暴露呈现以下三方面特征。一是农业产业链外汇风险暴露在

人民币汇率不同波动方向上具有不对称特征。二是农业产业链外汇风险暴露的分布特征呈现上中下游三环节的外汇风险暴露依次增大的特征。三是农业产业链在人民币汇率贬值时具有有利的外汇风险暴露，在人民币汇率升值时具有不利的外汇风险暴露，且农业产业链在人民币汇率升值时具有不利的外汇风险暴露主要体现在下游加工流通环节。

（二）中国农业产业链外汇风险暴露的影响因素

表 5 提供了（2）式的回归结果，其中，（1）列、（3）列和（5）列的因变量为人民币汇率升值时的外汇风险暴露水平（ FXE^1 ），分别是基于要素供给环节样本、种植养殖环节样本和加工流通环节样本的回归结果；（2）列、（4）列和（6）列的因变量为人民币汇率贬值时的外汇风险暴露水平（ FXE^2 ），分别是基于要素供给环节样本、种植养殖环节样本和加工流通环节样本的回归结果。

表 5 人民币汇率双向波动背景下外汇风险暴露影响因素的回归结果

变量	外汇风险暴露水平					
	要素供给环节		种植养殖环节		加工流通环节	
	升值时 (1)	贬值时 (2)	升值时 (3)	贬值时 (4)	升值时 (5)	贬值时 (6)
创新能力（ RD ）	-6.226* (3.453)	-2.402 (3.976)	0.717 (7.697)	-2.813 (8.522)	-5.413*** (1.764)	-0.857 (1.654)
金融对冲（ FH ）	-0.354*** (0.124)	-0.012 (0.150)	-0.011 (0.172)	0.574*** (0.193)	-0.368*** (0.131)	-0.340*** (0.128)
经营对冲（ OH ）	0.010 (0.010)	-0.023** (0.011)	-0.072** (0.028)	-0.013 (0.036)	-0.036* (0.019)	0.051* (0.028)
企业规模（ MV ）	0.037 (0.057)	-0.097* (0.056)	-0.147** (0.068)	-0.006 (0.087)	0.060 (0.042)	-0.007 (0.036)
企业成长性（ BM ）	-0.405 (0.375)	0.013 (0.433)	1.015** (0.407)	-0.507 (0.530)	-0.272 (0.272)	-0.133 (0.235)
企业流动性（ QR ）	0.073 (0.067)	-0.030 (0.033)	-0.036 (0.048)	-0.059 (0.061)	0.025 (0.026)	-0.001 (0.022)
财务杠杆（ LLR ）	0.481 (1.011)	-0.497 (0.909)	0.666 (0.754)	1.828** (0.864)	-1.159* (0.674)	-0.138 (0.645)
海外市场涉入程度（ POI ）	-0.187 (0.218)	-0.031 (0.239)	1.320** (0.548)	-0.395 (0.392)	0.746** (0.297)	0.005 (0.372)
盈利能力（ PM ）	-0.105 (0.566)	0.419 (0.587)	0.342 (0.496)	0.767* (0.454)	0.072** (0.030)	-0.005 (0.035)
常数项	0.778 (1.273)	3.504*** (1.258)	3.962** (1.643)	1.359 (2.049)	0.341 (1.064)	1.420 (0.913)
RESET 检验的 p 值	0.127	0.438	0.303	0.123	0.914	0.773
样本量	85	85	55	55	165	165

注：①***、**和*分别表示双尾 t 检验在 1%、5%和 10%的水平上显著；②括号内的数值为异方差稳健标准误。

表 5 中,创新能力的系数估计值在(1)列和(5)列中均显著为负,即要素供给环节和加工流通环节的企业通过提高创新能力,能够有效降低人民币汇率升值时的外汇风险暴露水平。该结果表明,创新能力强的企业能够有效地采用产品策略将汇率波动的影响转嫁给客户,从而减轻汇率波动的冲击(Miller and Reuer, 1998)。创新能力的系数估计值在(2)~(4)列和(6)列中均不显著,即要素供给环节和加工流通环节的企业未能通过提高创新能力显著降低人民币汇率贬值时的外汇风险暴露水平,种植养殖环节的企业未能通过提高创新能力显著降低人民币汇率升值和贬值时的外汇风险暴露水平。出现这种结果可能的原因在于:要素供给环节和加工流通环节的企业未能将其创新能力转换为有效的产品策略以管理人民币汇率贬值对其产生的影响,种植养殖环节的企业未能将创新能力转换为有效的产品策略以管理人民币汇率升值和贬值对其产生的影响。

金融对冲的系数估计值在表 5(1)列、(5)列和(6)列均显著为负,即要素供给环节的企业能够利用金融衍生工具等金融对冲方式,有效降低人民币汇率升值时的外汇风险暴露水平;加工流通环节的企业能够利用金融衍生工具等金融对冲方式,有效降低人民币汇率升值和贬值时的外汇风险暴露水平。该结果表明,外汇衍生工具是外汇风险管理的有效方式,具有显著的金融对冲作用(Das and Kumar, 2023)。金融对冲的系数估计值在表 5(2)列和(3)列中均不显著,而在表 5(4)列中显著为正,该结果表明,要素供给环节的企业未能利用金融衍生工具等金融对冲方式有效降低人民币汇率贬值时的外汇风险暴露水平;种植养殖环节的企业不仅未能利用金融衍生工具等金融对冲方式有效降低人民币汇率升值时的外汇风险暴露水平,反而增加了其在人民币汇率贬值时的外汇风险暴露水平。对该结果的可能解释是:种植养殖环节的企业未能秉持外汇风险中性理念,存在利用外汇衍生工具进行投机的行为,导致其外汇风险暴露水平不仅无法降低,反而可能增加(Chernenko and Faulkender, 2011)。

经营对冲的系数估计值在表 5(2)列、(3)列和(5)列中均显著为负,即要素供给环节的企业通过跨国多元化经营,能够有效降低人民币汇率贬值时的外汇风险暴露水平,种植养殖环节和加工流通环节的企业通过跨国多元化经营,能够有效降低人民币汇率升值时的外汇风险暴露水平。该结果表明,跨国经营能够使企业在全球各地的经营网络灵活调整生产要素投入和生产经营计划,以应对外汇风险,从而具有积极的经营对冲效果(Choi and Jiang, 2009)。经营对冲的系数估计值在表 5(1)列和(4)列中均不显著,在表 5(6)列中显著为正,即要素供给环节的企业未能通过跨国多元化经营显著影响其在人民币汇率升值时的外汇风险暴露水平,种植养殖环节的企业未能通过跨国多元化经营显著影响其在人民币汇率贬值时的外汇风险暴露水平,而加工流通环节的企业通过跨国多元化经营显著增加了其在人民币汇率贬值时的外汇风险暴露水平。出现该结果可能有两方面原因:一是相关农业企业在跨国多元化经营时缺乏合理布局,导致东道国之间汇率波动的关联性高,难以实现经营对冲;二是相关农业企业缺乏经营对冲意识和能力,无法在汇率波动中利用不同东道国异质性环境灵活地调整进出口等经营活动以应对外汇风险。

从控制变量来看,企业规模的系数估计值在表 5(2)列和(3)列中均显著为负,即要素供给环节和种植养殖环节的企业通过扩大经营规模,能够分别有效降低人民币汇率贬值时与升值时的外汇风

险暴露水平。该结果表明,规模大的企业会因规模经济效益更积极地采取措施管理外汇风险(Allayannis and Ofek, 2001)。企业成长性的系数估计值在表 5(3)列中显著为正,即当人民币汇率升值时,高成长性的种植养殖企业具有更低的外汇风险暴露水平。该结果表明,高成长性的种植养殖企业将因投资不足问题而更积极地进行外汇风险管理(He and Ng, 1998)。财务杠杆的系数估计值在表 5(4)列中显著为正,表明高财务杠杆的种植养殖企业因面临较严峻的财务约束而难以采取有效的措施进行外汇风险管理,从而具有更高的外汇风险暴露水平(Aggarwal and Harper, 2010)。财务杠杆的系数估计值在表 5(5)列中显著为负,表明高财务杠杆的加工流通企业为避免汇率波动导致企业进一步陷入财务困境的可能性,将更积极地进行外汇风险管理(He et al., 2021)。国际市场涉入程度的系数估计值在表 5(3)列和(5)列中均显著为正,即当人民币汇率升值时,种植养殖环节和加工流通环节企业的国际市场涉入程度越高,其外汇风险暴露水平越高。该结果表明,更多的海外收入提高了企业的外汇风险暴露水平(Jorion, 1990)。盈利能力的系数估计值在表 5(4)列和(5)列中均显著为正,即盈利能力更强的种植养殖环节企业,更容易暴露于人民币汇率贬值,而盈利能力更强的加工流通环节企业,更容易暴露于人民币汇率升值。该结果表明,盈利能力强的企业将因具有更高的安全边际而选择承担外汇风险而非进行对冲(Ng and Souare, 2014)。

表 5 中, RESET 检验的 p 值均无法拒绝不存在遗漏变量的原假设,说明表 5 的回归结果未受到遗漏变量问题的影响。此外,本文通过求解方差膨胀因子对自变量进行了多重共线性诊断。表 6 的结果显示各变量的方差膨胀因子在三类样本中均小于 3,说明表 5 的回归结果未受到多重共线性的影响。

表 6 农业产业链各环节样本中自变量多重共线性诊断的 VIF 值

变量	(1)	(2)	(3)
	要素供给环节	种植养殖环节	加工流通环节
创新能力 (RD)	2.41	1.49	1.30
金融对冲 (FH)	1.25	1.49	1.17
经营对冲 (OH)	1.29	1.89	1.51
企业规模 (MV)	1.97	1.23	1.32
企业成长性 (BM)	1.69	1.18	1.25
企业流动性 (QR)	1.73	2.33	1.20
财务杠杆 (LLR)	1.24	2.35	1.19
国际市场涉入程度 (POI)	1.24	1.81	1.62
盈利能力 (PM)	2.73	1.99	1.29
均值	1.40	1.61	1.25

五、稳健性分析

由于 2016 年的数据距离“8·11”汇改比较近,前文表 3 至表 5 的分析结果可能会受到短期政策效应的影响。为检验前文分析结果的稳健性,本文将样本期间变换为 2017—2022 年,重新分析中国

农业产业链的外汇风险暴露特征以及企业创新能力、金融对冲和经营对冲等因素的影响。表 7 和表 8 显示的结果与前文分析的中国农业产业链的外汇风险暴露特征一致。

表 7 农业产业链各环节中具有显著外汇风险暴露的企业占比：变换样本期间

	样本数	汇率升值		汇率贬值		合计	
		企业数	占比 (%)	企业数	占比 (%)	企业数	占比 (%)
要素供给环节	85	7	8.235	12	14.118	18	21.176
种植养殖环节	55	10	18.182	9	16.364	16	29.091
加工流通环节	165	37	22.424	29	17.576	59	35.756
总和	305	54	17.705	50	16.393	93	30.492

注：“合计”统计的是至少在一种汇率波动方向上存在显著外汇风险暴露的企业数及其占比。

表 8 农业产业链各环节企业外汇风险暴露水平 $\hat{a}_{1,i}$ 和 $\hat{a}_{2,i}$ 的描述性统计分析：变换样本期间

	汇率波动	最小值	中位数	最大值	均值	均值绝对值	N+	N-
要素供给环节	升值	-3.967	3.014	6.195	1.714	3.419	5	2
	贬值	-5.764	-1.825	1.884	-2.462	3.039	2	10
种植养殖环节	升值	-3.794	2.918	7.703	3.026	3.785	9	1
	贬值	-5.052	-2.706	5.134	-0.564	3.445	2	7
加工流通环节	升值	-11.087	-3.874	8.838	-2.642	4.975	11	26
	贬值	-5.549	-3.047	5.424	-1.771	3.611	8	21
合计	升值	-11.087	-2.226	8.838	-1.027	4.553	25	29
	贬值	-5.549	-2.840	5.424	-1.881	3.432	12	38

注：“N+”“N-”分别代表外汇风险暴露显著为正和为负的企业数量。

表 9 显示，企业创新能力、金融对冲和经营对冲等因素对中国农业产业链各环节企业外汇风险暴露水平的影响也与前文分析一致。这表明，在变换样本期间后，前文关于中国农业产业链外汇风险暴露特征及其影响因素的分析结论具有稳健性。

表 9 人民币汇率双向波动背景下外汇风险暴露影响因素的回归结果：变换样本期间

变量	外汇风险暴露水平					
	要素供给环节		种植养殖环节		加工流通环节	
	升值时	贬值时	升值时	贬值时	升值时	贬值时
	(1)	(2)	(3)	(4)	(5)	(6)
创新能力 (RD)	-6.244*	1.992	-2.400	-0.964	-4.298**	-0.540
	(3.595)	(4.299)	(6.992)	(9.353)	(1.902)	(1.462)
金融对冲 (FH)	-0.262**	-0.044	0.130	0.446**	-0.373***	-0.326***
	(0.117)	(0.165)	(0.231)	(0.218)	(0.124)	(0.114)
经营对冲 (OH)	0.001	-0.027**	-0.058*	-0.007	-0.037*	0.042*
	(0.008)	(0.011)	(0.031)	(0.036)	(0.022)	(0.024)
控制变量	控制	控制	控制	控制	控制	控制

表9 (续)

常数项	0.935 (1.235)	2.677** (1.241)	5.182*** (1.347)	1.290 (2.082)	0.320 (1.014)	0.977 (0.914)
样本量	85	85	55	55	165	165

注：①***、**和*分别表示双尾t检验在1%、5%和10%的水平上显著；②括号内的数值为异方差稳健标准误。

六、结论与政策启示

本文区分农业产业链上游要素供给、中游种植养殖、下游加工流通三个环节，利用2016—2022年中国农业上市公司数据和人民币汇率波动数据，研究中国农业产业链各环节的外汇风险暴露特征及其影响因素。

关于中国农业产业链各环节的外汇风险暴露特征，本文研究有如下发现。第一，农业产业链各环节在人民币汇率升值和贬值时的外汇风险暴露呈现不对称特征。要素供给环节具有显著外汇风险暴露的企业占比在人民币汇率贬值时高于人民币汇率升值时；而种植养殖环节和加工流通环节具有显著外汇风险暴露的企业占比在人民币汇率升值时高于人民币汇率贬值时。第二，随着农业产业链中生产关系的递进，外汇风险暴露呈增大趋势，即加工流通环节中具有显著外汇风险暴露的企业占比最高，种植养殖环节次之，要素供给环节最低。第三，农业产业链在人民币汇率贬值时呈现有利的外汇风险暴露，在人民币汇率升值时则呈现不利的外汇风险暴露，且主要体现在加工流通环节。

通过从产品策略、财务策略和运营策略三个维度分析创新能力、金融对冲和经营对冲对中国农业产业链外汇风险暴露的影响，本文研究有如下发现。第一，当人民币汇率升值时，要素供给环节企业的创新能力和金融对冲显著降低其外汇风险暴露；种植养殖环节企业的经营对冲显著降低其外汇风险暴露；加工流通环节企业的创新能力、金融对冲和经营对冲显著降低其外汇风险暴露。第二，当人民币汇率贬值时，要素供给环节企业的经营对冲显著降低其外汇风险暴露；种植养殖环节企业的金融对冲显著增加其外汇风险暴露；加工流通环节企业的金融对冲和经营对冲分别显著降低和增加其外汇风险暴露。上述结果表明，农业产业链各环节企业的创新能力、金融对冲和经营对冲等对其外汇风险暴露的影响具有异质性。

本文的研究发现具有以下政策启示。第一，外汇风险向农业产业链下游传递和放大可能给下游相关企业带来过大的风险压力，导致整个农业领域的风险变得不可控。为有效防止这种风险，国家应进一步加快农业产业链的培育发展，重点打造区域农业产业链一体化，建立农业产业链各环节风险共担机制，避免外汇风险在农业产业链某一环节聚集，以实现中国农业产业的可持续发展。第二，考虑到人民币汇率升值对农业产业链的潜在不利影响，特别是对农产品加工和流通环节的冲击最为明显，国家需要高度重视由此引发的外汇风险，并采取必要的政策措施。例如，政府可以通过引导农产品加工流通相关企业优化产品结构，提升市场竞争力，从而提高中国农业产业对外汇风险的抵御能力。第三，由于创新能力在农业企业管理外汇风险方面具有积极的作用，国家应进一步引导农业企业增加研发投入，鼓励农业科研院所、高校、农业龙头企业等开展产学研用一体化创新体系建设，促进农业新技术

的开发研究与推广,从而提升农业企业创新能力。第四,金融对冲工具在农业企业管理外汇风险中具有重要作用,但若使用不当,也可能增加其所面临的风险。为提升金融对冲工具在农业企业管理外汇风险中的作用,国家层面应做到:一方面,进一步完善外汇衍生品市场,为中国农业企业应对新常态下人民币汇率双向波动提供更多的外汇衍生工具;另一方面,进一步加强汇率风险的宣传和指导,引导农业企业秉持外汇风险中性理念、增强外汇风险管理意识,从而提升中国农业产业链各环节企业利用外汇衍生工具管理外汇风险意识和效率。第五,农业企业通过跨国经营可根据各国异质性灵活调整生产要素投入和生产经营计划,从而对外汇风险进行经营对冲。然而,跨国布局的合理性和跨国管理能力是影响经营对冲效果的关键因素。因此,农业企业在海外投资布局时,不仅要充分考虑不同国家间汇率变动的异质性和经济环境的异质性,以便提升其跨国布局的合理性,还应聘用具有丰富跨国管理经验的管理者、构建有效的内部治理结构,以增强其跨国管理能力,进而提升对外汇风险的经营对冲效果。

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The Characteristics and Influencing Factors of Foreign Exchange Risk Exposure in China's Agricultural Industry Chain

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Abstract: This study collects data on Chinese agricultural listed firms from 2016 to 2022 and fluctuations in the RMB exchange rate. Based on the asymmetric measurement model of RMB exchange rate fluctuations, this study investigates the characteristics and influencing factors of foreign exchange risk exposure in China's agricultural industry chain. This study finds that the foreign exchange risk exposure in each stage of the agricultural industry chain exhibits asymmetric characteristics under the background of the RMB exchange rate's bidirectional fluctuations. As the production relationship progresses, the foreign exchange risk exposure increases. The agricultural industry chain presents favorable foreign exchange risk exposure when RMB exchange rate depreciates and adverse foreign exchange risk exposure when RMB exchange rate appreciates, while the adverse foreign exchange risk exposure of the agricultural industry chain mainly manifested in the processing and distribution stage. This study further analyzes the influence of innovation ability, financial hedging and operational hedging on the exposure of China's agricultural industry chain to foreign exchange risks from three dimensions: product strategy, financial strategy, and operational strategy. This study finds that when the RMB exchange rate appreciates the innovation capability and financial hedging of agricultural firms in the production factor supply stage significantly reduce their foreign exchange risk exposure. The operation hedging of agricultural firms in the cultivation and breeding stage significantly reduces their foreign exchange risk exposure. The innovation capability, financial hedging, and operational hedging of agricultural firms in the processing and distribution stage significantly reduce their foreign exchange risk exposure. When the RMB exchange rate depreciates, the operational hedging of agricultural firms in the production factor supply stage significantly reduces their foreign exchange risk exposure. The financial hedging of agricultural firms in the cultivation and breeding stage significantly increases their foreign exchange risk exposure. The financial hedging of agricultural firms in the processing and distribution stage significantly reduces their foreign exchange risk exposure, but the operational hedging adopted by these firms significantly increases their foreign exchange risk exposure. The results of this study indicate that in the context of the RMB exchange rate's bidirectional fluctuations, understanding and preventing foreign exchange risks in China's agricultural industry chain requires consideration of both the bidirectional characteristics of the RMB exchange rate and the heterogeneity of each stage in the agricultural industry chain.

Keywords: Agricultural Industry Chain; Foreign Exchange Exposure; Agricultural Risk Management; RMB Exchange Rate

检索证明

根据委托人提供的论文材料，委托人华南农业大学经济管理学院 周超(学科类型:人文社科) 1 篇论文收录情况如下表。

序号	论文名称	发表刊物及发表的年月卷期/页码等	作者排名	论文等级	作者文中单位	收录情况	影响因子	中科院大类分区	引用
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Does global diversification promote or hinder green innovation? Evidence from Chinese multinational corporations

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ABSTRACT

Green innovation plays a critical role in facilitating firms to achieve sustainable development. This study aims to investigate how global diversification affects green innovation. Existing literature suggests that global diversification can have both positive and negative effects on firms' engagement in green innovation. While it can increase firms' pressure and ability to participate in green innovation activities, thereby promoting their green innovation efforts, it can, however, be utilized to evade environmental responsibility, thereby hindering their green innovation efforts. In an empirical analysis focusing on a sample of Chinese multinational corporations (MNCs) from 2008 to 2020, MNCs' global diversification is found to affect their green innovation significantly and positively. Moreover, the positive effect of global diversification on green innovation is enhanced by factors, such as the host country's institutional quality, state ownership, and the CEO's academic experience. The findings suggest that global diversification can facilitate Chinese MNCs' engagement in green innovation activities rather than being utilized to evade environmental responsibility. Furthermore, the results reveal that the positive effect of global diversification on green innovation depends on the external and internal environments in which MNCs operate. Overall, this study provides new insight into the determinants of corporate green innovation in emerging market MNCs.

1. Introduction

Over the past few decades, global economies have made remarkable achievements. However, on the flipside, these achievements have also led to serious environmental problems, such as air pollution, water pollution, and land desertification (Miao et al., 2019). These environmental problems impact people's quality of life and pose a significant threat to their future. As global citizens become more conscious of these environmental challenges, their focus on environmental protection has intensified (Liu and Lin, 2019; MacBean, 2007). This growing awareness has compelled governments worldwide to prioritize sustainable and clean green development. An important milestone in this regard was the Paris Agreement, which was adopted on December 12, 2015, during the Paris Climate Change Conference. Nearly 200 parties came together to make a binding arrangement and made ambitious efforts to combat climate change. Many countries, accounting for more than 70% of global GDP and greenhouse gas emissions, have set targets for attaining net-zero emissions by 2050. In this situation, firms, as the primary

contributors to numerous environmental problems, receive great pressure from a wide range of stakeholders, including government bodies, clients, mainstream media, and environmental non-governmental organizations (Bansal and Clelland, 2004). Many firms are actively seeking ways to reduce their environmental effects and embrace sustainability.

Green innovation (GI) is widely recognized as a crucial approach for firms to effectively address the concerns surrounding environmental problems (Kraus et al., 2020; Rehman et al., 2021). GI refers to the innovation in the process of developing and implementing new technologies, products, services, organizational structures, or management practices that aim to promote sustainable development (Renning, 2000). By focusing on GI, we can effectively address environmental concerns and work toward a more sustainable future (Song and Yu, 2018). Given the importance of the GI, its underlying factors warrant further investigation.

The literature extensively discusses the antecedent factors that influence GI. Prior studies found that GI is determined by various factors, including government policy (Xia et al., 2022), consumer demand

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(Horbach et al., 2012), public pressure (Chen et al., 2018), and top managers' attributes (Hao et al., 2019; Javed et al., 2023). Although scholars have made significant contributions to understanding the factors that drive corporate GI, the decisions of multinational corporations (MNCs) regarding GI have received little attention. With the globalization of economic activities, MNCs, as prominent participants in international relations, have an increasingly significant impact on the global environment (Christmann, 2004; Dymsha, 1984). Therefore, the factors contributing to GI in MNCs are worth investigating.

In this study, we seek to explore the factors contributing to GI in MNCs by investigating the effect of global diversification on GI in emerging market MNCs. Global diversification refers to the "number of different markets in which a firm operates and the importance of these markets to the firm," where markets are essentially "different geographic locations that cross national borders" (Hitt et al., 1997, 767). Given the important role that new green technologies play in GI by helping firms eliminate or reduce the pollution and ecological destruction (Aghion et al., 2016; Qi et al., 2010), this study specifically focuses on GI related to these technologies. According to literature, the relationship between global diversification and GI is often intricate and multifaceted. On one hand, global diversification might hinder GI by providing MNCs more opportunities to evade environmental responsibility by transferring operations to host countries with weaker environmental responsibility requirements (Walter and Ugelow, 1979). Global diversification, on the other hand, may promote GI by increasing external pressure from various stakeholders across countries and improving a firm's innovation ability in a variety of ways, such as achieving economies of scale (Kang, 2013) and absorbing new international knowledge (Perruchas et al., 2020). Given the complexities identified within the literature, more research is needed to understand if global diversification promotes or hinders GI.

To examine the association between global diversification and GI, we compiled a sample of Chinese MNCs listed on the A-share markets in Shanghai and Shenzhen from 2008 to 2020. We employed empirical analysis to investigate this relationship and found that global diversification had a significant and positive impact on GI. Furthermore, we found that host countries' institutional quality, state ownership, and CEO academic experience reinforce the positive effects of global diversification on GI. We verified the robustness of our findings through several sensitivity analyses, including the use of alternative dependent and independent variables, two-stage least squares (2SLS) regressions and the Heckman two-stage method.

This study contributes to existing literature in several ways. First, our findings contribute to the innovation literature. Scholars have provided several important insights into the impact of global diversification on innovation (Hitt et al., 1994; Juergensen et al., 2022; Wu et al., 2016). However, these studies often focus on the impact of global diversification on general innovation rather than on a specific type of innovation such as GI. This study focusing on the influence of global diversification on GI, one specific type of innovation, can provide new insights into the relationship between global diversification and innovation.

Second, our findings contribute to the corporate sustainability literature. Although the role of global diversification strategies in corporate sustainability has attracted the attention of many scholars (Strike et al., 2006; Wu et al., 2022; Zhou, 2022), limited research has been conducted on their role in GI, which is central to achieving corporate sustainability. Therefore, this study, which investigates the effect of global diversification on GI, deepens our understanding of how global diversification contributes to corporate sustainability.

Third, our findings contribute to literature on global diversification strategies in emerging markets. Global diversification has been suggested as an important strategy in modern corporations in emerging markets (Zhou, 2022), and scholars have undertaken insightful research on the consequences of global diversification on various aspects for firms (Gande et al., 2009; Gao and Chou, 2015; Moeller and Schlingemann, 2005; Zhou, 2023a,b). However, the knowledge regarding the

consequences of global diversification on GI is limited. Our study enriches this knowledge on emerging market firms.

The remainder of this study is organized as follows: Section 2 reviews the relevant literature on the relationship between an MNC's global diversification and its GI and proposes some hypotheses. Section 3 provides the details of our research methodology, including how we created the dataset and defined the variables. Section 4 presents the results obtained using the empirical models. Finally, Section 5 discusses the research findings, implications, and limitations.

2. Theoretical analysis and hypothesis

2.1. Global diversification and GI

We propose that global diversification enhances GI in two ways. First, increasing external pressure from various stakeholders across countries stimulates MNCs to focus on GI. Firms that conduct business globally often face several new stakeholders, including the host government, non-governmental organizations, international clients and communities, worldwide rivals, and global media (Kang, 2013; Khojastehpour and Shams, 2020; Park et al., 2014). These stakeholders generally have diverse needs owing to differences in institutional environments, cultural origins, and economic development across countries. In this context, MNCs must meet the legitimacy requirements of diverse stakeholders (Brammer et al., 2006). Based on the legitimacy requirement, MNCs must comply with the political, environmental, social, and other relevant legal systems in their home and host countries (Papanastassiou et al., 2020; Zaheer, 1995). Environmental responsibility is an important aspect of a firm's legitimacy.

The literature indicates that a better realization of environmental responsibility through GI has emerged as a significant means for foreign entities to enhance their credibility and legitimacy in the host country (Galbreath, 2019; Shu et al., 2016; Stefan and Paul, 2008). To reduce the threat of legitimacy and further develop business activities in the host country market, MNCs must pay attention to their environmental responsibilities in the internationalization process and adopt internationally accepted green technologies to meet diverse industry and market regulations (Lau et al., 2014). In other words, pressure from various stakeholders across countries is likely to stimulate firms to invest more in GI-related activities.

Second, global diversification enhances firms' ability to engage in GI activities. It is well-acknowledged that GI is often characterized by risks, long-term effects, and high investment. Notably, MNCs operating globally can share the GI costs and achieve significant economies of scale (Kang, 2013). Consequently, this can reduce the risks associated with technological innovation and create favorable conditions for MNCs' GI efforts (Perruchas et al., 2020). Moreover, global diversification enables MNCs to access new knowledge and expertise regarding technological innovation, including GI (Perruchas et al., 2020). This can enhance innovation capacity and keep MNCs updated with the latest developments and trends in the field, thereby driving their GI efforts further. Therefore, global diversification can provide MNCs with a range of GI benefits, including reduced risk, cost savings, and greater access to knowledge and expertise.

The pollution haven hypothesis suggests that firms may diversify their operational activities across host countries with relatively low environmental responsibility requirements, thereby evading environmental responsibilities and weakening their incentives to participate in GI (Behera and Sethi, 2022; Strike et al., 2006). However, emerging market firms tend to have limited space to exert their environmental arbitrage by diversifying their operational activities across countries because environmental regulations in emerging market economies such as China are relatively loose compared to those in host countries (Gugler and Shi, 2009; Zhang, 2011). In other words, firms from emerging market economies such as China are likely to have a relatively weak motivation to diversify their businesses to evade home country

environmental regulations.

Thus, we propose the following hypothesis:

Hypothesis 1. Global diversification is positively related to a firm's GI.

2.2. The moderating effect of institutional quality

The institutional environment is a key factor in determining firms' socially responsible behavior (Campbell, 2007). The institutional perspective suggests that a firm is inevitably bound by external constraints that arise from the institutional environment embedded in society (Khan et al., 2021). Institutional pressure forces firms to take steps to acquire legitimacy in society (Zhou, 2022). Fulfilling environmental responsibility is crucial to deal with institutional pressures (Babiak and Trendafilova, 2011). Accordingly, a firm is likely to participate in GI activities to improve its environmental performance and meet the environmental requirements of its host country's stakeholders. Therefore, the institutional environment can significantly affect a firm's engagement in GI activities.

Environmental protection has been emphasized in many countries. During international expansion, firms are constrained by the legal environmental protection system of the host country (Tashman et al., 2019). However, the strength of legal systems differs across countries (Harring, 2013). In countries with high institutional quality, enforcement of environmental protection laws is typically effective and stringent (Wei et al., 2017). MNCs conducting business in these countries tend to face high institutional pressure regarding their environmental responsibilities (Attig et al., 2016). To meet the environmental requirements of the host country's legal system, firms conducting business in a host country with better institutional quality are more inclined to participate in ecofriendly innovation initiatives. Thus, we propose the following hypothesis:

Hypothesis 2. The host country's institutional quality enhances the positive effect of a firm's global diversification on its GI.

2.3. The moderating effect of state ownership

State-owned firms are acknowledged as important components of socialist countries such as China (Su and He, 2012; Zhou, 2023b). These countries are considered to have a socialist country image when operating in international markets. These firms' behaviors are often guided and controlled by their home governments (Lau et al., 2014). In particular, state-owned firms are constrained by many social responsibility policies, such as the mandatory environmental requirements of their home governments (Chen et al., 2023; Zhang et al., 2022). Accordingly, state-owned firms are expected to face high corporate social responsibility pressures from their home government, such as environmental requirements. These firms tend to engage in more GI during international expansion to satisfy the requirements of their home governments and maintain a positive image of their home countries.

Furthermore, state ownership reflects connections with the government, and state-owned firms can acquire favorable treatment from the home government (Zhou et al., 2017). As governments of emerging countries, such as China, dominate a large proportion of scarce resources, including financial capital (Yang et al., 2019), state-owned firms generally have a greater advantage in accessing these resources than privately owned firms. Prior research has emphasized the critical role of resources in supporting GI (Bai et al., 2019) because GI activities often require substantial resources such as financial capital (Yang et al., 2019). Thus, state-owned firms that can acquire large amounts of resources from their home countries have a greater ability to participate in GI activities than privately owned firms.

Consequently, state-owned firms tend to engage in more GI activities in the process of diversifying their businesses globally than privately

owned firms. Thus, we propose the following hypothesis:

Hypothesis 3. State ownership enhances the positive effect of global diversification on GI.

2.4. The moderating effect of CEO academic experience

The literature suggests that the CEO, as the most influential decision-maker in a firm, significantly influences a firm's decisions and future development (Zhou, 2023a). Moreover, CEO has a particularly significant influence on firms' decision-making processes in emerging countries owing to the ineffectiveness of their formal institutions (Wei and Ling, 2015). It has been suggested that individuals' experiences have a significant impact on their cognition and behavior (Hamori and Koyuncu, 2015). We suggest that a CEO's academic experience enhances the positive effect of global diversification on GI in two ways.

First, the ethical cognition of a CEO with academic experience can lead the firm to behave more ethically and can, subsequently, make the firm actively respond to the host country's environmental concerns through GI. Academic work, such as scientific research, is a creative activity with moral characteristics (Tierney, 1997). Individuals with academic experience can form high moral values (Ma et al., 2019). They will be able to recognize that fulfilling environmental responsibility is an essential obligation for citizens (He et al., 2021). Academic experience strengthens CEOs' moral cognition and increases their ethical standards for environmental protection when making decisions. A CEO with academic experience thereby drives a firm to actively promote GI to respond better to the environmental requirements of host country stakeholders when diversifying their businesses worldwide.

Second, the professional competence of a CEO with academic experience helps promote GI in response to a host country's environmental concerns. Individuals with long-term academic training often exhibit good logical thinking, rigorous working attitudes, and excellent information-processing abilities (Jiang and Murphy, 2007). Moreover, CEOs with academic experience can take advantage of their professional competence to help the firm clearly comprehend the role of GI in the value of the firm in the long term and actively promote the firm's GI. Academic experience can also shape individuals' creative thinking patterns and boost their ability to grasp new ideas (Shen et al., 2020), which in turn helps firms access and promote external knowledge absorption and facilitates their ability to better undertake GI activities. Additionally, CEOs with academic experience often have a spirit of exploration and tend to be less sensitive to high-risk and uncertain innovation activities such as GI (Zhao et al., 2022). Therefore, CEOs with academic experience can promote GI better during international expansion.

Based on the foregoing discussion, we suggest the following hypothesis:

Hypothesis 4. The positive effect of global diversification on GI is more pronounced in firms led by CEOs with academic experience than those otherwise (Fig. 1).

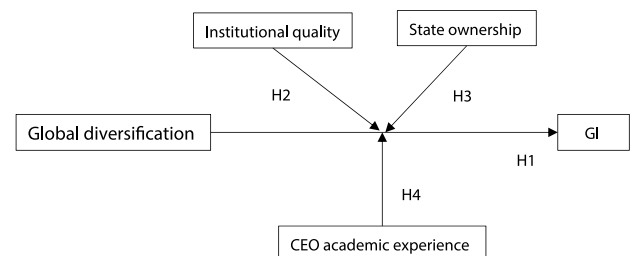


Fig. 1. Conceptual framework.

Source: Authors' elaboration from the theoretical analysis

3. Methodology

3.1. Data

This study focuses on Chinese MNCs. China, the world's second-largest economy and the largest emerging country, has increased its influence on global outbound foreign direct investment significantly in recent decades. According to the Chinese Ministry of Commerce, China's foreign direct investment (FDI) flow reached \$153.71 billion in 2020, a 12.3% rise. This accounted for 20.2% of the worldwide share, firmly establishing China as the world's leading investor. Furthermore, about 28000 Chinese domestic investors formed 45000 foreign enterprises in 189 nations or regions throughout the world, implying that Chinese investments could be found in more than 80% of the world. Therefore, Chinese MNCs are becoming increasingly influential in the international market. We focus on Chinese MNCs for providing valuable insights to academia and the business community to understand the impact of global diversification on GI.

To test these hypotheses, we construct a panel dataset consisting of A-share listed Chinese manufacturing MNCs from 2008 to 2020. The panel data set draws on four distinct data sources. The first data source is the China Stock Market and Accounting Research (CSMAR), one of the most widely used Chinese databases in the literature (Su and He, 2012; Zhou, 2022). This database provides detailed information on foreign subsidiaries and other original firm-level data. The second data source is the State Intellectual Property Office (SIPO) of the People's Republic of China (PRC), which contains patent information on firms. We gather each firm's green patent applications and grant information from the database. The third data source is the World Bank's Worldwide Governance Indicators (WGI) database. We extracted the institutional quality metrics for each country from the database. The fourth data source was the Statistical Yearbook of each Chinese province. Subsequently, we calculated the GDP of each province in which the firms in this database were located.

The datasets from different data sources were then matched. To ensure the accuracy of our data analysis, we made several exclusions and adjustments to the data processing. First, we eliminated foreign subsidiaries located in tax havens such as the Cayman Islands, Virgin Islands, and Bermuda. Furthermore, firms designated as "ST" (the abbreviation for "Special Treatment") by the Shanghai or Shenzhen Stock Exchange throughout the sample period are excluded since these firms often face unique financial situations that may diverge from conventional accounting norms. By excluding these firms from our study, we enhanced the accuracy and reliability of our results. We also address the issue of potential outliers that could distort our empirical results by winsorizing all continuous variable observations outside the 1st and 99th percentiles. Consequently, we obtained an unbalanced panel dataset consisting of 9211 observations from 2008 to 2020.

3.2. Variables

3.2.1. Dependent variables

Green innovation (GI). Literature suggests that a firm's GI can be captured from two perspectives: input and output (Brunnermeier and Cohen, 2003; Chen and Golley, 2014; Lee and Min, 2015). However, considering data availability constraints, capturing information on GI inputs is challenging because most Chinese firms do not differentiate between green- and non-green-related inputs. By contrast, information on GI output (i.e., green patents) can be obtained from existing databases. Thereafter, we follow the approach of prior research (Amore and Bennedsen, 2016) and capture GI from a GI output perspective. Specifically, we measured GI using the logarithm of the number of green patent applications plus one.

3.2.2. Independent variable

Global diversification (GD). A firm's global diversification can be

measured as the extent to which its operational activities are dispersed worldwide (Denis et al., 2002). These activities include sales, employment, assets, and subsidiaries. Ideally, a comprehensive index containing a firm's global distribution of all business activities would capture its level of global diversification (Kim, 1989). However, because of the limited information publicly available on Chinese A-share listed firms, we can only obtain detailed and precise location distribution information for a firm's foreign subsidiaries (Zhou, 2022). Therefore, considering the data availability, we gauge a firm's GD by taking the logarithm of the number of host countries in which its foreign subsidiaries are located. Our measurement can be a good proxy for a firm's global diversification appraisal because the extent to which the firm has diversified its operations across different markets and geographies is generally associated with the diversification of its foreign subsidiaries (Brammer et al., 2006).

3.2.3. Moderating variables

Institutional quality (IQ). Following previous studies (Le et al., 2016; Zhou, 2022), we first measure the institutional quality of a specified host country by averaging the values of its six institutional quality indicators from the WGI database. We then compute the institutional quality that an MNC encounters in host countries by averaging the institutional quality of all foreign countries where the MNC's subsidiaries are located. We employ a dummy variable (IQ) as a proxy to capture whether a firm faces good institutional quality in the host country. IQ equals "1" if the host country's institutional quality that a firm faces is above the median value of the sample, and "0" otherwise.

State ownership (State). Following a method widely used in previous studies (Lin et al., 2009; Su and He, 2012; Zhou, 2018), this study employs a dummy variable (State) as a proxy for a firm's state ownership. State equals "1" when the ultimate controlling body is the government agency of China, and "0" otherwise.

CEO academic experience (CAE). Following prior studies (Filippetti and Savona, 2017), this study defines academic experience as the work experience at universities, research institutions, or associations. We employed a dummy variable (CAE) to indicate whether a firm's CEO has academic experience. CAE equals "1" if the CEO has an academic background, and "0" otherwise.

3.2.4. Control variables

To control for other factors that may be related to a firm's GI, our empirical model contains the following control variables mentioned in prior literature on GI (Cai et al., 2020; Cui et al., 2022; Shao and Chen, 2022). First, we control for firm *Size*. We measure the *Size* of each firm using the logarithm of total sales. Second, we control for firm *Leverage* in our empirical model. *Leverage* is measured by using the ratio of a firm's total liabilities to its total assets. Third, we control for a firm's *Profitability*, measured as its return on equity. Fourth, we control for *Firm growth*, measured as the annual sales growth rate. Fifth, we control for *Slack resource*. According to previous studies (Zhou, 2022), slack resources are the sum of receivables, inventory, selling and administrative expenses. *Slack resource* is the ratio of these resources to a firm's total sales. Sixth, we control for a firm's *Capital intensity*, which is the logarithm of the ratio of its net fixed assets to its total number of employees. Seventh, we control for *Firm age*, which is the logarithm of the number of years between the establishment year of a firm and a given year. Eighth, we control for *GDP scale* of the province in which the firm is located. *GDP scale* is measured as the logarithm of the province's total GDP. Ninth, we control for *GDP growth* in the province in which the firm is located. *GDP growth* equals the annual GDP growth rate of a province.

In addition, to control for the fixed effects of industry and year, we set several industry- and year-dummy variables.

3.3. Empirical model

We propose the following empirical model to verify the relationship

between global diversification and GI:

$$GI_{i,t} = \beta_0 + \beta_1 GD_{i,t} + \beta_2 IQ_{i,t} + \beta_3 State_{i,t} + \beta_4 CAE_{i,t} + \vec{\omega} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $X_{i,t}$ represents the group of control variables mentioned above (including *Size*, *Leverage*, *Profitability*, *Firm growth*, *Slack resource*, *Capital intensity*, *Firm age*, *GDP scale*, and *GDP growth*), and $I_{i,t}$ represents the set of industry- and year-dummy variables. If [Hypothesis 1](#) is supported, then the estimated coefficient of *GD* in Model 1 is expected to be significantly positive.

To verify the moderating effects of institutional quality, state ownership, and CEO academic background on the relationship between global diversification and GI, we specify the following model:

$$GI_{i,t} = \theta_0 + \theta_1 GD_{i,t} + \theta_2 GD_{i,t} \times IQ_{i,t} + \theta_3 GD_{i,t} \times State_{i,t} + \theta_4 GD_{i,t} \times CAE_{i,t} + \theta_5 IQ_{i,t} + \theta_6 State_{i,t} + \theta_7 CAE_{i,t} + \vec{\omega} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $GD_{i,t} \times IQ_{i,t}$, $GD_{i,t} \times State_{i,t}$, and $GD_{i,t} \times CAE_{i,t}$ are the three interaction terms of $GD_{i,t}$ interacting with $IQ_{i,t}$, $State_{i,t}$, and $CAE_{i,t}$, respectively.

Based on these hypotheses, [Table 1](#) displays the expected signs of the coefficients in Models 1 and 2.

4. Results

4.1. Descriptive analyses

[Table 2](#) presents the summary statistics of the main variables. The average value of *GI* is 1.2432, suggesting that the number of GI patents in our sample is relatively low. The standard deviation of *GI* patents is 1.3261, indicating that the number of firms' GI in our sample varies significantly. Additionally, the mean value of *GD* is 1.0834, suggesting that the firms in our sample conduct business across approximately three foreign countries on average. [Table 3](#) presents the correlation matrices for these variables. As expected, there is a significantly positive relationship between *GD* and *GI*, with a significant correlation coefficient of 0.2958 at 1% level. This finding provides preliminary evidence to support [Hypothesis 1](#). Furthermore, the correlations between *GD* and the other variables are within acceptable standards, suggesting that multicollinearity concerns are not significant in our empirical analyses.

4.2. Regression analyses

[Table 4](#) presents the ordinary least squares (OLS) regression results. Column (i) shows the empirical results based on the baseline model, which includes only *IQ*, *State*, *CAE*, and control variables. Column (i) of [Table 4](#) shows that the coefficients of *State*, *CAE*, *Size*, *Leverage*, *Firm growth*, and *Slack resource* are positive and statistically significant. The findings indicate that state ownership, CEO academic experience, leverage, growth, and slack resources are likely to increase GI. Furthermore, the coefficient of *Firm age* is negative and statistically significant. This finding suggests that older firms tend to have lower GI. In addition, both *GDP scale* and *GDP growth* have significantly positive coefficients. This finding suggests that firms located in provinces with larger economic scales or high economic growth tend to have a higher

Table 2

The description statistics.

Variable	N	Mean	Std. Dev.	Min	Max
<i>GI</i>	9211	1.2432	1.3261	0	5.1985
<i>GD</i>	9211	1.0834	0.4750	0.6931	2.5650
<i>IQ</i>	9211	0.5001	0.5000	0	1
<i>State</i>	9211	0.2446	0.4299	0	1
<i>CAE</i>	9211	0.2214	0.4152	0	1
<i>Size</i>	9211	21.7696	1.3552	19.1138	25.5108
<i>Leverage</i>	9211	0.4182	0.1850	0.0656	0.8289
<i>Profitability</i>	9211	0.0668	0.1157	-0.5652	0.3179
<i>Firm growth</i>	9211	0.2001	0.4689	-0.5767	2.8719
<i>Slack resource</i>	9211	2.3240	2.0640	0.4655	12.8467
<i>Capital intensity</i>	9211	12.5598	0.8936	10.2170	14.7698
<i>Firm age</i>	9211	2.8196	0.3604	1.6094	3.4965
<i>GDP scale</i>	9211	27.9467	1.5250	24.3476	30.5755
<i>GDP growth</i>	9211	1.3298	3.2057	-6.7448	7.1500

Source: Authors' elaboration using data from CSMAR database, the SIPO of the PRC, WGI database and the Statistical Yearbook of each province in China.

GI.

Column (ii) presents the empirical results obtained by adding the dependent variable *GD* to the baseline model. The results in column (ii) are used to test [Hypothesis 1](#). Column (i) of [Table 4](#) shows that *GD* has a significantly positive coefficient ($\beta = 0.1512$, $p < 0.01$). This finding suggests that global diversification positively affects GI. Hence, [Hypothesis 1](#) is supported by our results.

Column (iii) presents the empirical results obtained by adding the dependent variable *GD* and the interaction term $GD \times IQ$ to the baseline model. The results in column (iii) are used to test [Hypothesis 2](#). We can see that the interaction term $GD \times IQ$ has a significantly positive coefficient ($\beta = 0.1062$, $p < 0.05$). This finding indicates that host country's institutional quality can significantly enhance the positive impact of global diversification on GI. Hence, [Hypothesis 2](#) is supported by our results.

Column (iv) presents the empirical results obtained by adding the dependent variable *GD* and the interaction term $GD \times State$ to the baseline model. The results in column (iv) are used to test [Hypothesis 4](#). Evidently, the interaction term $GD \times State$ has a significantly positive coefficient ($\beta = 0.1066$, $p < 0.05$). This finding indicates that the positive impact of global diversification on GI is greater in state-owned firms than private-owned ones. Hence, [Hypothesis 3](#) is supported by our results.

Column (v) presents the empirical results obtained by adding the dependent variable *GD* and the interaction term $GD \times CAE$ to the baseline model. The results in column (v) are used to test [Hypothesis 3](#). Apparently, the interaction term $GD \times CAE$ has a significantly positive coefficient ($\beta = 0.1368$, $p < 0.05$). This finding indicates that the positive effect of global diversification on GI is greater in firms led by CEOs with academic backgrounds than in those led by CEOs without academic backgrounds. Hence, [Hypothesis 4](#) is supported by our results.

Finally, column (vi) presents the regression results obtained by simultaneously incorporating all the variables. As shown in column (vi), the estimated coefficients of the three interaction terms ($GD \times IQ$, $GD \times State$, and $GD \times CAE$) are consistent with those found in the preceding columns.

4.3. Robustness checks

4.3.1. Alternative dependent variable

Prior studies suggest that patent granted can also be regarded as a direct reflection of the inventors' creative work achievement ([Cai et al., 2020](#)). Therefore, in addition to using the number of green patent applications as a measure of a firm's GI, previous studies have utilized the number of green patents granted as an alternative metric. To check whether the abovementioned empirical findings hold when employing alternative measures of GI, we use an alternative measurement for the

Table 1

The predicted coefficients in Model 1 and 2.

Hypothesis	β_1	θ_2	θ_3	θ_4
Hypothesis 1	positive			
Hypothesis 2		positive		
Hypothesis 3			positive	
Hypothesis 4				positive

Source: Authors' elaboration from the empirical model and Hypothesis.

Table 3
The correlation matrix for main variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. <i>GI</i>	1												
2. <i>GD</i>	0.2958***	1											
3. <i>IQ</i>	-0.1242***	-0.3645***	1										
4. <i>State</i>	0.1922***	0.0328***	-0.0134	1									
5. <i>CAE</i>	0.0047	0.0128	0.0253**	0.3741***	1								
6. <i>Size</i>	0.4922***	0.3695***	-0.1746***	-0.0996***	-0.1416***	1							
7. <i>Leverage</i>	0.3238***	0.2000***	-0.1194***	0.281***	0.0782***	0.1650***	1						
8. <i>Profitability</i>	0.0467***	0.0482	0.0023	-0.0282***	0.0219**	0.1897***	-0.1863***	1					
9. <i>Firm growth</i>	0.0903	0.0965	-0.1872***	0.1559***	-0.0386***	0.1897***	0.1404***	0.0101	1				
10. <i>Stock resource</i>	0.0786	-0.0111	0.0032	0.0148	0.0097	-0.0842***	0.0159	-0.0433***	-0.0404***	1			
11. <i>Capital intensity</i>	-0.2074***	-0.1385***	0.1025***	-0.169***	0.0811***	-0.4035***	-0.7130***	0.1027**	-0.1349***	0.0072	1		
12. <i>Firm age</i>	0.0698***	0.0231**	-0.0203*	0.1279***	-0.0460***	0.2336***	0.2264***	-0.1261***	0.1408***	-0.0686***	-0.2423***	1	
13. <i>GDP scale</i>	0.0991***	-0.0488**	-0.0385***	-0.0104	0.0598***	0.0091	0.0128	0.0315***	0.0315***	-0.0056	-0.0257**	0.0022	1
14. <i>GDP growth</i>	0.0580***	-0.0210**	0.2884***	0.0743***	-0.0341***	0.0099	0.0057	0.0379***	-0.1928***	0.0135	0.0187*	-0.0670***	-0.0652***

Notes: N=9211, *, **, and *** indicate significance levels of 10%, 5% and 1%, respectively.

Source: Authors' elaboration using data from CSMAR database, the SIPO of the PRC, WGI database and the Statistical Yearbook of each province in China.

dependent variable (*GI_A*). Specifically, $GI_A = \log(\text{the number of green patents granted} + 1)$.

Table 5 presents the empirical results using alternative dependent variables. The results reveal that the coefficients of our key variables, that is, *GD*, $GD \times IQ$, $GD \times CAE$ and $GD \times State$, are consistent with the results obtained in Table 4. This finding suggests that our findings are robust when different *GI* measurements are employed.

4.3.2. Alternative independent variable

We use an alternative independent variable to test whether our conclusions can be drawn using different measurements of global diversification. Specifically, we use the diversification of a firm's subsidiaries across foreign countries as an alternative measure for global diversification. Following the method used by Allayannis et al. (2001), we specify the following formula to measure global diversification:

$$GD_{A_{i,t}} = 1 - \sum_{j=1}^M \left(\frac{n_{i,j,t}}{N_{i,t}} \right)^2 \quad (3)$$

where *M* represents the total number of foreign countries in which firm *i* has subsidiaries. $n_{i,j,t}$ indicates the number of subsidiaries firm *i* operates in foreign country *j* in year *t*. $N_{i,t}$ refers to the total number of foreign subsidiaries firm *i* operates in year *t*.

Table 6 presents the empirical results obtained by using *GD_A* as an alternative independent variable. The estimated coefficients of our key variables *GD_A*, $GD_A \times IQ$, $GD_A \times CAE$, and $GD_A \times State$, are consistent with the findings presented in Table 4. This finding suggests that our findings are robust when different global diversification measurements are used.

4.3.3. 2SLS regressions

Endogeneity concerns may exist between global diversification and *GI*. In other words, a firm with greater *GI* may diversify its business across a larger global scope than its counterparts. To address this endogeneity concern, we employ a 2SLS regression in our empirical study. Specifically, in the first stage, we regress *GD* on the instrumental variable (lagged *GD*), covariates (the aforementioned control variables $X_{i,t}$), and industry- and year-dummy variables. Furthermore, we substitute the actual value of *GD* with its predicted value (*GD_{IV}*) obtained from the first stage.

Table 7 presents the empirical results, using *GD_{IV}* as an independent variable. The conclusions drawn from Table 4 are supported by the results presented in Table 7. Thus, our findings are robust after controlling for endogeneity concerns.

4.3.4. Heckman two-stage method

Our empirical study is limited to MNCs and focuses on firms with foreign subsidiaries. Thus, a sample selection bias may exist in our empirical investigation. To address this type of bias, we follow the literature (Heckman, 1979; Zhou, 2022) and deploy the Heckman two-stage method in our empirical study. Specifically, we first specify the following selection equation to forecast a firm's probability of establishing subsidiaries in foreign countries, and predict the inverse mills ratio (*IMR*):

$$\Pr(MN_{i,t} = 1) = \omega_0 + \omega_1 TFP_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $MN_{i,t}$ is a dummy variable serving as a proxy for whether firm *i* has a foreign subsidiary in year *t*. We use total factor productivity (*TFP*) as the key variable in our selection equation because of its critical role in a firm's international involvement (Helpman et al., 2004). Following with prior literature (Zhou, 2021), *TFP* is calculated according to the method proposed by Levinsohn and Petrin (2003). $X_{i,t}$ and $I_{i,t}$ are the variable matrices mentioned in Section 3.3.

Table 8 reports the empirical results, which includes *IMR* as an additional variable. Our findings in Table 8 demonstrate that the

Table 4

The empirical results.

Variable	$GI = \log(\text{the number of a firm's green patent applications} + 1)$					
	(i)	(ii)	(iii)	(ix)	(x)	(xi)
<i>GD</i>		0.1290*** (0.0301)	0.0802** (0.0338)	0.0923*** (0.0326)	0.1080*** (0.0325)	0.0102 (0.0383)
<i>GD</i> × <i>IQ</i>			0.1811*** (0.0568)			0.1874*** (0.0573)
<i>GD</i> × <i>State</i>				0.1277** (0.0535)		0.1511*** (0.0537)
<i>GD</i> × <i>CAE</i>					0.0963* (0.0565)	0.1136** (0.0565)
<i>IQ</i>	−0.0323 (0.0254)	0.0060 (0.0266)	−0.1793*** (0.0621)	0.0077 (0.0266)	0.0050 (0.0267)	−0.1850*** (0.0624)
<i>State</i>	0.1220*** (0.0288)	0.1336*** (0.0290)	0.1345*** (0.0289)	−0.0066 (0.0626)	0.1346*** (0.0289)	−0.0301 (0.0627)
<i>CAE</i>	0.1396*** (0.0257)	0.1335*** (0.0257)	0.1321*** (0.0257)	0.1336*** (0.0257)	0.0282 (0.0644)	0.0079 (0.0645)
<i>Size</i>	0.5039*** (0.0113)	0.4870*** (0.0120)	0.4880*** (0.0120)	0.4854*** (0.0120)	0.4869*** (0.0120)	0.4860*** (0.0120)
<i>Leverage</i>	0.4770*** (0.0918)	0.4665*** (0.0917)	0.4630*** (0.0916)	0.4712*** (0.0917)	0.4662*** (0.0917)	0.4680*** (0.0917)
<i>Profitability</i>	−0.1204 (0.1012)	−0.1140 (0.1010)	−0.1167 (0.1009)	−0.1126 (0.1011)	−0.1155 (0.1010)	−0.1169 (0.1011)
<i>Firm growth</i>	0.1892*** (0.0243)	0.1887*** (0.0243)	0.1896*** (0.0243)	0.1904*** (0.0243)	0.1881*** (0.0243)	0.1910*** (0.0243)
<i>Slack resource</i>	0.0234*** (0.0065)	0.0223*** (0.0064)	0.0225*** (0.0064)	0.0216*** (0.0065)	0.0227*** (0.0064)	0.0221*** (0.0065)
<i>Capital intensity</i>	0.0181 (0.0147)	0.0175 (0.0147)	0.0167 (0.0147)	0.0167 (0.0147)	0.0172 (0.0147)	0.0155 (0.0147)
<i>Firm age</i>	−0.1239*** (0.0342)	−0.1224*** (0.0342)	−0.1237*** (0.0342)	−0.1219*** (0.0342)	−0.1228*** (0.0342)	−0.1236*** (0.0342)
<i>GDP scale</i>	0.0284*** (0.0069)	0.0150** (0.0075)	0.0112 (0.0076)	0.0160** (0.0075)	0.0148** (0.0075)	0.0118 (0.0076)
<i>GDP growth</i>	0.0172** (0.0072)	0.0138* (0.0072)	0.0156** (0.0072)	0.0145** (0.0072)	0.0136* (0.0072)	0.0163** (0.0072)
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−9.0615*** (0.4027)	−8.4371*** (0.4273)	−8.2775*** (0.4282)	−8.3831*** (0.4281)	−8.4079*** (0.4271)	−8.1738*** (0.4285)
<i>N</i>	9211	9211	9211	9211	9211	9211
adj. R^2	0.450	0.451	0.452	0.452	0.452	0.453
<i>F</i>	148.8045	147.2967	144.7293	145.6987	145.0381	141.3124

Notes: *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. Heteroscedasticity-robust standard errors are reported in parentheses.

Source: Authors' elaboration using data from CSMAR database, the SIPO of the PRC, WGI database and the Statistical Yearbook of each province in China.

estimated coefficients of our key variables, including *GD*, *GD* × *IQ*, *GD* × *CAE* and *GD* × *State*, are similar to those in Table 4, which suggests that our conclusions still hold even when sample selection bias is controlled.

5. Discussion, implication, and limitation

5.1. Discussion

In recent years, environmental issues have caused growing concern in all sectors of society. Notably, GI has been identified as a crucial factor for combating environmental concerns. This innovation involves the development of new technologies to reduce environmental pollution and promote sustainable development (Aghion et al., 2016). Considering the significance of GI, it is worthwhile exploring its contributing factors. Therefore, this study examines the extent to which firms' GI is shaped by their global diversification, using data on Chinese manufacturing MNCs listed on the A-share market in Shanghai and Shenzhen from 2008 to 2020.

We find a significantly positive relationship between global diversification and GI. This finding indicates that firms with extensive global reach are more inclined to participate in GI activities. This finding supports the view that increasing external pressure from various stakeholders across countries stimulates MNCs to focus on GI (Galbreath, 2019; Lau et al., 2014), as well as the notion that global diversification can enhance a firm's ability to carry out GI by increasing its economies

of scale and absorbing new knowledge about technological innovation (Kang, 2013; Perruchas et al., 2020). However, this finding contradicts the pollution haven argument that Chinese firms may diversify their operational activities across host countries with relatively low environmental responsibility requirements (Behera and Sethi, 2022; Strike et al., 2006), thus evading environmental responsibility and weakening their incentives to participate in GI.

Our findings suggest that firms that diversify their businesses across host countries with good institutional quality are more likely to have higher GI. This indicates that firms operating in host countries with effective and strictly implemented legal and regulatory frameworks face greater institutional pressure to fulfill their environmental responsibilities (Attig et al., 2016). This, in turn, encourages them to allocate more resources to GI activities to comply with the environmental requirements and satisfy the stakeholders' expectations in such host countries. Therefore, the institutional environment plays a crucial role in shaping firms socially responsible behavior (Campbell, 2007), and meeting environmental responsibilities is particularly important in addressing such institutional pressures (Babik and Trendafilova, 2011).

The findings show that the positive effect of global diversification on GI is more pronounced in state-owned than privately owned firms. We suggest that the difference in the relationships between state-owned and privately owned firms can be attributed to two factors. First, state-owned firms are often associated with the image of a socialist country when operating in international markets. The behaviors of these firms

Table 5

Robustness Check: Alternative dependent variable.

Variable	GLA=log (the number of a firm's granted green patents + 1)				
	(i)	(ii)	(iii)	(iv)	(v)
<i>GD</i>	0.1512*** (0.0276)	0.1225*** (0.0318)	0.1205*** (0.0302)	0.1213*** (0.0301)	0.0503 (0.0362)
<i>GD × IQ</i>		0.1062** (0.0516)			0.1102** (0.0521)
<i>GD × State</i>			0.1066** (0.0503)		0.1310*** (0.0504)
<i>GD × CAE</i>				0.1368** (0.0534)	0.1531*** (0.0536)
<i>IQ</i>	0.0147 (0.0243)	−0.0940* (0.0567)	0.0160 (0.0243)	0.0132 (0.0243)	−0.0981* (0.0570)
<i>State</i>	0.1357*** (0.0235)	0.1349*** (0.0235)	0.1358*** (0.0234)	−0.0139 (0.0597)	−0.0325 (0.0598)
<i>CAE</i>	0.0772*** (0.0265)	0.0778*** (0.0265)	−0.0398 (0.0575)	0.0787*** (0.0265)	−0.0643 (0.0576)
<i>Size</i>	0.4170*** (0.0111)	0.4176*** (0.0111)	0.4157*** (0.0111)	0.4169*** (0.0111)	0.4158*** (0.0111)
<i>Leverage</i>	0.4839*** (0.0837)	0.4818*** (0.0836)	0.4878*** (0.0837)	0.4834*** (0.0837)	0.4860*** (0.0836)
<i>Profitability</i>	−0.1912** (0.0959)	−0.1928** (0.0958)	−0.1901** (0.0960)	−0.1934** (0.0959)	−0.1938** (0.0961)
<i>Firm growth</i>	0.1449*** (0.0222)	0.1454*** (0.0222)	0.1463*** (0.0222)	0.1440*** (0.0222)	0.1463*** (0.0222)
<i>Slack resource</i>	0.0185*** (0.0056)	0.0186*** (0.0056)	0.0179*** (0.0056)	0.0191*** (0.0056)	0.0186*** (0.0056)
<i>Capital intensity</i>	0.0345** (0.0135)	0.0340** (0.0135)	0.0338** (0.0135)	0.0341** (0.0135)	0.0329** (0.0135)
<i>Firm age</i>	−0.1112*** (0.0317)	−0.1119*** (0.0317)	−0.1108*** (0.0317)	−0.1117*** (0.0317)	−0.1121*** (0.0317)
<i>GDP scale</i>	0.0032 (0.0067)	0.0009 (0.0068)	0.0039 (0.0067)	0.0028 (0.0067)	0.0013 (0.0068)
<i>GDP growth</i>	0.0095 (0.0066)	0.0106 (0.0066)	0.0101 (0.0066)	0.0092 (0.0066)	0.0110* (0.0066)
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes
<i>Year dummies</i>	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−7.1337*** (0.4039)	−7.0402*** (0.4044)	−7.0887*** (0.4052)	−7.0924*** (0.4029)	−6.9350*** (0.4046)
<i>N</i>	9211	9211	9211	9211	9211
<i>adj. R²</i>	0.433	0.433	0.433	0.433	0.434
<i>F</i>	131.5655	129.3166	129.7544	129.8106	126.0684

Notes: *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. Heteroscedasticity-robust standard errors are reported in parentheses.

Source: Authors' elaboration using data from CSMAR database, the SIPO of the PRC, WGI database and the Statistical Yearbook of each province in China.

are routinely guided and influenced by their home governments (Lau et al., 2014). Notably, the home country's government imposes higher environmental requirements on state-owned firms than on privately owned ones (Zhang et al., 2022). Consequently, state-owned firms are likely to engage in more GI activities during their international expansions to meet the demands of their home governments. Second, state-owned firms have special relationships with their home country (Zhou et al., 2017). They are often better positioned than privately owned firms to obtain the resources necessary to encourage environmental innovation. Consequently, state-owned firms have greater ability to engage in GI activities in the process of global diversification. Overall, our findings suggest that state-owned firms may be particularly well-suited to driving environmentally friendly practices in the context of international business.

Our results indicate that the positive effect of global diversification on GI is more pronounced in firms led by CEOs with academic experience than in those led by CEOs without academic experience. This difference can be interpreted in two ways. First, academic work can shape CEOs' ethical cognition (Ma et al., 2019), thereby raising their ethical standards when it comes to environmental protection (He et al., 2021). Consequently, CEOs with academic experience can lead firms to actively respond to global environmental concerns through GI. Second, academic experience can enhance CEOs' professional competencies, including logical thinking, rigorous working attitudes, information processing abilities, and creative thinking patterns (Jiang and Murphy, 2007).

These special professional competencies enable firms to respond actively to environmental concerns in host countries through GI. Our findings suggest that academic experience is a valuable asset for MNCs seeking to drive environmental sustainability in an international business context.

5.2. Implications

5.2.1. Implication for the theory

Scholars can draw several implications from this study. First, while previous research has examined various factors that influence GI, limited emphasis has been paid to MNC decisions in this area. This study throws light on MNCs' global strategies in determining GI and emphasizes the impact of global diversification on GI. We recommend that future researchers investigating the antecedent determinants of GI examine the effects of MNC decisions.

Second, this study emphasizes the importance of host country's institutional quality in determining the effect of MNCs' global strategies on their GI. This finding suggests that the extent to which MNCs engage in GI activities during the internationalization process is determined by the host country's operational environment. Therefore, we encourage researchers to further investigate the conditions in the host country to achieve better GI outcomes in MNCs during the internationalization process.

Third, this study suggests that state ownership significantly

Table 6

Robustness Check: Alternative independent variable.

Variable	GI=log (the number of a firm's green patent applications + 1)				
	(i)	(ii)	(iii)	(iv)	(v)
<i>GD_A</i>	0.2142*** (0.0401)	0.1364*** (0.0501)	0.1650*** (0.0429)	0.1811*** (0.0434)	0.0404 (0.0551)
<i>GD_A</i> × <i>IQ</i>		0.1823*** (0.0696)			0.1834*** (0.0699)
<i>GD_A</i> × <i>CAE</i>			0.1985*** (0.0745)		0.2277*** (0.0748)
<i>GD_A</i> × <i>State</i>				0.1509** (0.0754)	0.1781** (0.0757)
<i>IQ</i>	0.0139 (0.0267)	−0.0469 (0.0342)	0.0163 (0.0267)	0.0124 (0.0267)	−0.0461 (0.0342)
<i>State</i>	0.1357*** (0.0289)	0.1345*** (0.0289)	0.0696* (0.0364)	0.1368*** (0.0288)	0.0600* (0.0363)
<i>CAE</i>	0.1319*** (0.0257)	0.1313*** (0.0257)	0.1321*** (0.0257)	0.0800** (0.0348)	0.0701** (0.0347)
<i>Size</i>	0.4870*** (0.0117)	0.4890*** (0.0118)	0.4846*** (0.0118)	0.4870*** (0.0117)	0.4862*** (0.0118)
<i>Leverage</i>	0.4748*** (0.0916)	0.4759*** (0.0916)	0.4779*** (0.0917)	0.4752*** (0.0916)	0.4798*** (0.0917)
<i>Profitability</i>	−0.1110 (0.1009)	−0.1132 (0.1008)	−0.1100 (0.1010)	−0.1122 (0.1010)	−0.1135 (0.1011)
<i>Firm growth</i>	0.1911*** (0.0244)	0.1914*** (0.0243)	0.1930*** (0.0243)	0.1909*** (0.0243)	0.1933*** (0.0243)
<i>Slack resource</i>	0.0231*** (0.0064)	0.0234*** (0.0064)	0.0222*** (0.0064)	0.0236*** (0.0064)	0.0230*** (0.0065)
<i>Capital intensity</i>	0.0168 (0.0147)	0.0162 (0.0147)	0.0165 (0.0147)	0.0166 (0.0147)	0.0154 (0.0147)
<i>Firm age</i>	−0.1221*** (0.0342)	−0.1235*** (0.0342)	−0.1224*** (0.0342)	−0.1223*** (0.0342)	−0.1241*** (0.0342)
<i>GDP scale</i>	0.0093 (0.0078)	0.0073 (0.0078)	0.0100 (0.0078)	0.0091 (0.0078)	0.0079 (0.0078)
<i>GDP growth</i>	0.0126* (0.0072)	0.0148** (0.0072)	0.0133* (0.0072)	0.0124* (0.0072)	0.0153** (0.0072)
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes
<i>Year dummies</i>	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−8.2092*** (0.4336)	−8.1549*** (0.4330)	−8.1580*** (0.4336)	−8.1995*** (0.4335)	−8.0843*** (0.4327)
<i>N</i>	9211	9211	9211	9211	9211
adj. <i>R</i> ²	0.452	0.452	0.452	0.452	0.453
<i>F</i>	147.3827	144.6308	145.9767	145.0143	141.3022

Notes: *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. Heteroscedasticity-robust standard errors are reported in parentheses.

Source: Authors' elaboration using data from CSMAR database, the SIPO of the PRC, WGI database and the Statistical Yearbook of each province in China.

influences the effect of MNCs' global strategies on their GI. This finding implies that the internal ownership structure has a significant impact on GI activities during the internationalization process. Consequently, we recommend that researchers should further delve deeper into the ownership structure conditions to enhance our understanding of how they affect GI outcomes in MNCs during the internationalization process.

Fourth, this study identifies CEO characteristics that influence the effect of MNCs' global strategies on their GI, with CEOs' academic experience being an important factor. This finding implies that top managers' attitudes and abilities play a significant role in determining MNCs' GI activities during internationalization process. Therefore, we suggest that researchers should further explore the effects of decision-makers in achieving better GI outcomes in MNCs during the internationalization process.

5.2.2. Implication for practices

Our findings also have practical implications for firms. First, our findings suggest that firms that seek to improve their GI performance can do so by expanding their global reach. This is because diversifying globally enables firms to tap into new consumer bases, access resources, and benefit from economies of scale, thereby facilitating their participation in GI activities. Therefore, firms should actively explore international opportunities and expand their presence in other regions.

Second, our findings indicate that host country's good institutional

quality provides an environment conducive to business operations, thereby facilitating GI. This finding implies that the choice of host countries to diversify business activities is crucial in determining a firm's GI performance. It is essential for firms to prioritize the expansion of their business activities in host countries characterized by good institutional quality so as to fully leverage their potential for their GI. Therefore, firms should carefully consider host country's institutional quality, such as strong legal frameworks, stable political systems, and transparent governance during the internationalization process.

Third, our findings suggest that privately owned firms should recognize their disadvantages in enhancing GI in the global diversification process compared with state-owned firms. Specifically, privately owned firms often face challenges such as limited resources, limited access to government support, and potential difficulties in navigating complex international markets. Therefore, privately owned firms should enhance their capabilities and formulate environmental protection management systems to promote their green development.

Fourth, our findings suggest that CEO plays a significant role in shaping an MNC's attitude toward and ability to participate in GI. Therefore, appointing the right top executive is crucial for effectively promoting MNCs' GI in the internationalization process. Individuals with academic experience generally have high ethical standards for environmental protection and a good understanding of the long-term value of GI for a firm. Thus, MNCs should consider hiring CEOs with academic backgrounds to lead their GI efforts, as such individuals can

Table 7
Robustness check: 2SLS.

Variable	First stage	Second stage				
	GD	GI=log (the number of a firm's green patent applications + 1)				
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
<i>GD_{IV}</i>		0.1359*** (0.0352)	0.0902** (0.0388)	0.0825** (0.0384)	0.1067*** (0.0381)	−0.0100 (0.0444)
<i>GD_{IV} × IQ</i>			0.1822*** (0.0673)			0.1915*** (0.0681)
<i>GD_{IV} × State</i>				0.1792*** (0.0618)		0.2086*** (0.0620)
<i>GD_{IV} × CAE</i>					0.1317** (0.0663)	0.1605** (0.0662)
<i>IQ</i>		−0.0093 (0.0291)	−0.2040*** (0.0754)	−0.0062 (0.0291)	−0.0111 (0.0292)	−0.2126*** (0.0759)
<i>State</i>		0.1114*** (0.0318)	0.1126*** (0.0318)	−0.0947 (0.0749)	0.1129*** (0.0317)	−0.1254* (0.0751)
<i>CAE</i>		0.1480*** (0.0291)	0.1469*** (0.0291)	0.1482*** (0.0291)	−0.0024 (0.0788)	−0.0362 (0.0787)
<i>Lag GD</i>	0.8563*** (0.0086)					
<i>Size</i>	0.0189*** (0.0027)	0.5035*** (0.0137)	0.5037*** (0.0137)	0.5016*** (0.0138)	0.5033*** (0.0137)	0.5012*** (0.0138)
<i>Leverage</i>	0.0346 (0.0222)	0.5535*** (0.1055)	0.5504*** (0.1055)	0.5578*** (0.1056)	0.5531*** (0.1056)	0.5548*** (0.1056)
<i>Profitability</i>	0.0764*** (0.0187)	−0.1060 (0.1124)	−0.1068 (0.1124)	−0.1081 (0.1125)	−0.1089 (0.1123)	−0.1128 (0.1126)
<i>Firm growth</i>	0.0090 (0.0065)	0.2281*** (0.0286)	0.2295*** (0.0286)	0.2306*** (0.0285)	0.2286*** (0.0285)	0.2329*** (0.0284)
<i>Slack resource</i>	0.0025 (0.0016)	0.0319*** (0.0082)	0.0319*** (0.0082)	0.0308*** (0.0082)	0.0323*** (0.0082)	0.0312*** (0.0082)
<i>Capital intensity</i>	0.0006 (0.0032)	0.0290* (0.0168)	0.0289* (0.0167)	0.0277* (0.0168)	0.0287* (0.0167)	0.0270 (0.0167)
<i>Firm age</i>	−0.0155** (0.0075)	−0.1053*** (0.0393)	−0.1057*** (0.0393)	−0.1042*** (0.0392)	−0.1054*** (0.0393)	−0.1045*** (0.0392)
<i>GDP scale</i>	0.0310*** (0.0018)	0.0157* (0.0085)	0.0126 (0.0085)	0.0166** (0.0084)	0.0155* (0.0085)	0.0133 (0.0085)
<i>GDP growth</i>	0.0086*** (0.0015)	0.0116** (0.0080)	0.0193** (0.0080)	0.0184** (0.0080)	0.0173** (0.0080)	0.0200** (0.0080)
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−1.1279*** (0.1005)	−12.0036*** (0.5277)	−11.8373*** (0.5278)	−11.8864*** (0.5280)	−11.9686*** (0.5276)	−11.6497*** (0.5277)
<i>N</i>	7355	7355	7355	7355	7355	7355
<i>adj. R²</i>	0.843	0.471	0.472	0.472	0.471	0.473
<i>F</i>	857.4288	134.0352	131.5186	133.2317	132.0654	129.2392

Notes: *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. Heteroscedasticity-robust standard errors are reported in parentheses.
Source: Authors' elaboration using data from CSMAR database, the SIPO of the PRC, WGI database and the Statistical Yearbook of each province in China.

effectively drive sustainable practices, foster innovation, and align a firm's strategic goals with its global integration objectives.

5.2.3. Implication for policymaking

Our study has several policy implications for governments. First, our findings suggest that governments in emerging countries can effectively promote firms' GI by increasing the degree of firms' global diversification. Thus, governments can develop mechanisms to ensure the long-term positive effects of global diversification on GI. This may involve creating policies and programs that assist firms in expanding their operations internationally and providing them with the necessary resources and assistance to navigate the potential risks and obstacles that firms may encounter during the process of global diversification. Second, government policymakers seeking to enhance MNCs' GI should focus on optimizing the institutional environment. This can be achieved by creating a favorable business climate and regulatory framework that encourages MNCs to actively participate in GI. By reducing bureaucratic hurdles, streamlining administrative processes, and providing transparent and predictable legal systems, governments can enhance MNCs' motivation to engage in global diversification and contribute to GI. Third, policymakers should consider the differences between state-

owned and privately owned firms while strengthening the positive role of global diversification in GI. Allocating resources in a reasonable and effective manner based on a firm's property characteristics is of utmost importance. This means that the government needs to adopt different strategies and policies to support state-owned and privately owned firms in diversifying globally and promoting GI. By tailoring their support to the specific requirements of each type of firm, governments can maximize the benefits of global diversification in both sectors.

5.3. Limitations

This study has several limitations. First, we measure GI from the perspective of firms' GI output (i.e., green patents). Although our approach is the most popular measurement of GI and can capture its essence, a firm's GI may not be patentable because some firms may choose to avoid patent applications to safeguard their technological secrets of their GI. Therefore, future studies should consider more precise measurements for GI. Second, we consider only green patents to capture GI because of data availability. However, it is important to recognize that GI encompasses various types beyond green patents. Future research should explore other forms of GI, such as green products launched in the market, to further expand our understanding in this

Table 8

Robustness Check: Heckman two-stage method.

Variables	First stage	Second stage				
	MN	GI=log (the number of a firm's green patent applications + 1)				
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
<i>GD</i>		0.1281*** (0.0301)	0.0786** (0.0338)	0.0917*** (0.0326)	0.1074*** (0.0325)	0.0093 (0.0383)
<i>GD</i> × <i>IQ</i>			0.1835*** (0.0568)			0.1897*** (0.0573)
<i>GD</i> × <i>State</i>				0.1268** (0.0535)		0.1501*** (0.0536)
<i>GD</i> × <i>CAE</i>					0.0950* (0.0564)	0.1121** (0.0564)
<i>IQ</i>		0.0066 (0.0266)	−0.1811*** (0.0620)	0.0082 (0.0266)	0.0055 (0.0267)	−0.1868*** (0.0624)
<i>State</i>		0.1299*** (0.0291)	0.1307*** (0.0291)	−0.0093 (0.0291)	0.1310*** (0.0291)	−0.0328 (0.0627)
<i>CAE</i>		0.1348*** (0.0257)	0.1335*** (0.0257)	0.1349*** (0.0257)	0.0309 (0.0645)	0.0109 (0.0645)
<i>TFP</i>	0.0788*** (0.0191)					
<i>Size</i>	0.2572*** (0.0178)	0.5113*** (0.0179)	0.5132*** (0.0179)	0.5095*** (0.0178)	0.5109*** (0.0178)	0.5107*** (0.0178)
<i>Leverage</i>	0.0330 (0.0730)	0.4562*** (0.0919)	0.4522*** (0.0919)	0.4609*** (0.0920)	0.4560*** (0.0920)	0.4574*** (0.0920)
<i>Profitability</i>	−0.0608 (0.0715)	−0.1191 (0.1012)	−0.1219 (0.1011)	−0.1176 (0.1013)	−0.1206 (0.1012)	−0.1219 (0.1013)
<i>Firm growth</i>	−0.0204* (0.0116)	0.1833*** (0.0245)	0.1840*** (0.0245)	0.1851*** (0.0245)	0.1827*** (0.0245)	0.1856*** (0.0244)
<i>Slack resource</i>	0.0037 (0.0030)	0.0212*** (0.0065)	0.0214*** (0.0065)	0.0205*** (0.0065)	0.0217*** (0.0065)	0.0211*** (0.0065)
<i>Capital intensity</i>	−0.0337** (0.0133)	0.0136 (0.0149)	0.0128 (0.0149)	0.0129 (0.0149)	0.0135 (0.0149)	0.0117 (0.0149)
<i>Firm age</i>	−0.2412*** (0.0328)	−0.1429*** (0.0357)	−0.1449*** (0.0357)	−0.1422*** (0.0356)	−0.1430*** (0.0357)	−0.1444*** (0.0356)
<i>GDP scale</i>	0.2816*** (0.0167)	0.0148* (0.0076)	0.0109 (0.0076)	0.0157** (0.0075)	0.0146* (0.0076)	0.0115 (0.0076)
<i>GDP growth</i>	0.0621 (0.2752)	0.0137* (0.0072)	0.0156** (0.0072)	0.0144** (0.0072)	0.0136* (0.0072)	0.0163** (0.0072)
<i>IMR</i>		0.1731** (0.0847)	0.1798** (0.0848)	0.1718** (0.0845)	0.1709** (0.0847)	0.1758** (0.0845)
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−8.6084*** (0.4447)	−11.6889*** (0.5495)	−11.5336*** (0.5478)	−11.6082*** (0.5495)	−11.6551*** (0.5501)	−11.3930*** (0.5480)
<i>N</i>	16587	9200	9200	9200	9200	9200
adj. <i>R</i> ²	–	0.451	0.452	0.452	0.451	0.452
<i>F</i>	–	145.8673	143.4012	144.2590	143.6343	139.9835

Notes: *, ** and *** indicate significance levels of 10%, 5% and 1%, respectively. Heteroscedasticity-robust standard errors are reported in parentheses.

Source: Authors' elaboration using data from CSMAR database, the State Intellectual Property Office of the People's Republic of China, WGI database and the Statistical Yearbook of each province in China.

area. Third, constrained by data availability, we estimate global diversification using the distribution of foreign subsidiaries across host countries. Although our measurement is extensively used in the literature (Tallman and Li, 1996; Zhou, 2022), an ideal measure of an MNC's global diversification should capture the global distribution of all business activities (i.e., sales, employees, assets, and subsidiaries) across foreign countries. Future studies should consider more precise variables when quantifying global diversification. Fourth, our empirical findings are based on manufacturing in MNCs from China. However, the generalizability of these findings to MNCs in other countries and/or industries remains uncertain because our study may be limited to a specific context. Thus, future studies may provide additional evidence using samples from different countries or industries.

Data availability

Data will be made available on request.

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Global diversification, host-country environments, and corporate philanthropic giving: Evidence from Chinese multinational corporations

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ABSTRACT

Previous studies suggest that multinational corporations (MNCs) are likely to participate in more philanthropic activities because these activities could facilitate their operation in host countries. Focusing on a sample of Chinese MNCs between 2006 and 2019, this study investigates whether more diversified firms have higher corporate philanthropic giving (CPG), and the moderating effect of host-country environments. The results indicate that there is not a significant relationship between firm's global diversification and CPG. Nonetheless, we find that a host country's cultural distance, institutional quality and country risk negatively moderate the global diversification–CPG relationship, while a host country's economic growth positively moderates this relationship. Our findings suggest that although global diversification increases the incentives for Chinese firms to engage in philanthropy, it also constrains on their involvement in such activities. Furthermore, the precise effect of global diversification on a firm's CPG is conditional on the environment of its host country, and the host country that has large cultural difference to home country, good institutional quality, high risk and bad economic prospect leads to decrease in MNCs' CPG. Our study provides new evidences for the determinants of CPG in MNCs from emerging markets.

1. Introduction

Global diversification refers to the “number of different markets in which a firm operates and the importance of these markets to the firm,” where markets are essentially “different geographic locations that cross national borders” (Hitt et al., 1997, 767). In recent years, global diversification has become a widely adopted strategy for Chinese firms. According to *2020 Statistical Bulletin of China's Outward Foreign Direct Investment*, by the end of 2020, 28,000 Chinese domestic investors had set up 45,000 foreign subsidiaries in 189 countries (regions). It is suggested that global diversification is a key strategy for emerging market firms to achieve competitive advantages through ways such as access to new markets, additional growth opportunities and new resources (Hitt et al., 1997; Purkayastha et al., 2012). However, when firms operate in more locations globally, they are also likely to confront new challenges such as the liability of foreignness (Zaheer and Mosakowski, 1997), the difficulty of organization management (Siddharthan and Lall, 1982), a potentially unfriendly foreign environment (Zahra and Garvis, 2000), as well as intensified pressures arising from larger and more diverse international stakeholder environment (Brammer et al., 2006; Brammer et al., 2009).

Previous studies suggest that corporate philanthropic giving (CPG), as a key component of corporate social responsibility (CSR), could assist a multinational corporation (MNC) to tackle the pressures it faces from various stakeholder groups (Bae et al., 2021). In particular, CPG could assist an MNC to establish a strong reputation (Hogarth et al., 2018), develop a good relationship with its clients (Hall, 2006), create a conducive business environment (Chen et al., 2015), and maintain its corporate legitimacy with local regulators (Hornstein and Zhao, 2018). Given these benefits of CPG to MNCs, it follows that global diversification is likely to induce a firm's involvement in CPG (Brammer et al., 2009; Kang, 2013).

Researchers have uncovered several important insights on the relationship between a firm's global diversification and its involvement in CPG (Brammer et al., 2009; Cheung et al., 2015; Kang, 2013). Nonetheless, there remain two significant gaps in the literature. First, previous studies mainly investigate the global diversification–CPG relationship by focusing on firms from developed markets, such as those operating in U. S. and U. K. (e.g., Brammer et al., 2009; Kang, 2013). It remains unclear whether their findings apply to firms from emerging markets. Second, the environment of a host country has been long emphasized in influencing the behavior of an MNC (Herrera-Echeverri

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Table 1
The data source of this study.

Data source	Application in this study
Annual reports	We collect data on firms' foreign business from their annual reports, such as the various host countries in which they have business operations. The data is used to measure a firm's global diversification.
CSR reports	We obtain CPG data in firms' CSR reports.
Hofstede Insights	We obtain the raw information of national culture from Hofstede Insights so as to calculate cultural distance.
WGI database	We collect data describing each country's institutional quality from WGI database.
ICRG	We obtain country risk data from the ICRG, which is provided by the PRS Group.
WDI database	We obtain economic growth for each host country in our dataset from the WDI database.
CSMAR	Other firm-level data used in this study is from CSMAR.

Table 2
Variable definitions and measures.

Variable	Variable definitions
<i>CPG</i>	100 times the ratio of social donation amount to total sales.
<i>Global diversification</i>	The number of foreign countries where a firm has subsidiaries.
<i>Cultural distance</i>	The average of cultural distance of foreign countries in which a firm operates subsidiaries. Culture distance between China and each host country is measured as an index that is similar to that of Kogut and Singh (1988).
<i>Institutional quality</i>	The average of institutional quality of foreign countries in which a firm operates subsidiaries. The measure of each foreign country's institutional quality is based on data from the WGI database.
<i>Country risk</i>	The average of country risk of foreign countries in which a firm operates subsidiaries. The country risk of each foreign country is derived from the country risk index in the ICRG.
<i>Economic growth</i>	The average of economic growth of foreign countries where a firm has subsidiaries.
<i>State ownership</i>	A dummy variable, <i>State ownership</i> takes the value of 1 if a firm's ultimate controller is the government, otherwise <i>State ownership</i> takes the value of 0.
<i>Firm size</i>	The log of total assets.
<i>Debt level</i>	Ratio of total liabilities to total assets.
<i>Profitability</i>	Net profit divided by equity.
<i>Slack</i>	The ratio of slack resources to total sales. The slack resources include receivables, inventory, and selling, general, and administrative expenses.
<i>Firm growth</i>	A firm's sales growth rate.
<i>Firm age</i>	The logarithm of the number of years from the establishment year.

Table 3
The prediction of hypotheses in Model 1 and 2.

Hypothesis	β_1	θ_2	θ_3	θ_4	θ_5
Hypothesis 1a	Positive				
Hypothesis 1b	Negative				
Hypothesis 2a		Positive			
Hypothesis 2b		Negative			
Hypothesis 3a			Positive		
Hypothesis 3b			Negative		
Hypothesis 4a				Positive	
Hypothesis 4b				Negative	
Hypothesis 5a					Positive
Hypothesis 5b					Negative

et al., 2014; Rahko, 2021). However, there is very little knowledge about the effect of host country environment on the global diversification-CPG relationship.

To address the two knowledge gaps discussed above, in this study we focus on MNCs originating from China, an emerging market, and investigate the extent to which the CPG of these firms is affected by

Table 4
Descriptive statistics.

Variables	N	Mean	Std. Dev.	Min	Max
1. <i>CPG</i>	2111	0.0199	0.0693	0	0.5340
2. <i>Global diversification</i>	2111	3.3323	3.3778	1	28
3. <i>Cultural distance</i>	2111	2.2609	1.0628	0.7498	6.1153
4. <i>Institutional quality</i>	2111	1.0768	0.5021	-0.8230	1.8620
5. <i>Country risk</i>	2111	0.1814	0.0561	0.0400	0.4400
6. <i>Economic growth</i>	2111	2.5852	1.7265	-5.2809	10.1254
7. <i>State ownership</i>	2111	0.6138	0.4870	0	1
8. <i>Firm size</i>	2111	23.5353	1.2584	19.9831	27.4677
9. <i>Debt level</i>	2111	0.5260	0.1705	0.0810	0.9345
10. <i>Profitability</i>	2111	0.0403	0.0543	-0.1724	0.2040
11. <i>Slack</i>	2111	0.5762	0.3714	0.0999	3.2654
12. <i>Firm growth</i>	2111	0.1513	0.4080	-0.6496	4.3673
13. <i>Firm age</i>	2111	2.9419	0.2948	1.0986	3.6636

global diversification. By investigating a sample of Chinese A-share-listed manufacturing MNCs operating during the period from 2006 to 2019, we find that there is no significant relationship between a firm's global diversification and its CPG. Moreover, we also find that the characteristics of the host country in which a firm operates significantly moderate that firm's global diversification-CPG relationship. Specifically, we find that the cultural distance, institutional quality and country risk of a host country negatively moderates the global diversification-CPG relationship, while the economic growth of a host country positively moderates the relationship. These findings remain robust when we use alternative measures of CPG and when we control for sample selection bias.

Our findings make several important contributions to the literature on the relationship between global diversification and social performance (Attig et al., 2016; Brammer et al., 2006; Brammer et al., 2009). First, our findings provide new insights into the effect of global diversification on CPG in firms from an emerging economy. Previous studies, which mainly focus on firms from developed countries (Brammer et al., 2009; Kang, 2013), suggest that firms that diversify globally will increase their involvement in CPG so as to meet the increasing demands from their stakeholders worldwide. However, we find that there is no significant relationship between global diversification and an emerging-market MNC's involvement in CPG. Our findings suggest that although global diversification increases the incentives for Chinese firms to engage in philanthropy, it also constrains their involvement in such activities. Our findings further suggest that a firm's global diversification-CPG relationship is dependent on the relative strengths of two opposing effects. Overall, our findings contribute new empirical evidence that clarifies the relationship between firms' global diversification and their involvement in CPG.

Second, our study unpacks the "black box" of the relationship between a firm's global diversification and its involvement in CPG by investigating the moderating effect of the environment of a host country. Specifically, we incorporate four characteristics of a host country's environment—that is, its cultural distance, institutional quality, country risk and economic growth—into our analysis of the global diversification-CPG relationship. The results demonstrate that a host country's environment plays a significant role in shaping the CPG of MNCs. These findings therefore contribute new empirical evidence that advance understanding on how host-country environments determine the CPG of MNCs.

The remainder of the study is organized as follows. In the second section, we review the literature on the relationship between a firm's global diversification and its CPG, and propose hypotheses. In the third section, we describe our research methodology, which includes the construction of the dataset and the definition of the analytical variables. In the fourth section, we present the empirical results. In the final section, we discuss the research findings and their implications, and describe potential directions for future research.

Table 5
Correlation matrix.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. CPG	1											
2. Global diversification	0.0568**	1										
3. Cultural distance	-0.0113	0.2639***	1									
4. Institutional quality	0.0827***	-0.3192***	-0.0039	1								
5. Country risk	-0.0509**	0.2578***	0.4551***	-0.1778***	1							
6. Economic growth	-0.0057	-0.0121	-0.2061***	-0.1778***	-0.0166	1						
7. State ownership	-0.1249***	-0.0554**	0.0790***	0.0431*	0.0523**	-0.0206	1					
8. Firm size	-0.0378	0.3048***	0.0845**	-0.0890***	0.0904***	0.0067	0.1836***	1				
9. Debt level	-0.1126***	0.1685***	0.0417*	-0.1267***	0.1466***	0.0420*	0.1773***	0.4196***	1			
10. Profitability	0.1620***	0.0008	0.0332	0.0284	-0.0083	0.0707***	-0.1792***	0.0474*	-0.4461***	1		
11. Slack	0.0305	0.0262	-0.0392	-0.1487	0.1177***	-0.0033	-0.1193***	-0.2179***	-0.2085***	0.0061	1	
12. Firm growth	0.0213	-0.0404	-0.0092	-0.0297	0.0401	0.0307	0.0555**	-0.0226	-0.0188	0.0553**	0.1694***	1
13. Firm age	-0.011	-0.0341	-0.0054	0.0076	-0.0779***	-0.1266***	-0.0247	-0.01	-0.0608**	-0.0363	0.0064	-0.0421*

Note: N = 2111, ***, **, * and * represent significance levels at 1 %, 5 % and 10 %, respectively.

Table 6

The relationship between global diversification and CPG.

Variables	CPG = 100 × Donation amount / Total sales	
	(1)	(2)
Global diversification		-0.0004 (0.0003)
Cultural distance	-0.0024*** (0.0009)	-0.0019** (0.0009)
Institutional quality	0.0231*** (0.0019)	0.0221*** (0.0019)
Country risk	-0.0312** (0.0135)	-0.0342** (0.0136)
Economic growth	-0.0019*** (0.0006)	-0.0019*** (0.0006)
State ownership	-0.0458*** (0.0023)	-0.0461*** (0.0023)
Firm size	0.0139*** (0.0001)	0.0143*** (0.0001)
Debt level	-0.0193*** (0.0045)	-0.0189*** (0.0045)
Profitability	0.2788*** (0.0195)	0.2788*** (0.0195)
Slack	-0.0011 (0.0032)	-0.0011 (0.0032)
Firm growth	0.0025 (0.0017)	0.0024 (0.0017)
Firm age	0.0146*** (0.0009)	0.0141*** (0.0009)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Constant	-1.0701*** (0.0028)	-1.0741*** (0.0028)
N	2111	2111
Log likelihood	158.1049	158.1342

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

2. Literature review and hypothesis development

2.1. Global diversification and CPG

Previous studies propose that stakeholder theory can account for many aspects of firms' socially responsible behaviors (Attig et al., 2016; Brammer et al., 2006; De Villa et al., 2019). Stakeholder theory posits that one of the main objectives of a firm's managers is to meet the various expectations of the firm's stakeholders. The theory also holds that a firm's involvement in CSR, such as CPG, plays an important role in helping the firm to build good relationships with its stakeholders (Hillman and Keim, 2001). For instance, a firm can establish a sound reputation and attain legitimacy in local markets by actively participating in numerous philanthropic activities (Brammer et al., 2009). The process of global diversification tends to result in a firm's stakeholder environment becoming more international and diverse. Specifically, when a firm has a wide geographical range of operations, it inevitably encounters new important stakeholder groups, such as new customers, employees, and government regulators in foreign countries. Consequently, the intensity and diversity of stakeholder pressures that such a firm encounters will increase significantly, owing to variations in the social, cultural, legal and economic environment between different countries (Sharfman et al., 2004). Stakeholder theory suggests that many of these stakeholder pressures relate to issues with firms' CSR (Simerly, 1997). Therefore, MNCs are expected to increase their engagement in CSR activities (such as philanthropic activities) in response to the increasing and varied demands of various stakeholders in different countries.

Hypothesis 1a. *An MNC's level of global diversification is positively related to its involvement in CPG, with more diversified MNCs investing more financial resources in CPG than less diversified MNCs.*

Increasing global diversification can also lead to a decrease in a firm's

Table 7
The moderating effects of host country environment.

Variables	CPG = 100 × Donation amount / Total sales				
	(1)	(2)	(3)	(4)	(5)
Global diversification	0.0052*** (0.0004)	0.0017*** (0.0003)	0.0038*** (0.0004)	−0.0031*** (0.0003)	0.0103*** (0.0004)
Global diversification × Cultural distance	−0.0022*** (0.0001)				−0.0008*** (0.0002)
Global diversification × Institutional quality		−0.0024*** (0.0004)			−0.0035*** (0.0004)
Global diversification × Country risk			−0.0211*** (0.0017)		−0.0379*** (0.0020)
Global diversification × Economic growth				0.0009*** (0.0001)	0.0007*** (0.0001)
Cultural distance	0.0027*** (0.0009)	−0.0015* (0.0009)	−0.0024** (0.0009)	−0.0011 (0.0009)	0.0001 (0.0009)
Institutional quality	0.0234*** (0.0019)	0.0290*** (0.0019)	0.0219*** (0.0019)	0.0222*** (0.0019)	0.0323*** (0.0019)
Country risk	−0.0444*** (0.0136)	−0.0335** (0.0136)	0.0125 (0.0136)	−0.0427*** (0.0136)	0.0407*** (0.0137)
Economic growth	−0.0023*** (0.0006)	−0.0019*** (0.0006)	−0.0020*** (0.0006)	−0.0037*** (0.0006)	−0.0035*** (0.0006)
State ownership	−0.0460*** (0.0023)	−0.0460*** (0.0023)	−0.0462*** (0.0023)	−0.0459*** (0.0023)	−0.0459*** (0.0023)
Firm size	0.0141*** (0.0001)	0.0145*** (0.0001)	0.0141*** (0.0001)	0.0142*** (0.0001)	0.0143*** (0.0001)
Debt level	−0.0193*** (0.0045)	−0.0185*** (0.0045)	−0.0194*** (0.0045)	−0.0184*** (0.0045)	−0.0190*** (0.0045)
Profitability	0.2776*** (0.0195)	0.2816*** (0.0196)	0.2788*** (0.0195)	0.2826*** (0.0195)	0.2854*** (0.0196)
Slack	−0.0011 (0.0032)	0.0001 (0.0032)	−0.0014 (0.0032)	−0.0000 (0.0032)	0.0008 (0.0032)
Firm growth	0.0017 (0.0017)	0.0019 (0.0017)	0.0024 (0.0017)	0.0019 (0.0017)	0.0011 (0.0017)
Firm age	0.0143*** (0.0009)	0.0140*** (0.0009)	0.0145*** (0.0009)	0.0150*** (0.0009)	0.0153*** (0.0009)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	−1.0791*** (0.0028)	−1.0898*** (0.0028)	−1.0794*** (0.0028)	−1.0645*** (0.0028)	−1.1008*** (0.0028)
N	2111	2111	2111	2111	2111
Log likelihood	158.9487	158.8533	158.2292	159.2145	160.3567

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

involvement in CPG. First, highly diversified firms are likely to have large operational costs, which limit their abilities to undertake corporate charitable activities. Firms that operate in multiple countries tend to have great difficulty adapting to foreign markets due to the “liability of foreignness,” which arises from differences between firms’ home-country environments and host countries’ environments, and result in firms in host countries incurring higher costs than local firms (Zaheer and Mosakowski, 1997). For instance, firms that operate in certain host countries do not easily acquire legitimacy in these countries’ local contexts, and encounter obstacles when attempting to coordinate employees from the populations of these foreign countries, due to these countries’ cultures differing from that of firms’ home country (Peltokorpi and Clausen, 2011). In this regard, MNCs must often invest substantial capital to overcome the “liability of foreignness”. The coordination of foreign subsidiaries distributed across multiple geographic regions is also a significant challenge because each foreign subsidiary may prioritize its own interests, which may not be aligned with the interests of the firm (Chen and Yu, 2012). Separate foreign subsidiaries operating in different regions may even compete with one another instead of collaborating (Zhou, 2018). Thus, managing multiple foreign subsidiaries located in different regions is likely to represent a significant challenge for MNCs. To address this challenge, MNCs must often invest substantial capital to restructure their organizational management systems to respond to the geographically diversified nature of their business operations. This increased expenditure in response to global diversification is likely to limit MNCs’ capacities for engaging in philanthropic activities.

Second, global diversification is likely to strengthen a firm’s precautionary motives, which in turn may weaken its motivation for investing in philanthropic activities. A firm that has a very broad geographical scope of operations will inevitably face high levels of international uncertainty, owing to various factors that differ among the countries in which the firm operates (Mascarenhas, 1982). These factors may include cultural heterogeneity, political risk, uncertainty regarding economic policy, institutional heterogeneity, and exchange rate fluctuations (Johanson and Vahlne, 1977). Consequently, with increasing global diversification, the international uncertainty faced by a firm increases significantly due to the extensive heterogeneity of the environments across multiple countries in which the firm operates. The literature suggests that a firm that is conducting business in an uncertain environment is likely to have a strong precautionary motive and thus maintain a high level of financial flexibility, as this enhances its ability to mitigate any future business distress (Han and Qiu, 2007; Duong et al., 2020). Moreover, compared to conducting business within a narrow geographical scope, doing business across a wide geographical scope allows a firm to access more potentially profitable investment opportunities (Kogut and Kulatilaka, 1994). These new opportunities will also strengthen the precautionary motive of an MNC, i.e., it will cultivate its financial flexibility to effectively seize investment opportunities in diversified geographical areas (Martínez-Sola et al., 2018). Therefore, a firm with a high level of global diversification is likely to maintain a high level of financial flexibility and to minimize its investments in philanthropic activities (i.e., CPG), as these are expensive and have few financial benefits.

Table 8

Robustness check of the relationship between global diversification and CPG (Alternative dependent variable).

Variables	CPG = 100 × Donation amount / Total assets	
	(1)	(2)
Global diversification		−0.0001 (0.0002)
Cultural distance	−0.0003 (0.0006)	−0.0002 (0.0006)
Institutional quality	0.0158*** (0.0013)	0.0155*** (0.0013)
Country risk	−0.0226** (0.0094)	−0.0233** (0.0095)
Economic growth	−0.0007 (0.0004)	−0.0007 (0.0004)
State ownership	−0.0331*** (0.0016)	−0.0332*** (0.0016)
Firm size	0.0076*** (0.0001)	0.0077*** (0.0001)
Debt level	0.0042 (0.0031)	0.0043 (0.0031)
Profitability	0.2356*** (0.0137)	0.2356*** (0.0137)
Slack	−0.0143*** (0.0022)	−0.0143*** (0.0022)
Firm growth	0.0001 (0.0011)	0.0001 (0.0011)
Firm age	0.0087*** (0.0007)	0.0086*** (0.0007)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Constant	−0.6952*** (0.0020)	−0.6961*** (0.0020)
N	2111	2111
Log likelihood	398.3244	398.3244

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

Given the discussion above, the following hypothesis is proposed.

Hypothesis 1b. *An MNC's level of global diversification is negatively related to its involvement in CPG, with more diversified MNCs investing less financial resources in CPG than less diversified MNCs.*

2.2. The role of host-country environment

2.2.1. The role of cultural distance

Culture is defined as “the collective programming of the mind” possessed by a group of people (Hofstede, 1980). A country's national culture consists of various aspects, such as social norms, beliefs and values, which are deeply embedded in the minds of its people (Shenkar, 2001). National culture is thus an important component of the informal institutional environment (Hofstede, 2003). Although it is difficult to directly observe national culture, it has a far-reaching and profound influence on individuals and economic entities (Yiu and Makino, 2002). The term “cultural distance” denotes the extent of cultural differences between two nations (Quer et al., 2012). Cultural distance may have two opposing effects on the relationship between a firm's global diversification and its involvement in CPG.

On the one hand, a firm operating in a host country with a large cultural distance from home country may participate in more CPG than a firm operating in a host with a small cultural distance from home country. Prior research suggests that large cultural distance will make it difficult for the firm to interact with local stakeholders in its host country (Zaheer and Mosakowski, 1997). As a result, the firm will face considerable obstacles in its pursuit of social legitimacy and in addressing the complicated demands of its different stakeholders (Kang and Jiang, 2012). In this scenario, stakeholder theory posits that the firm's CPG will play an active role in its response to stakeholder demands. That is, compared to a firm that operates in the host country that

is culturally close to home country, the firm that operates in the host country that is culturally distant to home country are likely to engage in more philanthropic activities, in attempts to establish and maintain good relationships with local stakeholders in their host countries.

Hypothesis 2a. *The cultural distance between a firm's home and host country positively moderates the relationship between its global diversification and involvement in CPG.*

On the other hand, a firm operating in a host country with a large cultural distance from home country may also participate in less CPG than a firm operating in a host country with a small cultural distance from home country. Previous studies suggest that cultural distance is a major source of uncertainty for any firm conducting its business in the international market (Kogut and Singh, 1988; Jain et al., 2019). For example, Cho and Padmanabhan (2005) show that MNCs operating in culturally distant host countries often face great uncertainty due to their lack of familiarity with the business environments of their host countries. According to the precautionary motive (Han and Qiu, 2007), experiencing a high level of external uncertainty will increase a firm's motivation to retain high levels of cash holdings, as these will give the firm the financial flexibility it needs to mitigate potentially adverse circumstances in the future. Thus, MNCs operating in widely global scope are likely to be involved in fewer philanthropic activities than MNCs operating in limited global scope, as this enables them to achieve greater financial flexibility when operating in culturally distant countries. Therefore, the following hypothesis is proposed.

Hypothesis 2b. *The cultural distance between a firm's home and host country negatively moderates the relationship between its global diversification and involvement in CPG.*

2.2.2. The role of institutional quality

The extant literature suggests that institutional environment plays an important role in international operations (Henisz, 2000). Institutional quality is an indicator to clarify how good a country's institutional environments (i.e., government system, property rights, contract enforcement, investor protection, and the like) are (Levchenko, 2007). Firms operating in countries with high institutional quality may participate in more philanthropic activities than firms operating in countries with low institutional quality. Luo (2006) suggests that the countries with high institutional quality typically have well-established charity systems that encourage corporate philanthropic donations and thereby could ensure that firms' donations reach their target beneficiaries, while in countries with imperfect institutional environments, the frequent loss of philanthropic donations before they reach their targeted beneficiaries discourages firms from engaging in local philanthropic activities. As a result, the countries with high institutional quality will attract firms to donate more. In addition, the general public in host countries with high institutional quality also tends to place a greater emphasis on the significance of CSR than the general public in host countries with low institutional quality (Yang and Rivers, 2009). Thus, firms entering countries with high institutional quality may initiate philanthropic engagements to satisfy their local stakeholders' expectations.

Hypothesis 3a. *The institutional quality of a firm's host country positively moderates the relationship between its global diversification and its involvement in CPG.*

From another point of view, the low institutional quality of a host country may increase a firm's engagement in CPG. Often, an imperfect institutional environment in a country suggests that there is a lack of transparency and supervision over CPG in that country (Zhou, 2015). The local stakeholders of such countries also tend to greatly distrust foreign firms (Zeng and Xu, 2019). Firms operating in such countries therefore have to overcome the liability of foreignness to enable them to obtain social license to operate, and maintain good political and commercial relationships with local governments (Shirodkar et al., 2018).

Table 9

Robustness check of the moderating effects of host country environment (Alternative dependent variable).

Variables	CPG = $100 \times \text{Donation amount} / \text{Total assets}$				
	(1)	(2)	(3)	(4)	(5)
Global diversification	0.0036*** (0.0003)	0.0015*** (0.0002)	0.0010*** (0.0002)	−0.0020*** (0.0002)	0.0045*** (0.0003)
Global diversification × Cultural distance	−0.0014*** (0.0001)				−0.0006*** (0.0001)
Global diversification × Institutional quality		−0.0018*** (0.0003)			−0.0018*** (0.0003)
Global diversification × Country risk			−0.0054*** (0.0012)		−0.0137*** (0.0014)
Global diversification × Economic growth				0.0006*** (0.0001)	0.0005*** (0.0001)
Cultural distance	0.0028*** (0.0007)	0.0001 (0.0006)	−0.0003 (0.0006)	0.0003 (0.0006)	0.0015** (0.0007)
Institutional quality	0.0164*** (0.0013)	0.0207*** (0.0013)	0.0155*** (0.0013)	0.0156*** (0.0013)	0.0211*** (0.0013)
Country risk	−0.0300*** (0.0095)	−0.0227** (0.0095)	−0.0114 (0.0095)	−0.0291*** (0.0095)	0.0002 (0.0096)
Economic growth	−0.0010** (0.0004)	−0.0007 (0.0004)	−0.0007 (0.0004)	−0.0020*** (0.0004)	−0.0018*** (0.0004)
State ownership	−0.0331*** (0.0016)	−0.0331*** (0.0016)	−0.0332*** (0.0016)	−0.0330*** (0.0016)	−0.0330*** (0.0016)
Firm size	0.0076*** (0.0001)	0.0079*** (0.0001)	0.0077*** (0.0001)	0.0077*** (0.0001)	0.0077*** (0.0001)
Debt level	0.0041 (0.0032)	0.0046 (0.0032)	0.0041 (0.0032)	0.0046 (0.0031)	0.0044 (0.0032)
Profitability	0.2349*** (0.0137)	0.2378*** (0.0138)	0.2356*** (0.0137)	0.2382*** (0.0137)	0.2396*** (0.0138)
Slack	−0.0143*** (0.0022)	−0.0133*** (0.0022)	−0.0144*** (0.0022)	−0.0135*** (0.0022)	−0.0130*** (0.0022)
Firm growth	−0.0004 (0.0011)	−0.0003 (0.0011)	0.0001 (0.0011)	−0.0003 (0.0011)	−0.0008 (0.0011)
Firm age	0.0088*** (0.0007)	0.0086*** (0.0007)	0.0087*** (0.0007)	0.0092*** (0.0007)	0.0093*** (0.0007)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	−0.6992*** (0.0020)	−0.7078*** (0.0020)	−0.6975*** (0.0020)	−0.6892*** (0.0020)	−0.7079*** (0.0020)
N	2111	2111	2111	2111	2111
Log likelihood	399.2027	399.2838	398.3299	399.4592	400.3834

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

Thus, as philanthropic activity is generally an effective strategy by which foreign firms can improve their legitimacy in a host market (Rathert, 2016), firms operating in host countries with low institutional quality can be incentivized to engage in CPG. Based on the above discussion, the following hypothesis is proposed.

Hypothesis 3b. *The institutional quality of a firm's host country negatively moderates the relationship between its global diversification and its involvement in CPG.*

2.2.3. The role of country risk

Country risk refers to the uncertainty in the political, economic and financial environments (Cosset and Roy, 1991; Nordal, 2001). The level of risk in a host country is a key factor that may influence a firm's business actions in that country (Dunning, 1988). There are numerous factors that can determine country risk, such as the relative uncertainties of government instability, socioeconomic conditions, internal conflicts, external conflicts, corruption, financial conditions, unexpected inflation and economic policies (Oetzel et al., 2001). When a firm operating in a foreign market, the level of country risk associated with the host country is an important channel through which the host-country environment may influence the firm's actions (De Villa et al., 2019). Studies suggest that country risk may influence the CPG of MNCs from the following two opposite ways.

From one perspective, country risk may increase the CPG of MNCs. Studies suggest that firms practice CSR to reduce their external risk (Albuquerque et al., 2019; Chintrakarn et al., 2021). For example, Albuquerque et al. (2019) develop a theoretical model to analyze the

relationship between the engagement of firms' CSR activities and firm risk, and suggest that the engagement of CSR activities can be a tool for mitigating the level of firm risk. Similarly, Chatjuthamard et al. (2020) show that CSR can substantially mitigate the negative effect of political risk on a firm. In addition, Chintrakarn et al. (2021) find that firms participating in more CSR activities tend to experience less risk during global financial crises than those participating in fewer CSR activities. Therefore, MNCs conducting their business in host countries with high levels of country risk are likely to participate in more CPG, an important part of CSR, than those conducting their business in host countries with low levels of country risk, as this can reduce the possibility that firms are adversely impacted in the future by problems arising due to their host countries' risk.

Hypothesis 4a. *The relative level of country risk associated with a firm's host country positively moderates the relationship between that firm's global diversification and its engagement in CPG.*

From a different perspective, country risk may also weaken the motivation of firms to participate in CPG. First, firms operating in foreign countries with a high level of country risk are likely to have high operational costs, which will limit their capacities for philanthropic activities. Such firms also tend to have difficulty accessing reliable and useful business information (Delios and Henisz, 2003), and thus will experience severe information asymmetry. An adverse outcome of information asymmetry is an increase in the cost of raising external capital (Dierkens, 1991; Lambert et al., 2012), which accounts for firms' in such countries having increased operation costs (as mentioned above), in

Table 10

Robustness check of the relationship between global diversification and CPG (Heckman two-stage method).

Variables	CPG = 100 × Donation amount / Total sales	
	(1)	(2)
Global diversification		−0.0005 (0.0003)
Cultural distance	−0.0023** (0.0009)	−0.0018* (0.0009)
Institutional quality	0.0234*** (0.0019)	0.0223*** (0.0019)
Country risk	−0.0304** (0.0137)	−0.0338** (0.0137)
Economic growth	−0.0016** (0.0006)	−0.0016** (0.0006)
State ownership	−0.0455*** (0.0023)	−0.0459*** (0.0023)
Firm size	0.0131*** (0.0001)	0.0134*** (0.0001)
Debt level	−0.0170*** (0.0045)	−0.0166*** (0.0046)
Profitability	0.2791*** (0.0201)	0.2792*** (0.0201)
Slack	−0.0021 (0.0032)	−0.0021 (0.0032)
Firm growth	0.0038** (0.0017)	0.0037** (0.0017)
Firm age	0.0152*** (0.0010)	0.0147*** (0.0010)
IMR	−0.0222*** (0.0056)	−0.0234*** (0.0056)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Constant	−1.0471*** (0.0029)	−1.0500*** (0.0029)
N	2111	2111
Log likelihood	158.1049	158.1342

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

addition to high financial pressures. Under such circumstances, any engagement by a firm in CPG may be counterproductive, as it requires extensive capital investment yet provides limited and unpredictable financial benefits (Margolis and Walsh, 2003). Therefore, firms conducting business activities in host countries with a high level of country risk may participate less in CPG than those conducting business activities in host countries with a low level of country risk.

Second, a firm may reduce its engagement in CPG in a host country with a high level of country risk due to having a stronger precautionary motive than other firms. That is, firms that conduct their businesses in high-risk environments expect to be impacted by severe levels of information asymmetry and to subsequently encounter adverse financial conditions (Cashman et al., 2015). Such firms are likely to adopt conservative financial policies that lower the probability that they will be impacted by financial distress in the future (Huang et al., 2015; Wang et al., 2021). Thus, firms operating in foreign countries with a high level of country risk have strong precautionary incentives to retain their financial resources, as this gives them greater financial flexibility than engaging in CPG.

Based on the above discussion above, the following hypothesis is proposed.

Hypothesis 4b. *The relative level of country risk associated with a firm's host country negatively moderates the relationship between that firm's global diversification and its engagement in CPG.*

2.2.4. The role of economic growth

The economic growth of a country is generally considered to be a manifestation of its overall economic prosperity, and is thus a country must have sufficient economic growth to enable MNCs to operate in the country (Gomes-Casseres, 1990; Rahko, 2021). The economic growth of

a host country may influence the relationship between a firm's global diversification and its engagement in CPG in two contrasting ways.

On the one hand, the economic growth of a host country may positively moderate the relationship between a firm's global diversification and its engagement in CPG. Studies suggest that external social support plays an important role in determining a firm's ability to seize investment opportunities because the external stakeholder groups could offer critical resources for the firm's development (Sethi and Guisinger, 2002; Pfeffer and Salancik, 1978), with this being especially true for firms operating in foreign countries (Lu and Xu, 2006). Nonetheless, due to their lack of familiarity with the local environment, MNCs often suffer from the liability of foreignness in their host countries (Zaheer, 1995). Literature on CPG suggests that firms can gain social support in local markets by engaging in philanthropic activities, as these activities facilitate the development of good relationships between firms and their local regulators and customers (Chen et al., 2015; Hornstein and Zhao, 2018). Thus, compared to MNCs operating in host countries with relatively low levels of economic growth, MNCs operating in host countries with relatively high levels of economic growth will likely participate in more philanthropic activities to cultivate favorable business connections and seize investment opportunities.

Hypothesis 5a. *The economic growth of a firm's host country positively moderates the relationship between the firm's global diversification and its engagement in CPG.*

On the other hand, the economic growth of a host country may also strengthen a firms' precautionary motive. If this occurs, the economic growth of a host country will negatively moderate the relationship between a firm's global diversification and its engagement in CPG. It is proposed that the high economic growth of a country signals that many valuable opportunities exist in the country (Kuznets, 1973). Firms that conduct business in host countries with high economic growth are thus well positioned to take advantage of numerous favorable investment opportunities (Temiz and Gkmen, 2014). Nonetheless, firms often require additional financial support to seize investment opportunities (Smith and Watts, 1992), and thus firms aiming to effectively seize and implement development opportunities will likely have stronger precautionary motives than firms that are not aiming to do so. Specifically, they the former firms will reduce their participation in cash-consuming activities, such as CPG, to retain liquidity for use in future investment opportunities. Based on the points discussed above, the following hypothesis is proposed.

Hypothesis 5b. *The economic growth of a firm's host country negatively moderates the relationship between the firm's global diversification and its engagement in CPG.*

3. Methodology

3.1. Data

The study focuses on A-share listed MNCs in the manufacturing sector in China over the period of 2006–2019. We collect data for the study as follows. First, we obtain the information of Chinese A-share listed manufacturing firms from China Stock Market and Accounting Research (CSMAR), a widely used data-source in Chinese studies (Chen et al., 2015). Second, to document the characteristics of MNCs' global diversification, we scrutinize firms' annual reports and manually collect information on their foreign businesses, such as the various host countries in which they have business operations. Third, we obtain CPG data from the firms' CSR reports. Chinese A-share listed firms began disclosing CSR reports in 2006 and 862 firms disclosed CSR reports in this year. Such reports have become increasingly valued by firms. By 2019, the number of CSR reports issued by Chinese A-share listed manufacturing firms reached 2316. Fourth, as we aim to measure cultural distance using Hofstede's cultural indices (see below), we collect

Table 11

Robustness check of the moderating effects of host country environment (Heckman two-stage method).

Variables	CPG = 100 × Donation amount / Total sales				
	(1)	(2)	(3)	(4)	(5)
Global diversification	0.0052*** (0.0004)	0.0017*** (0.0003)	0.0037*** (0.0004)	−0.0031*** (0.0003)	0.0104*** (0.0004)
Global diversification × Cultural distance	−0.0022*** (0.0001)				−0.0008*** (0.0002)
Global diversification × Institutional quality		−0.0024*** (0.0004)			−0.0035*** (0.0004)
Global diversification × Country risk			−0.0209*** (0.0017)		−0.0381*** (0.0020)
Global diversification × Economic growth				0.0009*** (0.0001)	0.0007*** (0.0001)
Cultural distance	0.0028*** (0.0009)	−0.0014 (0.0009)	−0.0022** (0.0009)	−0.0010 (0.0009)	0.0003 (0.0010)
Institutional quality	0.0236*** (0.0020)	0.0294*** (0.0020)	0.0221*** (0.0020)	0.0224*** (0.0020)	0.0327*** (0.0020)
Country risk	−0.0440*** (0.0138)	−0.0331** (0.0138)	0.0123 (0.0138)	−0.0421*** (0.0138)	0.0416*** (0.0139)
Economic growth	−0.0020*** (0.0006)	−0.0016** (0.0006)	−0.0017*** (0.0006)	−0.0034*** (0.0007)	−0.0032*** (0.0007)
State ownership	−0.0458*** (0.0023)	−0.0458*** (0.0023)	−0.0460*** (0.0023)	−0.0457*** (0.0023)	−0.0457*** (0.0023)
Firm size	0.0132*** (0.0001)	0.0136*** (0.0001)	0.0133*** (0.0001)	0.0134*** (0.0001)	0.0134*** (0.0001)
Debt level	−0.0168*** (0.0046)	−0.0160*** (0.0046)	−0.0172*** (0.0046)	−0.0161*** (0.0046)	−0.0165*** (0.0046)
Profitability	0.2781*** (0.0201)	0.2822*** (0.0202)	0.2792*** (0.0201)	0.2830*** (0.0201)	0.2859*** (0.0202)
Slack	−0.0022 (0.0032)	−0.0009 (0.0032)	−0.0025 (0.0032)	−0.0011 (0.0032)	−0.0003 (0.0032)
Firm growth	0.0031* (0.0017)	0.0033* (0.0017)	0.0037** (0.0017)	0.0032* (0.0017)	0.0025 (0.0017)
Firm age	0.0149*** (0.0010)	0.0146*** (0.0010)	0.0150*** (0.0010)	0.0155*** (0.0010)	0.0158*** (0.0010)
IMR	−0.0250*** (0.0056)	−0.0251*** (0.0056)	−0.0226*** (0.0056)	−0.0228*** (0.0056)	−0.0247*** (0.0056)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	−1.0526*** (0.0029)	−1.0639*** (0.0029)	−1.0562*** (0.0029)	−1.0406*** (0.0029)	−1.0754*** (0.0029)
N	2111	2111	2111	2111	2111
Log likelihood	158.9487	158.8533	158.2292	159.2145	160.3567

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

the raw information of national culture from Hofstede Insights. Fifth, we collect data describing each country's institutional quality from the World Bank's Worldwide Governance Indicators (WGI) database, a widely used database in studies on institutional environments (Marano et al., 2017; Hornstein and Zhao, 2018). The WGI database contains information that reflect the relative quality of institutions in each of approximately 212 countries globally. Sixth, we measure host-country risk using the data obtained from the International Country Risk Guide (ICRG), which is provided by the PRS Group. The ICRG provides a composite rating for the political, financial, and economic risk associated with each country. Seventh, to analyze the effect of a host country's economic growth on a MNCs' philanthropic giving, we obtain economic data for each host country in our dataset from the World Development Index (WDI) database, which contains rich development indicators for countries worldwide. Finally, we obtain the additional firm-level data from CSMAR. After matching the data from the various datasets outlined above, we obtain 2111 firm-year observations in the final sample. Table 1 summarizes the data source of this study.

3.2. Variables

3.2.1. Dependent variable

CPG. We proxy each firm's CPG based on a measure of its social donations relative to its total sales. This measurement of CPG is a commonly used indicator in the existing literature (Brown et al., 2006;

Wei et al., 2018). Specifically, CPG is measured as the following way:

$$CPG_{i,t} = 100 \times \frac{\text{Total social donations}_{i,t}}{\text{Total sales}_{i,t}} \quad (1)$$

where $\text{Total social donations}_{i,t}$ is firm i's total social donations in year t, $\text{Total sales}_{i,t}$ is firm i's total sales in year t.

3.2.2. Independent variables

Global diversification. Our measure of global diversification is derived from information in annual reports of Chinese A-share listed firms. Based on existing disclosure rules for Chinese A-share listed firms, they are not obliged to disclose the details and the precise distributions of their operations globally in a consistent way. Accordingly, a widely used alternative measure for a firm's global diversification is the total number of foreign countries in which a firm's subsidiaries are located (Brammer et al., 2006; Tallman and Li, 1996). This provides a suitable proxy measure of a firm's global diversification for two reasons. First, it effectively captures global diversification because a firm's operational distribution is strongly related to the distribution of its subsidiaries (Tallman and Li, 1996). Second, information about the locations of a firm's subsidiaries is often available in the notes of its annual report. Thus, we measure the global diversification of a firm as the number of foreign countries on which the firm has subsidiaries.

Table 12

The relationship between global diversification and CPG by employing 2SLS.

First stage		Second stage	
Variables	Global diversification	Variables	CPG = $100 \times \frac{\text{Donation amount}}{\text{Total sales}}$
		Global	−0.0003
		<i>diversification_{IV}</i>	(0.0003)
		<i>Cultural distance</i>	−0.0019** (0.0009)
		<i>Institutional quality</i>	0.0221*** (0.0019)
<i>Lag Global diversification</i>	0.8408*** (0.0168)	<i>Country risk</i>	−0.0342** (0.0136)
<i>Lag Productivity</i>	0.2151* (0.1187)	<i>Economic growth</i>	−0.0019*** (0.0006)
<i>Lag State ownership</i>	−0.2322* (0.1196)	<i>State ownership</i>	−0.0461*** (0.0023)
<i>Lag Firm size</i>	0.1730*** (0.0553)	<i>Firm size</i>	0.0143*** (0.0001)
<i>Lag Debt level</i>	−0.2551 (0.4132)	<i>Debt level</i>	−0.0189*** (0.0045)
<i>Lag Profitability</i>	−1.0270 (1.2471)	<i>Profitability</i>	0.2788*** (0.0195)
<i>Lag Slack</i>	−0.0686 (0.1806)	<i>Slack</i>	−0.0011 (0.0032)
<i>Lag Firm growth</i>	−0.0541 (0.1256)	<i>Firm growth</i>	0.0024 (0.0017)
<i>Lag Firm age</i>	−0.1189 (0.2002)	<i>Firm age</i>	0.0141*** (0.0009)
Year fixed effects	Yes	Year fixed effects	Yes
Industry fixed effects	Yes	Industry fixed effects	Yes
Constant	−2.5638 (2.8365)	Constant	−1.0741*** (0.0028)
N	1839	N	1839
F test of excluded instruments:	278.26	Sargan statistic	5.48
Prob > F	0.0000	Chi ² P value	0.6019

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

3.2.3. Moderator

Cultural distance. We measure *Cultural distance* as the average cultural distance between China (the home country for all firms in our study) and all foreign countries in which a firm has subsidiaries. Cultural distance between China and a given host country is measured by constructing an index that is similar to that built by [Kogut and Singh \(1988\)](#); this method is widely used in previous studies within the field of international business ([Peltokorpi and Froese, 2009](#); [Liu et al., 2020](#)). The formula for a given host country *j*'s cultural distance is as follows:

$$\text{Cultural distance}_j = \frac{1}{6} \left[\sum_k \frac{(I_{kj} - I_{kCH})^2}{V_k} \right], k = 1, \dots, 6 \quad (2)$$

where I_{kj} , j and $I_{k, CH}$ represent country *j*'s and China's scores in Hofstede's k^{th} dimension, respectively; and V_k indicates the variance of the k^{th} dimension across countries. We use six dimensions of national culture to calculate the culture distance index. The six dimensions include “power distance”, “individualism v.s. collectivism”, “masculinity v.s. femininity”, “uncertainty avoidance”, “long term orientation v.s. short term normative orientation”, “indulgence v.s. restraint”.

Institutional quality. We measure *Institutional quality* as the average institutional quality across all foreign countries in which a firm has subsidiaries. Since a firm's sales or asset in each country cannot be obtained exactly, the weight of each country is not included in the calculation of *Institutional quality*. The measure of each host country's institutional quality is based on data from the WGI database, a widely used database in studies of institutional environments ([Marano et al., 2017](#); [Hornstein and Zhao, 2018](#)). The WGI database contains six different indicators including “voice and accountability”, “political

stability and absence of violence/terrorism”, “government effectiveness”, “regulatory quality”, “rule of law”, and “control of corruption”. Each of those indicators is a measure in a conceptually distinct dimension of the quality of a country's institutions. Each indicator in the WGI database has been standardized. In keeping with previous studies (e.g., [Herrera-Echeverri et al., 2014](#)), we measure each country's institutional quality by averaging its scores for these six indicators.

Country risk. We measure *Country risk* as the average country risk across all foreign countries in which a firm has subsidiaries. The country risk of each foreign country is derived from its Country Risk Rating in the ICRG, which is widely used in previous studies ([Erb et al., 1996](#); [Lee et al., 2017](#)). The Country Risk Rating is a composite rating of a given country's political, financial, and economic risk. According to the ICRG, the highest value of Country Risk Rating is 100, which corresponds to a country with the lowest level of risk. To facilitate the interpretation of the relevant empirical results, we measure the country risk of each host country as

$$\text{Country Risk}_j = 1 - \frac{\text{Country Risk Rating}_j}{100} \quad (3)$$

where *Country Risk Rating_j* represents country *j*'s Country Risk Rating in the ICRG. In doing so, we finally obtain the metric *Country risk*, in which larger values correspond to higher levels of risk.

Economic growth. We measure *Economic growth* as the average economic growth across all foreign countries in which a firm has subsidiaries. The economic growth of each country is proxied by its annual growth rate of GDP per capita; this is one of the most widely used indicators of a country's economic growth ([Borensztein et al., 1998](#); [Zheng and Walsh, 2019](#)).

3.2.4. Control variables

As a firm's CPG may be influenced by factors other than those outlined above, we include the following set of control variables in the empirical model, as is done in previous empirical studies on CPG. (i) *State ownership*. Previous studies find that state ownership plays an important role in shaping the social responsibility of firms in emerging markets ([Li and Zhang, 2010](#)). In accordance with a commonly used method ([Luo et al., 2017](#)), we use a dummy variable to measure *State ownership*, which has a value of “1” when a firm's ultimate decision-making body is the Chinese government, and “0” otherwise. (ii) *Firm size*. Studies suggest that larger firms are more visible to the general public than smaller firms ([Zhang et al., 2015](#)), and thus large firms take part in more philanthropic activities than small firms. We calculate *Firm size* as the logarithm of a firm's total assets. (iii) *Debt level*. High debt levels tend to increase firms' costs, which weaken a firm's ability to satisfy public expectations by engaging in CPG ([Adams and Hardwick, 1998](#)). We measure a firm's *Debt level* as the ratio of its total liabilities to its total assets. (ix) *Profitability*. Previous research suggests that more profitable firms are likely to possess greater capacities for participating in philanthropic activities than less profitable firms ([Cochran and Wood, 1984](#)). Therefore, we control for a firm's profitability, which we measure as its net profit divided by its equity. (x) *Slack*. We control for a firm's organizational slack (*Slack*), i.e., excess capacity, because a firm with higher slack has a greater ability to focus on philanthropy than a firm with lower slack ([Xu et al., 2015](#)). *Slack* equals the ratio of a firm's slack resources to its total sales, where slack resources include receivables, inventory, and selling-, general- and administrative expenses ([Belderbos et al., 2014](#)). (xi) *Firm growth*. Compared to firms that experience low growth, those that experience high growth may face greater liquidity pressures that weaken their abilities to commit to philanthropic activities ([Luo et al., 2017](#)). We measure *Firm growth* as the rate of growth in a firm's sales. (xii) *Firm age*. Compared to younger firms, older firms may be more active in philanthropy because they are embedded in wide charity networks ([Wei et al., 2018](#); [Marquis and Lee, 2013](#)). We define *Firm age* as the logarithm of the number of years since the year of

Table 13The moderating effects of host country environment by using *Global diversification_IV* obtained from 2SLS.

Variables	CPG = 100 × Donation amount / Total sales				
	(1)	(2)	(3)	(4)	(5)
<i>Global diversification_IV</i>	0.0064*** (0.0004)	0.0008** (0.0003)	0.0091*** (0.0004)	−0.0008** (0.0003)	0.0190*** (0.0004)
<i>Global diversification_IV</i> × <i>Cultural distance</i>	−0.0027*** (0.0001)				−0.0022*** (0.0001)
<i>Global diversification_IV</i> × <i>Institutional quality</i>		−0.0011*** (0.0003)			−0.0031*** (0.0004)
<i>Global diversification_IV</i> × <i>Country risk</i>			−0.0461*** (0.0016)		−0.0519*** (0.0019)
<i>Global diversification_IV</i> × <i>Economic growth</i>				0.0002** (0.0001)	0.0003** (0.0001)
<i>Cultural distance</i>	0.0074*** (0.0009)	−0.0003 (0.0009)	−0.0011 (0.0009)	−0.0003 (0.0009)	0.0051*** (0.0009)
<i>Institutional quality</i>	0.0209*** (0.0018)	0.0239*** (0.0018)	0.0202*** (0.0018)	0.0204*** (0.0018)	0.0307*** (0.0019)
<i>Country risk</i>	−0.0915*** (0.0126)	−0.0732*** (0.0126)	0.0462*** (0.0127)	−0.0752*** (0.0126)	0.0534*** (0.0127)
<i>Economic growth</i>	0.0049*** (0.0006)	0.0054*** (0.0006)	0.0050*** (0.0006)	0.0048*** (0.0006)	0.0053*** (0.0006)
<i>State ownership</i>	−0.0317*** (0.0021)	−0.0317*** (0.0021)	−0.0317*** (0.0021)	−0.0318*** (0.0021)	−0.0317*** (0.0021)
<i>Firm size</i>	0.0163*** (0.0001)	0.0167*** (0.0001)	0.0159*** (0.0001)	0.0165*** (0.0001)	0.0160*** (0.0001)
<i>Debt level</i>	−0.0334*** (0.0042)	−0.0328*** (0.0042)	−0.0338*** (0.0042)	−0.0332*** (0.0042)	−0.0331*** (0.0042)
<i>Profitability</i>	0.2692*** (0.0198)	0.2754*** (0.0198)	0.2732*** (0.0198)	0.2738*** (0.0198)	0.2736*** (0.0198)
<i>Slack</i>	−0.0116*** (0.0029)	−0.0112*** (0.0029)	−0.0123*** (0.0029)	−0.0115*** (0.0029)	−0.0112*** (0.0029)
<i>Firm growth</i>	−0.0022 (0.0017)	−0.0015 (0.0017)	−0.0015 (0.0017)	−0.0013 (0.0017)	−0.0029* (0.0017)
<i>Firm age</i>	0.0141*** (0.0009)	0.0124*** (0.0009)	0.0135*** (0.0009)	0.0127*** (0.0009)	0.0138*** (0.0009)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	−0.5378*** (0.0026)	−0.5311*** (0.0026)	−0.5258*** (0.0026)	−0.5213*** (0.0026)	−0.5602*** (0.0026)
<i>N</i>	1839	1839	1839	1839	1839
Log likelihood	185.3797	184.6926	186.0247	184.5998	187.3818

Notes: Values in the parentheses are heteroscedasticity-robust standard error. ***, ** and * represent significance levels at 1 %, 5 % and 10 %, respectively.

establishment of a given firm.

In addition to the variables described above, we also control for fixed effects of a firm's specific industry and year, by including one dummy variable for each.

Table 2 presents the definitions and measures of the main variables.

3.3. Model

To examine the effect of a firm's global diversification on its CPG, we construct a model as follows:

$$CPG_{i,t} = \beta_0 + \beta_1 Global\ diversification_{i,t} + \beta_2 Cultural\ distance_{i,t} + \beta_3 Institutional\ quality_{i,t} + \beta_4 Country\ risk_{i,t} + \beta_5 Economic\ growth_{i,t} + \vec{\omega}X_{i,t} + \vec{\gamma}I_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $X_{i,t}$ is a set of the control variables defined above (*State ownership*, *Firm size*, *Debt level*, *Profitability*, *Slack*, *Firm growth*, and *Firm age*); and $I_{i,t}$ is a set of dummy variables for the year and industry.

We construct the following model to examine the moderating effect of a firm's host-country environment on the relationship between its global diversification and its CPG.

$$\begin{aligned} CPG_{i,t} = & \theta_0 + \theta_1 Global\ diversification_{i,t} \\ & + \theta_2 Global\ diversification_{i,t} \times Cultural\ distance_{i,t} \\ & + \theta_3 Global\ diversification_{i,t} \times Institutional\ quality_{i,t} \\ & + \theta_4 Global\ diversification_{i,t} \times Country\ risk_{i,t} \\ & + \theta_5 Global\ diversification_{i,t} \times Economic\ growth_{i,t} \\ & + \theta_6 Cultural\ distance_{i,t} + \theta_7 Institutional\ quality_{i,t} \\ & + \theta_8 Country\ risk_{i,t} + \theta_9 Economic\ growth_{i,t} + \vec{\omega}X_{i,t} + \vec{\gamma}I_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (5)$$

Table 3 presents the predicted coefficients for Model 2 and Model 3 according to hypotheses in previous sections.

4. Results

4.1. Descriptive analyses

Table 4 presents the descriptive statistics of main variables used in this study. The results indicate that Chinese manufacturing firms donate less to the public (their average CPG is equivalent to only 0.02 % of their total sales). The mean value of *Global diversification* is 3.3323, which indicates that, on average, a firm operates in more than three countries. Moreover, Chinese manufacturing firms tend to operate in countries with which they share a large cultural distance (the mean value of *Cultural distance* is 2.2609), and in countries featuring high institutional quality (the mean value of *Institutional quality* is 1.0768), low country risk (the mean value of *Country risk* is 0.1814), and high economic

growth (the mean value of *Economic growth* is 2.59 %).

Table 5 presents a correlation matrix for the main variables. The results indicate that the correlations between *Global diversification* and the other explanatory variables (and control variables) all fall within acceptable ranges. This suggests that our analyses are not significantly affected by multicollinearity.

4.2. Data analyses

We use the Tobit regression technique for the statistical analysis because the value of the dependent variable *CPG* is greater than or equal to zero. This approach is commonly used in previous studies on CPG (e.g., Li et al., 2015; Luo et al., 2017).

4.2.1. Global diversification and CPG

Table 6 reports the results of regressions for *CPG* on the main independent variables. Model 1 is the baseline model, as it includes only *Cultural distance*, *Institutional quality*, *Country risk*, *Economic growth*, and the control variables. As seen from column (1), *State ownership* has a negative coefficient (−0.0458) and is significant at the 1 % level; this indicates that state ownership is likely to reduce a firm's total charitable donations. *Firm size* has a positive coefficient (0.0139) and is significant at the 1 % level; this indicates that compared to smaller firms, larger firms are likely to have more resources to dedicate toward philanthropic activities. *Debt level* has a negative coefficient (−0.0193) and is significant at the 1 % level, suggesting firms that are highly leveraged tend to donate less than firms that are not highly leveraged. *Profitability* has a positive coefficient (0.2788) and is significant at the 1 % level, suggesting that profitable firms tend to donate more than unprofitable firms. *Firm age* has a positive coefficient (0.0146) and is significant at the 1 % level, suggesting that compared to younger firms, older firms are more engaged in philanthropic activities.

Column 2 in Table 6 adds the variable *Global diversification* into the baseline model, which aims to test H1. The results of the regression show that *Global diversification* has a negative coefficient (−0.0004) and is insignificant at the 10 % level. This indicates that firms' relative levels of global diversification do not significantly affect their public donations. Therefore, this finding does not support Hypothesis 1a or Hypothesis 1b.

4.2.2. The role of host-country environment

Table 7 reports the results of regressions testing for the moderating effects of host-country characteristics. Column (1) presents the results of a regression testing for the moderating effect of the cultural distance of a host country on the relationship between a firm's global diversification and its CPG. The results show that the coefficient of the interaction term *Global diversification* × *Cultural distance* is negative (−0.0022) and significant at the 1 % level. This suggests that the greater the cultural distance between a firm's home and a host country, the more negative the relationship between the firm's global diversification and its CPG. This finding supports H2b.

Column (2) presents the results of a regression testing for the moderating effect of the institutional quality of a firm's host country on the relationship between the firm's global diversification and its CPG. The results show that the coefficient for the interaction term *Global diversification* × *Institutional quality* is negative (−0.0024) and significant at the 1 % level. This suggests that the higher a firm's host country's institutional quality, the more negative the relationship between the firm's global diversification and its CPG. This finding supports H3b.

Column (3) presents the results of a regression testing for the moderating effect of the country risk of a firm's host country on the relationship between the firm's global diversification and its CPG. The results show that the coefficient of the interaction term *Global diversification* × *Country risk* is negative (−0.0211) and significant at the 1 % level. This suggests that the greater the economic risk of a firm's host country, the more negative the relationship between the firm's global diversification and its CPG. This finding supports H4b.

Column (4) presents the results of a regression testing for the moderating effect of the economic growth of a firm's host country on the relationship between the firm's global diversification and its CPG. The results show that the coefficient of the interaction term *Global diversification* × *Economic growth* is positive (0.0009) and significant at the 1 % level. These results suggest that the higher the economic growth of a firm's host country, the less negative the relationship between the firm's global diversification and its CPG. This finding supports H5a.

Finally, Column (5) presents the results of a regression that simultaneously incorporates all of the variables. The results in this column are in line with those reported in the previous columns.

4.3. Robustness check

4.3.1. Alternative dependent variable

In this section, we conduct an additional analysis to test for the robustness of our findings concerning the relationship between a firm's global diversification and its CPG. Specifically, we use an alternative dependent variable to proxy a firm's CPG. This alternative dependent variable is measured as the following equation.

$$CPG_{i,t} = 100 \times \frac{\text{Total social donations}_{i,t}}{\text{Total assets}_{i,t}} \quad (6)$$

where *Total social donations_{i,t}* is firm *i*'s total social donations in year *t*, *Total assets_{i,t}* is firm *i*'s total assets in year *t*.

Tables 8 and 9 report the results of the Tobit regression employing the alternative dependent variable. The results show that the coefficients for the term *Global diversification* and for the interaction terms *Global diversification* × *Cultural distance*, *Global diversification* × *Institutional quality*, *Global diversification* × *Country risk*, and *Global diversification* × *Economic growth*, are consistent with the results in Tables 6 and 7. Thus, our empirical results are robust to use an alternative dependent variable.

4.3.2. Heckman two-stage method

As we only use data from MNCs to test our study hypotheses, sample selection bias may occur. To correct for potential sample selection bias, we employ the Heckman two-stage method, which is widely used in previous research (Heckman, 1979). Specifically, in the first stage, we predict the probability that a firm enters into the international market, and calculate an inverse mills ratio term. This is achieved using the following selection equation:

$$Pr(D_{i,t} = 1) = \omega_0 + \omega_1 \text{Productivity}_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (7)$$

where *D_{i,t}* equals “1” if firm *i* has at least one foreign subsidiary, and “0” otherwise; *Productivity* is measured as the natural logarithm of sales divided by the number of employees; *X_{i,t}* is a set of control variables (mentioned in previous section); and *I_{i,t}* is a vector containing dummy variables for year and industry.

In the second stage, the inverse mills ratio (*IMR*) generated during the first stage is included in the Tobit regression models as an additional explanatory variable.

Tables 10 and 11 report the results of the regression incorporating *IMR* in the Tobit model. The results show that the estimated coefficients of *IMR* in Tables 10 and 11 are statistically significant; this suggests that sample selection bias exists. After we control for sample selection bias, the estimated coefficients of the term *Global diversification* as well as the interaction terms *Global diversification* × *Cultural Distance*, *Global diversification* × *Political Risk*, and *Global diversification* × *Economic Growth* reported in Tables 10 and 11 continue to support the conclusions in Tables 6 and 7. This suggests that the results of our study are robust when the sample selection bias is corrected.

4.3.3. 2SLS regression

Firms with higher CPG may diversify their business across more

countries. That is to say, the non-sample induced endogeneity may exist in this study. Following with prior studies (Konadu et al., 2022), this study employs the two-stage least squares (2SLS) regressions to deal with the non-sample induced endogeneity. In the first stage, this study regresses *Global diversification* on lagged instrumental variables including *Global diversification* and *Productivity*, and lagged covariates including *State ownership*, *Firm size*, *Debt level*, *Profitability*, *Slack*, *Firm growth*, *Firm age*. The industry-year effects are also included so as to reduce identification concerns. Then, we replace the actual value of the endogenous variable (*Global diversification*) with its predicted scores (*Global diversification_{IV}*) from the first stage. Table 12 reports the first stage regression and the effect of *Global diversification_{IV}* on CPG in the second stage regression. The F test of excluded instruments in the first stage is 278.26, which is higher than 10, and the Sargan statistic is 5.48 (i.e., $p > 0.1$), which suggest the validity of our instruments. Further, the effect of *Global diversification_{IV}* on CPG is insignificant, which still support the results in Table 6.

Table 13 further shows the moderating effects of host-country environment results by replacing *Global diversification* with *Global diversification_{IV}*. The results still support the conclusion in previous section, which indicates the findings of this study are robust when we control for the non-sample induced endogeneity.

5. Discussion and conclusion

5.1. Discussion of the results

In recent years, a growing number of Chinese firms have pursued global diversification. Previous research argues that MNCs operating in a widely global scope tend to participate in more philanthropic activities because these activities could facilitate their operation in host countries (Brammer et al., 2009; Cheung et al., 2015). However, the extant research mainly investigates the global diversification-CPG relationship by focusing on developed market firms, while whether the argument still apply to the firm from emerging markets remains poorly investigated. In addition, there is very little knowledge about the effect of host country environment on the global diversification-CPG relationship, though the role of host country's environments is emphasized in the MNCs' behavior such as CSR contribution (Attig et al., 2016; Rahko, 2021). Therefore, using a unique sample of Chinese A-share listed manufacturing MNCs during the period 2006–2019 and a Tobit regression technique, this study investigates the extent to which a firm's CPG is affected by its global diversification and the role of a firm's host country's characteristics in shaping the firm's global diversification-CPG relationship.

The empirical results suggest that there is not a significant relationship between global diversification and CPG. This finding contradicts the conventional view of stakeholder theory; that is, compared to MNCs operating in limited global scope, MNCs operating in widely global scope should have greater incentives to engage in CPG because they face more intense and diverse stakeholder pressures (Brammer et al., 2009; Cheung et al., 2015). The finding also suggests that globally diversified MNCs may be subject to other factors that cause them to reduce their engagement in CPG. For instance, increasing global diversification may limit a firm's ability to engage in philanthropic activities because geographically diversified firms incur large operational costs in meeting the challenges of the international market. In addition, the increasing uncertainty and investment opportunities that firms encounter as they diversify into various countries may strengthen their precautionary motive (Zheng, 2019). This will weaken their motivation to undertake philanthropic activities, thereby decreasing their liquidity. The opposing effects described above collectively account for the insignificant relationship between firms' global diversification and their CPG.

We find that multiple characteristics of MNCs' host countries have strong moderating effects on firms' global diversification-CPG relationships. First, we show that the cultural distance between a firm's

home and host countries negatively moderates the relationship between its global diversification and its CPG. This finding suggests that compared to low cultural distance, high cultural distance tends to limit a firm's capacity for philanthropic activities, instead of facilitating its involvement in philanthropic activities. We attribute this negative effect of cultural distance to its role as a source of international uncertainty, which increases a firm's motivation to maintain high financial flexibility to increase its ability to cope with any future adverse circumstances. As a result, compared to MNCs operating in limited global scope, MNCs operating in widely global scope are likely to engage in fewer philanthropic activities, as they instead opt to maintaining high levels of financial flexibility when operating in culturally distant countries.

Second, our findings suggest that the institutional quality of a firm's host country negatively moderates the relationship between its global diversification and its CPG. This finding supports the argument that MNCs are likely to use philanthropic activities as means for improving their social legitimacy in local markets when their host countries have imperfect institutional environments (Rathert, 2016; Marano et al., 2017; Yang and Rivers, 2009). The finding indicates that CPG can be a strategic tool for tackling an imperfect institutional environment, and that access to good institutions can reduce a firm's operating costs in a host country, such as by reducing its expenditure on philanthropic donations.

Third, our findings indicate that country risk strengthens the negative relationship between global diversification and CPG. This finding is inconsistent with that of previous studies, which suggest that CPG is used by firms to reduce external risk such as political risk (Albuquerque et al., 2019; Chintrakarn et al., 2021). Specifically, our finding provides evidence for two counterarguments. The first argument is that compared to a firm operating in a country with a low level of country risk, a firm operating in a country with a high level of country risk will have higher operational costs and subsequently experience greater financial pressures, which will limit its ability to participate in philanthropic activities. The second argument is that compared to a firm operating in a country with a low level of country risk, a firm operating in a country with a high level of country risk will have a stronger precautionary motive, and thus will increase its financial flexibility by engage less in philanthropic activities.

Fourth, our findings suggest that the economic growth of a firm's host country positively moderates the relationship between the firm's global diversification and its CPG. We argue that high economic growth of a host country provides many growth opportunities for an MNC, and that philanthropic donations represent an effective means to seize such opportunities.

5.2. Theoretical and practical implications

Our findings have important implications for research of corporate philanthropy, in addition to practical implications. In terms of research implications, our findings suggest that the environment of an MNC's host country can play a critical role in determining the firm's philanthropic activities in the country. Thus, we suggest that studies on the philanthropic behaviors of MNCs should examine the roles of the environments of firm's host countries.

In terms of practical implications, our findings suggest that policymakers of countries seeking corporate philanthropy should strive to optimize their economic and institutional environments. For example, policymakers should cultivate stable institutional and economic environments, as these will enhance the capacities of MNCs to engage in philanthropic activities by reducing their operational costs. In addition, policymakers should seek to achieve high-quality economic development and to create valuable growth opportunities, which will enhance MNCs' motivations to engage in philanthropic activities.

5.3. Limitations and directions for future research

Like many other studies, there exist some limitations in this study, and these limitations need to be addressed in future research. First, the sample used in this empirical study only includes MNCs from China. Whether the findings could still hold for MNCs from other countries especially emerging countries with different economic and institutional environments may provide additional evidences. Second, the moderators (i.e., cultural distance, institutional quality, country risk and economic growth) are measured by the average of host countries' environment. Due to the data constraint, this study cannot get each country's weight by a firm's sales or asset in that country. Future studies could extend our study by constructing more precise variables to capture host countries' environment faced by MNCs.

Author statement

I have made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; and I have drafted the work or revised it critically for important intellectual content; and I have approved the final version to be published; and I agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Home country digital finance development and post-entry internationalization speed of emerging market SMEs: Empirical evidence from China

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ABSTRACT

Digital finance development (DFD) has profoundly impacted various aspects of our society. This study investigates how home country DFD affects the post-entry internationalization speed (PIS) of small and medium-sized enterprises (SMEs) in emerging markets. Using data on Chinese manufacturing SMEs from 2011 to 2020, we find that home country DFD exerts a significantly positive impact on emerging market SMEs' PIS. In particular, this positive impact is especially pronounced for SMEs led by CEOs with overseas experience, those in high-tech industries, and those in home country regions with a high level of traditional finance development. The mechanism analysis demonstrates that home country DFD enhances SMEs' PIS through two channels: easing firm financing constraints and improving firm productivity. Our findings advance the knowledge about the economic effects of DFD and the determinants of PIS.

1. Introduction

In recent decades, digitalization has driven dramatic changes in the financial industry (Lee & Shin, 2018). These changes are characterized by the expansion of connectivity in customer interfaces and back-office processes, an increase in information processing speed, and the introduction of entirely new business opportunities and models in financial services firms (Gomber et al., 2018). Digital finance, as a new model of finance developed using digital technology, provides a set of new financial products and services that traditional finance cannot provide (Gomber et al., 2018; Ozili, 2018). It has changed social interactions, reduced the problem of market information asymmetry to a large extent, reduced transaction costs, and expanded the content of financial services through the deep integration of digital technology and financial services (Gomber et al., 2017; Guo et al., 2016). Researchers argue that digital finance is conducive to improving and expanding the opportunities for external financing for firms, especially SMEs (Liu et al., 2021; Lu et al., 2022). Inspired by this argument, this study addresses whether digital finance development (DFD) in home country can facilitate the internationalization process of emerging market SMEs.

Internationalization speed, a temporal dimension of the

internationalization process, has been considered as an important issue for dynamic internationalization in the international business literature (Bolívar et al., 2022; Buckley & Casson, 1981; Casillas & Acedo, 2013; Chetty et al., 2014; Gao & Pan, 2010; Mathews & Zander, 2007; Melin, 1992; Welch & Luostarinen, 1988). The extant literature suggests that increasing internationalization speed aids firms in gaining competitive advantages (Hilmersson & Johanson, 2016; Huang et al., 2022; Tan & Mathews, 2015). For example, by employing rapid internationalization strategy, a firm could achieve first-mover advantages and grasp new market opportunities (Jiang et al., 2014; Mohr & Batsakis, 2017; Powell, 2014; Schu et al., 2016; Vermeulen & Barkema, 2002; Weerawardena et al., 2007). Firms from emerging countries such as China usually have strong motivations to employ rapid internationalization strategies because they are eager to quickly overtake competitors from developed countries (Bonaglia et al., 2007; Deng, 2012). Therefore, the factors that determine the internationalization speed of firms from emerging countries such as China are worth investigating.

The internationalization speed literature differentiates two distinct issues: early-stage internationalization speed, which is the time spent by a firm to start internationalization since its establishment (Musteen et al., 2010), and post-entry internationalization speed (PIS), which is

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the average pace of a firm's initial and subsequent international activities (Autio et al., 2000; Prashantham et al., 2019; Zahoor & Al-Tabbaa, 2021). These two issues are inherently different and may thus be determined by different factors. However, while the determinants of early-stage internationalization speed have been widely investigated (Acedo & Galán, 2011; Amorós et al., 2016; Casillas et al., 2020; Gassmann & Keupp, 2007; Kabongo & Okpara, 2019; Li et al., 2015; Luo et al., 2005; Musteen et al., 2014; Ramos et al., 2011; Zucchella et al., 2007), the determinants of PIS have received little attention.

The extant literature demonstrates that PIS is a critical factor closely linked to a range of organizational outcomes, such as overall performance and success in internationalization efforts (Chang & Rhee, 2011; Chetty et al., 2014; Hilmersson & Johanson, 2016; Huang et al., 2022). For example, Chang and Rhee (2011) find that rapid PIS can significantly improve the performance of firms operating in industries facing higher globalization pressures. Similarly, Chetty et al. (2014) find that firms implementing higher levels of PIS have higher levels of internationalizing success. Despite the progress made in understanding the importance of PIS, little is known about the antecedents of PIS. In other words, what factors contribute to a firm's ability to accelerate PIS? This is an important area of research, as understanding the antecedents of PIS can help firms develop strategies to improve their internationalization efforts. Therefore, more research is needed to fully understand the factors contributing to PIS.

The current study seeks to extend the extant literature by investigating the determinants of PIS in small and medium-sized enterprises (SMEs) from emerging markets. SMEs and large firms are known to face different external constraints. In particular, SMEs usually suffer more serious external financial constraints than large firms (Dhanaraj & Beamish, 2003; Mina & Santoleri, 2021; Song et al., 2020). SMEs in emerging countries may face even more serious financial constraints owing to the immature financial markets in such countries (Chan et al., 2012). However, the support of external funds is critical for firms' expansion in the complex international market, and external financial constraints will limit firms' international expansion (Buch et al., 2014; Minetti & Zhu, 2011; Yan et al., 2018). In this case, the home country DFD that influences the availability of external funds may impact the PIS of SMEs from emerging countries such as China.

By constructing a sample consisting of the digital financial inclusion (DFI) index released by Peking University and the data of A-share manufacturing SMEs listed in the SME Board and Growth Enterprise Market (GEM) from 2011 to 2020, this study investigates the effect of home country DFD on emerging market SMEs' PIS. Our empirical results demonstrate a positive relationship between home country DFD and emerging market SMEs' PIS. Our analysis also demonstrates that this positive relationship is increasingly pronounced for SMEs managed by chief executive officers (CEOs) with overseas experience, in high-tech industries, and in home country regions with a high level of traditional finance development. Further, our mechanism analysis demonstrates that home country DFD enhances SMEs' PIS by reducing their financing constraints and increasing their productivity.

This study has the following contributions. First, we extend the literature on the economic effects of DFD. Many recent studies have explored the effects of DFD in various fields, including consumption (Li et al., 2020), financial stability (Risman et al., 2021), green innovation (Li et al., 2022), and firm value (Tang et al., 2022). However, few works have investigated the impact of DFD on firms' internationalization process. By focusing on the relationship between DFD and PIS, the current study clarifies the important role of DFD in internationalization and provides new knowledge for understanding the economic impacts of DFD.

Second, we contribute to the PIS literature by investigating the role of DFD in determining PIS. The extant PIS literature mainly focuses on PIS outcomes (Chang & Rhee, 2011; Chetty et al., 2014; Deng et al., 2018; Hilmersson & Johanson, 2016; Huang et al., 2022). Hence, little attention has been paid to the determinants of PIS (Ibeh et al., 2018;

Prashantham et al., 2019; Zahoor & Al-Tabbaa, 2021). In the current study, we consider the role of DFD in determining PIS, and the results advance the knowledge about PIS.

Third, we contribute to the literature about SMEs' internationalization. The prior literature on SMEs' international business posits that home country environments are important factors that drive SMEs to explore opportunities across foreign countries (Adomako et al., 2020; Cui et al., 2014; Khan & Lew, 2018). However, whether the financial environment of home countries can promote or inhibit emerging market SMEs' PIS remains unclear. Therefore, our study of the impact of home country DFD on emerging market SMEs' PIS could advance the understanding of the role of home country conditions on SMEs' internationalization.

Finally, we extend the literature about the determinants of PIS by using firms from China, a unique emerging country. The literature about the determinants of PIS is mainly based on samples from developed countries such as the United Kingdom (Zahoor & Al-Tabbaa, 2021). Therefore, limited knowledge is available about the PIS of firms from emerging markets. In recent decades, firms from emerging markets such as China have played an increasingly important role in international markets (Acedo & Jones, 2007; Weerawardena et al., 2007). In line with this progress, our study extends our understanding of PIS by focusing on Chinese firms' PIS.

The succeeding parts of the paper are organized as follows: Section 2 provides an overview of DFD in China. Section 3 reviews the literature on the relationship between home country DFD and PIS and presents the research hypotheses. Section 4 discusses the methods. Section 5 details the empirical results. Section 6 describes the mechanism analysis. Section 7 summarizes the findings, explains the study's implications, and identifies possible future research directions.

2. DFD in China

With the accelerated innovation of the Internet-related technologies, the financial industry in China is undergoing dramatic changes. Digital finance, which is closely related to these new technologies, is on the rise and has attracted extensive attention. According to the DFI index released by Peking University, the median value of the DFI index among 31 provinces in China in 2020 reached 334.82, which was almost ten times that in 2011 (Fig. 1). This statistic suggests that DFD in China has rapidly developed in the past decades. From a global perspective, DFD in China is in a leading position. According to the 2019 Fintech100 Report jointly released by KPMG and H2 Ventures, 10 of the top 100 fintech companies in the world are from China, which ranks second to the United States and the United Kingdom. China is now recognized as far ahead in developing the digital economy and leads the world in digital finance penetration in online shopping, digital money transfer, and retail payments.

In fact, DFD in China comprises three development stages. The first stage was electronic finance. From the end of the 20th century to the beginning of the 21st century, China's financial industry moved from traditional manual operations to electronic replacement, and traditional financial institutions remained the main body of development. In this stage, informatization and electronization did not alter the business model of the financial industry. The second stage was Internet finance. After 2012, new financial models, such as peer-to-peer finance, crowdfunding, and online lending, developed, and China's financial system experienced a boom of Internet financial innovation, which quickly spread to various segments of the financial industry. The third stage was the deep integration of finance and technology. The emergence of Alibaba's online money fund product "Yu Ebao" in 2013 marked the arrival of a real digital financial era. New digital financial forms and products continue to emerge, thereby changing the development pattern of China's financial industry. Digital finance developed from new technologies is gradually becoming an indispensable to the Chinese financial system.

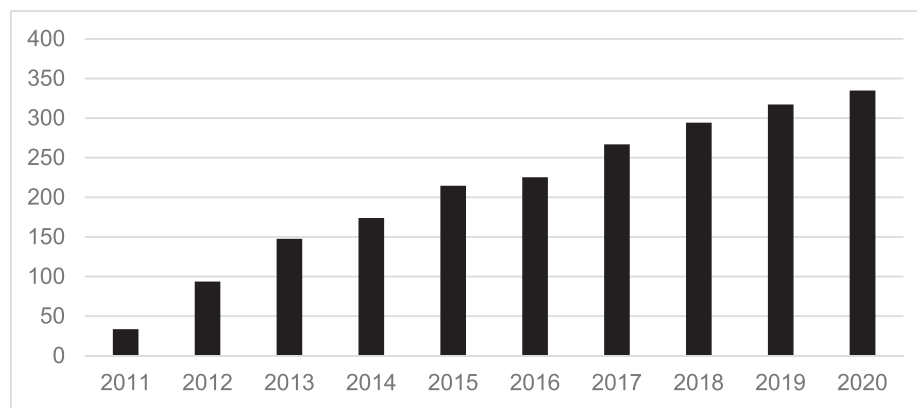


Fig. 1. The DFD in China over the period of 2011 to 2020.

Note: The median value of the provincial DFI index proxies for the DFD in China. The provincial-level DFI index is obtained from a research group at the institute of digital finance at Peking University.

China has unique conditions for rapid DFD. First, China has substantial unmet financial needs. China's financial system has long been dominated by banks, and in this system, bank credit decisions are prone to administrative interventions or inappropriate control by the government, resulting in insufficient credit rationing for private firms and SMEs. This situation provides opportunities for DFD because digital finance can alleviate information asymmetry and thus improve credit services for private firms and SMEs (Lu et al., 2022). Second, China has greatly improved the infrastructure related to Internet communication, which has effectively promoted the popularization of the Internet. Having large numbers of Internet users provides an important foundation for DFD. Third, Internet technologies have undergone remarkable progress in China. These technologies help financial institutions overcome geographical limitations and provide financial services to customers in remote areas and long-tail markets. Finally, the Chinese government provides strong support for DFD. The government has been committed to promoting common prosperity and financial inclusion as a national strategy. Digital finance is inherently inclusive and can promote financial inclusion by reducing financing costs, preventing risks, and promoting competition. In this case, DFD has received substantial support from the Chinese government.

New financial forms in China include digital payment, digital currency, online credit, intelligent investment, digital securities, intelligent financial management, and digital insurance. Digital finance in China profoundly affects and changes many aspects of society by efficiently supporting the real economy and serving the digital economy with various forms of finance.

3. Literature review and hypothesis

3.1. Relationship between home country DFD and emerging market SMEs' PIS

In this study, we argue that home country DFD could facilitate emerging market SMEs' PIS in two ways. The first way is alleviating firms' financing constraints. The extant literature suggests that the support of external capital plays an essential role in firms' expansion in the complex and uncertain international market (Chan & Manova, 2015; Minetti & Zhu, 2011) and that financing constraints limit firms' ability to expand internationally (Buch et al., 2014; Tan & Mahoney, 2005; Yan et al., 2018). If a firm has difficulty obtaining external financial resources, its internationalization plans may be put on hold, and its PIS could slow down. Financial constraints are likely to be an important factor limiting SMEs' PIS because these firms, as vulnerable groups, often face difficulties in obtaining bank loans from traditional financial sectors (Behr & Guettler, 2007). This case may be especially true for SMEs from

emerging countries owing to these countries' immature finance markets (Chan et al., 2012).

DFD with inclusive characteristics could provide various channels for emerging market SMEs to solve their financing difficulties (Lu et al., 2022). More specifically, DFD is accompanied by the rise of innovative technologies, such as information technology, big data, and cloud computing, and can thus break through geographical restrictions, reduce market friction, and change the traditional approach to credit investigation (Gomber et al., 2018; Kabakova & Plaksenkov, 2018). Such development could fundamentally improve information transparency for lenders and borrowers, reduce credit discrimination against SMEs, and thereby improve the possibility for SMEs to obtain reasonably priced borrowing funds (Gomber et al., 2017). In this regard, we argue that home country DFD could help cultivate a good financial ecological environment, alleviate emerging market SMEs' financing constraints, and ultimately improve their PIS.

The second way in which home country DFD facilitates emerging market SMEs' PIS is to improve their productivity. Productivity is an important factor determining firms' international expansion (Helpman et al., 2004). Firms with high productivity will be competitive in the international market (Hsu, 2016) and tend to have significant incentives to rapidly expand their businesses across countries. The extant literature suggests that improving firms' productivity is significantly positively correlated with the availability of financial support (Midrigan & Xu, 2014). Technological innovation, as the key factor in improving firm productivity, is generally regarded as an activity characterized by high investment, high risk, and long return cycles (Kortum & Lerner, 2000; Shahzad et al., 2021; Zhou et al., 2021). When firms are subject to high financing constraints or costs, they are reluctant to invest in such projects (Beladi et al., 2021; Xiang et al., 2022). In this regard, financial support is one necessary condition for improving firm productivity. Therefore, we argue that home country DFD could provide financial support for SMEs' technology progress, improve their productivity, and therefore facilitate their PIS.

On the basis of the above discussion, the following hypothesis is proposed:

Hypothesis 1. A significantly positive relationship exists between home country DFD and emerging market SMEs' PIS.

3.2. Impact of heterogeneous factors

3.2.1. Impact of CEOs' overseas experience

The extant literature suggests that top managers' overseas experience could affect firms' various operational activities (Zhou, 2023). CEOs are firms' most influential decision-makers. Their overseas experience could greatly influence firms' operations. We suggest that CEOs' overseas

experience could enhance the positive relationship between home country DFD and emerging market SMEs' PIS in two ways. First, firms managed by CEOs with overseas experience are open to taking advantage of digital finance to satisfy their financial demand related to the acceleration of internationalization. Digital finance is a new financial form based on new technologies (Puschmann, 2017). Prior studies suggest that overseas experience could broaden managers' horizons and enhance their ability to understand advanced technology, thereby promoting their open attitude toward new technology (Cheng et al., 2020). Hence, firms managed by CEOs with overseas experience are more likely than firms whose CEOs lack overseas experience to be open to using digital finance to alleviate their financial constraints. In this case, home country DFD is likely to exert a greater positive effect on the PIS of SMEs led by CEOs with overseas experience than on the PIS of SMEs led by CEOs without overseas experience.

Second, SMEs led by CEOs with overseas experience could effectively take advantage of the financial resource benefits of DFD in the internationalization process. In this way, the positive relationship between home country DFD and emerging market SMEs' PIS is enhanced. Prior literature suggests that firms' international expansion speed is limited by their managers' management capabilities (Tan et al., 2020). CEOs' overseas experience could benefit firms' multinational management ability in several ways. For example, Hutzschenreuter and Horstkotte (2013) suggest that managers with overseas experience generally can keenly perceive the uncertainties across international markets and, therefore, could enhance firms' ability to overcome the uncertainties in internationalization. Li (2018) suggests that managers with overseas experience generally have broad formal or informal networks across international markets and thus tend to improve firms' ability to obtain valuable information in these markets. Yi et al. (2021) suggest that managers with overseas experience could deeply understand the cultures and institutions across countries and improve firms' ability to manage subsidiaries in countries with different cultures, customs, and practices. In this regard, CEOs' overseas experience might alleviate the management resource constraints SMEs face in the internationalization process, and SMEs could effectively use the financial resources from DFD to accelerate their PIS.

In line with this discussion, the following hypothesis is proposed:

Hypothesis 2. The positive relationship between home country DFD and PIS is more pronounced in SMEs led by CEOs with overseas experience than in those led by CEOs without overseas experience.

3.2.2. Impact of industry type

Industry type is an important factor that affects firms' business behavior (Javalgi et al., 2000; Sin et al., 2005). The effect of home country DFD on emerging market SMEs' PIS may differ for high-tech and low-tech firms. In contrast to firms in low-tech industries that are generally labor-intensive, firms in high-tech industries are generally technology- and knowledge-intensive (Zhou, 2020). These firms tend to maintain high intensity of research and development (R&D) investments to compete with their counterparts (Zhou, 2021). However, R&D investments are often long-term and uncertain, and firms cannot easily maintain R&D investments by relying solely on internal funds (Hall, 2002; Müller & Zimmermann, 2009; Zhang & Kong, 2022). In this case, the support of external financing is crucial to high-tech firms (Neville & Lucey, 2022; Sahut et al., 2021). Hence, external financing constraints tend to exert considerable adverse effects on high-tech firms' various behaviors, including PIS. In consideration of the mitigating effects of DFD on financing constraints, we argue that by alleviating financial constraints, DFD has greater power to facilitate the PIS of high-tech firms in comparison with the PIS of low-tech firms. Therefore, the following hypothesis is proposed:

Hypothesis 3. The positive relationship between home country DFD and PIS is more pronounced in high-tech SMEs than in low-tech SMEs.

3.2.3. Impact of traditional finance development

In addition to digital finance, traditional finance is an important channel for firms to obtain external funds. In regions with a high level of traditional finance development, competition among traditional financial sectors (e.g., traditional banks) is fierce (Claessens & Laeven, 2003). Traditional financial institutions in these regions could provide diversified financial services for firms (Love, 2003). In this case, digital finance will face greater market competition from traditional finance. To succeed, digital finance must exert effort to provide financial services for SMEs through its unique technology advantages (Gomber et al., 2018). Therefore, home country DFD is likely to have great ability to reduce the financial constraints of SMEs located in regions with a high level of traditional finance development and thus exerts a strong positive effect on the PIS of these firms.

Traditional financial sectors play the leading role in the emerging market financial system, and they serve as important financial channels for firms to obtain external funds (Clarke et al., 2006; Lu et al., 2022). However, the level of traditional finance development typically varies across regions in emerging countries (Bai et al., 2021). In this context, we argue that home country DFD will likely have a strong positive effect on the PIS of emerging market SMEs in home country regions with a high level of traditional finance development. Subsequently, the following hypothesis is proposed:

Hypothesis 4. The positive relationship between home country DFD and PIS is more pronounced in SMEs in home country regions with a high level of traditional finance development than in SMEs in such regions with a low level of traditional finance development.

4. Methodology

4.1. Data

This study constructs a sample of Chinese SMEs from 2011 to 2020 to test our hypotheses. China is one of the most influential emerging market nations (Peng et al., 2008). Our study focuses on Chinese SMEs, which provide valuable insights to both academia and the business community for understanding the impact of home country DFD on emerging market SMEs' PIS. Following prior research conducted on Chinese SMEs (Ren et al., 2015; Zhou, 2023), we confined our investigation to manufacturing firms that are publicly listed on either the Small and Medium Enterprise Board or the Growth Enterprise Board. In addition, our sample only includes firms that had entered the international market (i.e., have established at least one subsidiary in a foreign country) in our sample period because we focus on the PIS of SMEs.

Furthermore, we do not consider the establishment of a subsidiary in a tax haven as internationalization behavior. Detailed information on the firms' overseas subsidiaries was obtained from the China Stock Market and Accounting Research database developed by Shenzhen Xishima Data Technology Co., Ltd. We also obtained all the firm-level data used in our empirical study from this database. The DFI index is another critical data in our study because the index is used to measure the DFD of China. The index was developed by the digital finance research center of Peking University and Ant Financial Services Group. It covers Chinese domestic DFD since 2011 and covers 337 prefecture-level cities in 31 provinces. Our study also uses provincial data from the National Bureau of Statistics of China.

Finally, we matched the data from different sources above. We deleted the firms are labeled as ST (the abbreviation of "Special Treatment") by the Shenzhen Exchange during our sample period. This is because these firms are generally in an abnormal financial situation, and normal accounting standards may not apply. Therefore, we deleted the firms labeled as ST from our analysis to ensure the accuracy and reliability of our results. Our final panel data contains 3653 observations. To eliminate outliers, we winsorized the observations for each continuous variable that are not within the 1st and the 99th percentile.

4.2. Variables

4.2.1. PIS

In this study, PIS is our dependent variable. PIS captures the number of new foreign markets a firm engages in over a specific time interval after its initial entry into foreign markets (Vermeulen & Barkema, 2002). Following prior studies (Hilmersson & Johanson, 2016; Jain et al., 2019; Vermeulen & Barkema, 2002), we measure PIS by computing the average number of foreign countries each firm enters per year. More specifically, we measure PIS by using the following formula:

$$PIS_{i,t} = \frac{N_{i,t}}{T_{i,t}} \quad (1)$$

where $N_{i,t}$ is the total number of foreign countries entered by firm i in year t . $T_{i,t}$ is the number of years since the firm's entry into the foreign market in year t . A large value of PIS indicates a high speed of post-entry international expansion.

4.2.2. Home country DFD (DFD)

DFD in a firm's home country city is associated with its financial availability. Hence, home country city-level DFD can be used to measure the DFD faced by a firm in its home country. Prior studies suggest that the DFI index released by Peking University is a good indicator to capture the DFD in China (Chen & Zhang, 2021; Li et al., 2022) as it covers 337 prefecture-level cities in 31 provinces. In this study, we measure home country DFD (DFD) by using the log of the DFI index for the city where the firm is located.

4.2.3. CEOs' overseas experience (OB)

This study uses a dummy variable (OB) to capture the overseas experience of a firm's CEO. If the firm's CEO has overseas experience, OB takes the value of "1" and the value of "0" otherwise. Following prior literature (Lee & Park, 2008; Sambharya, 1996), we define overseas experience as the studying experience or working experience outside of the home country.

4.2.4. Industry type (HT)

This study focuses on the different relationships between home country DFD and emerging market SMEs' PIS across high-tech and low-tech industries. We classify high-tech and low-tech groups according to the method used by Wang et al. (2022). Specifically, high-tech industries include "pharmaceutical manufacturing, aviation spacecraft and equipment manufacturing, electronic and communication equipment manufacturing, computer and office equipment manufacturing, medical equipment and instrumentation manufacturing and information chemicals manufacturing" (Wang et al., 2022, page 12). Other industries are then regarded as low-tech industries. A dummy variable (HT) was employed to proxy for a firm's industry type. If the firm belongs to a high-tech industry, HT takes the value of "1" and the value of "0" otherwise.

4.2.5. Traditional finance development (TF)

Owing to differences in economic development and institutional changes, the eastern regions in China generally have a higher level of traditional finance development than other regions (Bai et al., 2021). Therefore, following the method used by Deng and Yang (2011), we regard the eastern regions in China (i.e., Beijing, Tianjin, Shanghai, Hebei, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan) as the regions with a high level of traditional finance development. Other regions are regarded as having a low level of traditional finance development. This study uses a dummy variable (TF) to measure traditional finance development. TF takes the value of "1" if a firm is in the eastern regions of China and the value of "0" otherwise.

4.2.6. Control variables

Following prior literature (e.g., Chen & Zhang, 2021; He et al., 2020; Jain et al., 2019), this study controls for a set of firm-level factors that may affect a firm's PIS. More specifically, we control for the following firm-level factors: *Firm Size*, *Leverage*, *Tobin's Q*, *Profitability*, *State Ownership*, *Firm Age*, *Firm Growth*, and *International Experience*. *Firm Size* is measured by the log of a firm's total number of employees. *Leverage* equals to the ratio of total liability to total assets. *Tobin's Q* is measured as a firm's market value of equity plus its book value of debt and then divided by its total assets. *Profitability* is measured by a firm's return on equity. *State Ownership* is measured by a dummy variable; it equals to 1 if a firm is ultimately controlled by a government agency and 0 otherwise. *Firm Age* is measured by the log of the number of years the firm has been in existence. *Firm Growth* is the sales growth rate of a firm. *International Experience* is measured by the log of the number of years since a firm's initial entry into a foreign market.

Given the uneven development across regions in China, regional-level factors at the home country may also affect a firm's PIS. Therefore, we control for two regional-level factors: provincial-level *GDP growth* and provincial-level economic *Openness*, defined as total imports plus exports divided by GDP. (See Table 1.)

In addition, we set up several dummy variables for year and industry to control for possible industry- and year-fixed effects.

5. Results

5.1. Description analysis

Table 2 provides the descriptive statistics for the main variables used in our empirical study. The mean value of PIS is 1.147, which suggests that Chinese SMEs invested in 1.147 countries per year on average during the study period. This speed is higher than that reported by Chang and Rhee (2011) for Korean firms (0.42). This result proves that Chinese firms tend to deploy a rapid internationalization strategy. Table 3 provides the Pearson correlation matrix of the main variables. The results indicate that the correlation coefficients between PIS and other control variables are all within acceptable range, suggesting multicollinearity is not a serious problem in our study. Further, we also deploy the Variance Inflation Factor (VIF) test as an additional test for multicollinearity issues and report the results in Table 4. It demonstrates that the VIFs of all variables are significantly <10, further confirming that multicollinearity is not a serious issue.

5.2. Empirical results

Table 5 reports the ordinary least squares (OLS) regression results of

Table 1
Definitions of main variables.

Variable	Definition
<i>PIS</i>	The number of foreign countries the firm had subsidiaries divided by the number of years since the first foreign entry.
<i>DFD</i>	The log of Chinese DFI index.
<i>Firm Size</i>	The natural logarithm of the number of employees.
<i>Leverage</i>	Total liability divided by total assets at the end of a fiscal year.
<i>Tobin's Q</i>	(Market value of equity + Book value of debt)/total assets at the end of a fiscal year.
<i>Profitability</i>	A firm's return on equity.
<i>State Ownership</i>	A dummy variable equal to 1 if the ultimate controller of a firm is the government agency, otherwise 0.
<i>Firm Age</i>	The natural log of the number of years elapsed since the year that a firm established.
<i>Firm Growth</i>	The sales growth rate of a firm.
<i>International Experience</i>	The natural log of the number of years since a firm's initial entry into foreign market.
<i>GDP Growth</i>	The GDP growth of a province the firm located.
<i>Openness</i>	The trade volume (Total imports plus exports) of a province the firm located, divided by the province's GDP.

Table 2
Descriptive statistics.

Variable	Mean	SD	Min	Max
PIS	1.147	1.138	0.111	7.000
DFD	5.377	0.334	4.017	5.771
Firm Size	7.697	0.981	4.357	11.078
Leverage	0.374	0.173	0.056	0.989
Tobinq Q	2.139	1.176	0.885	8.579
Profitability	0.056	0.147	−1.182	0.363
State Ownership	0.076	0.264	0.000	1.000
Firm Age	2.718	0.357	1.609	3.434
Firm Growth	0.259	0.727	−0.869	9.971
International Experience	1.317	0.696	0.000	2.565
GDP Growth	0.090	0.041	−0.071	0.226
Openness	0.555	0.322	0.055	1.443

Note: $N = 3653$. Mean indicates the mean value of variable. SD indicates Standard deviation. Min indicates the minimum value of variable. Max indicates the maximum value of variable.

PIS for the independent variable DFD and main control variables. The regression results reported in Column (i) are based on the full sample. As illustrated in this Column, the coefficient of *DFD* is significant at the 5% statistical level and has a positive sign, suggesting that home country DFD could accelerate emerging market SMEs' PIS. This finding underscores the significant role that external capital support plays in facilitating SMEs' expansion in the complex and uncertain international market (Chan & Manova, 2015; Minetti & Zhu, 2011), and home country DFD can foster a good financial environment conducive to SMEs seeking to expand their international footprint. Therefore, our results confirm hypothesis 1.

To test hypothesis 2, we constructed two subsamples based on CEOs' overseas experience. One subsample consists of firms led by CEOs with overseas experience ($OB = 1$), while the other consists of firms led by CEOs without overseas experience ($OB = 0$). Based on the two subsamples, we conducted a subsample analysis, and the empirical results are reported in Columns (ii) and (iii). The significantly positive relationship between home country DFD and PIS can only be observed in Column (ii) ($\beta_1 = 0.965, p < 0.05$). To check whether the coefficients of *DFD* differ between the two subsamples, we conducted an additional test using the Fisher's permutation test, which is employed by prior literature (Cleary, 1999; Kirchhain et al., 2020; Odén & Wedel, 1975). Our analysis reveals that the coefficients of *DFD* in the two subsamples significantly differ from each other ($p = 0.050$). The results indicate that the positive effect of home country DFD on PIS is more pronounced in SMEs led by CEOs with overseas experience than in those led by CEOs without overseas experience. This finding highlights that digital finance is a new financial form based on new technologies (Puschmann, 2017) and requires managers to have special skills, such as overseas experience, to effectively take advantage of the benefits of home country DFD. Hence, hypothesis 2 is supported.

To test hypothesis 3, we constructed two subsamples on based on industry type. One subsample consists of firms belonging to high-tech industries ($HT = 1$), while the other subsample consists of firms belonging to low-tech industries ($HT = 0$). Based on the two subsamples, we conducted a subsample analysis, and the empirical results are illustrated in Columns (iv) and (v). The significantly positive relationship between home country DFD and PIS can only be observed in Column (iv) ($\beta_1 = 0.519, p < 0.05$). We conducted additional tests to check whether the coefficients of *DFD* differ between the two subsamples. Our analysis reveals that the coefficients of *DFD* in the two subsamples significantly differ from each other ($p = 0.081$). The results indicate that the positive effect of home country DFD on PIS is more pronounced in high-tech SMEs than in low-tech SMEs. This finding indicates that the support of external financing is crucial to the development of high-tech firms (Neville & Lucey, 2022; Sahut et al., 2021), and home country DFD could mitigate financing constraints for these firms and then facilitate their speed of international expansion. Thus, hypothesis 3 is supported.

Table 3
Pearson correlation matrix.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. PIS	1.000											
2. DFD	0.063	1.000										
3. Firm Size	0.066***	0.044***	1.000									
4. Leverage	0.051***	0.107***	0.397***	1.000								
5. Tobinq Q	−0.043***	0.059***	−0.191***	−0.250***	1.000							
6. Profitability	0.050***	−0.072***	0.099***	−0.246***	0.140***	1.000						
7. State ownership	−0.059***	−0.065***	0.080***	0.003	0.047***	0.021	1.000					
8. Firm Age	−0.108***	0.483***	−0.012	0.036**	0.029*	−0.039**	−0.007	1.000				
9. Firm Growth	0.067***	−0.001	−0.030*	0.042**	−0.021	0.041**	0.064***	−0.018	1.000			
10. International Experience	−0.296***	0.352***	0.282***	0.191***	−0.002	−0.081***	0.052***	0.185***	−0.043***	1.000		
11. GDP Growth	0.030*	−0.224**	−0.006	−0.018	−0.052***	0.034**	−0.002	−0.130***	−0.003	−0.097***	1.000	
12. Openness	−0.023	−0.126***	−0.090**	−0.136***	0.038**	0.023	−0.015	−0.178***	−0.053***	−0.007	0.140***	1.000

Note: $N = 3653$, ***, **, * and * denote statistical significance at 1%, 5% and 10% level, respectively.

Table 4

Variance inflation factor.

Variable	VIF	1/VIF
DFD	1.51	0.661
Firm Size	1.38	0.725
Leverage	1.38	0.724
Tobin Q	1.11	0.899
Profitability	1.15	0.869
State Ownership	1.03	0.974
Firm Age	1.34	0.748
Firm Growth	1.02	0.981
International Experience	1.27	0.785
GDP Growth	1.07	0.933
Openness	1.08	0.927
Mean VIF	1.21	–

Note: N = 3653.

To test [hypothesis 4](#), we constructed two subsamples based on traditional finance development in home country regions. One subsample consists of firms in regions with high traditional finance development ($TF = 1$), while the other subsample consists of firms in regions with high traditional finance development ($TF = 0$). Based on the two subsamples, we conducted a subsample analysis, and the empirical results are reported in Columns (vi) and (vii). The results demonstrate that the significantly positive relationship between home country DFD and PIS can only be observed in Column (vi) ($\beta_1 = 0.970$, $p < 0.01$). We conducted additional tests to check whether the coefficients of DFD differ between the two subsamples. Our analysis reveals that the coefficients of DFD in the two subsamples significantly differ from each other ($p = 0.009$). The results indicate that the positive effect of home country DFD on PIS is more pronounced in SMEs in home country

Table 5

Empirical results.

Variable	PIS						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
	Full sample	OB = 1	OB = 0	HT = 1	HT = 0	TF = 1	TF = 0
DFD	0.373** (0.180)	0.965** (0.402)	0.152 (0.210)	0.519** (0.215)	0.030 (0.330)	0.970*** (0.244)	−0.097 (0.319)
Firm Size	0.173*** (0.025)	0.269*** (0.084)	0.171*** (0.027)	0.179*** (0.031)	0.135*** (0.043)	0.226*** (0.030)	−0.015 (0.047)
Leverage	0.425*** (0.127)	1.263*** (0.405)	0.258* (0.134)	0.508*** (0.156)	0.195 (0.201)	0.375** (0.148)	0.579** (0.277)
Tobin Q	−0.003 (0.017)	−0.008 (0.052)	0.003 (0.018)	−0.017 (0.021)	0.056** (0.028)	0.006 (0.019)	−0.035 (0.036)
Profitability	0.277** (0.126)	0.013 (0.544)	0.298*** (0.110)	0.260* (0.151)	0.335 (0.217)	0.203 (0.153)	0.339* (0.195)
State Ownership	−0.260*** (0.058)	−0.800*** (0.153)	−0.204*** (0.061)	−0.300*** (0.071)	−0.307*** (0.088)	−0.106 (0.074)	−0.553*** (0.086)
Firm Age	−0.258*** (0.064)	−0.121 (0.210)	−0.247*** (0.066)	−0.273*** (0.085)	−0.220** (0.089)	−0.228*** (0.068)	−0.143 (0.225)
Firm Growth	0.082*** (0.029)	0.307** (0.154)	0.060** (0.028)	0.099** (0.038)	0.045 (0.045)	0.111*** (0.035)	0.025 (0.055)
International Experience	−0.572*** (0.029)	−0.817*** (0.114)	−0.546*** (0.028)	−0.551*** (0.034)	−0.612*** (0.052)	−0.659*** (0.034)	−0.323*** (0.050)
GDP Growth	−0.076 (0.429)	−0.331 (1.339)	0.238 (0.421)	0.140 (0.522)	−0.448 (0.713)	−0.148 (0.511)	0.636 (0.808)
Openness	−0.077 (0.066)	−0.075 (0.205)	−0.064 (0.069)	−0.199** (0.079)	0.271** (0.123)	−0.288*** (0.093)	0.323 (0.666)
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Constant	−0.737 (1.035)	−4.932** (2.169)	0.399 (1.207)	−1.557 (1.235)	1.083 (1.898)	−4.288*** (1.401)	2.332 (1.711)
Observations	3653	620	3033	2525	1128	3004	649
R-squared	0.153	0.235	0.156	0.140	0.199	0.184	0.180
Empirical P-value							
DFD _{OB=0} VS DFD _{OB=1}	–		[0.050]	–		–	
DFD _{HT=0} VS DFD _{HT=1}	–		–	[0.081]		–	
DFD _{TF=0} VS DFD _{TF=1}	–		–	–			[0.009]

Note: Values in parentheses are robust standard errors. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively; Values in brackets are P-values. 1000 bootstrap replications are used to calculate empirical P-value.

regions with high traditional finance development than in SMEs in home country regions with low traditional finance development. This finding suggests that digital finance could provide financial services for SMEs through its unique technological advantages ([Gomber et al., 2018](#)) and complement traditional finance ([Meng & Zhang, 2022](#)). Thus, [hypothesis 4](#) is supported.

5.3. Robustness check

5.3.1. Alternative measurement of the dependent variable

In this section, we employ an alternative measurement of PIS to verify the robustness of our results. Specifically, we follow the method used by [Chang and Rhee \(2011\)](#) and specify PIS as the number of foreign countries entered by a firm in the past three years. Compared with the measure of PIS described in the previous section, the current method assigns greater weight to investments made in recent years.

[Table 6](#) presents OLS regression results by employing the alternative dependent variable. As shown in the table, the significance and sign of the estimated coefficients of DFD are almost the same as those in [Table 5](#). Hence, the empirical results are robust with an alternative dependent variable.

5.3.2. Two-stage least square method

The documented positive relationship between home country DFD and emerging market SMEs' PIS may be biased by endogeneity concerns related to reverse causality and omitted variables. Following the method used in prior literature ([Konadu et al., 2022](#); [Zhou, 2022](#)), this study uses the two-stage least squares (2SLS) regressions to alleviate the bias that may arise from endogeneity concerns. In the first stage, we specify the following formula to predict the value of the endogenous variable (DFD):

Table 6

Robustness checks: Alternative measurement of dependent variable.

Variable	PIS						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
	Full sample	OB = 1	OB = 0	HT = 1	HT = 0	TF = 1	TF = 0
<i>DFD</i>	0.847** (0.406)	2.002** (0.946)	0.409 (0.472)	1.293*** (0.481)	−0.173 (0.779)	1.832*** (0.587)	−0.097 (0.595)
<i>Firm Size</i>	0.572*** (0.064)	0.651*** (0.200)	0.575*** (0.068)	0.596*** (0.077)	0.487*** (0.108)	0.702*** (0.076)	0.057 (0.096)
<i>Leverage</i>	1.274*** (0.305)	4.087*** (0.972)	0.805** (0.318)	1.671*** (0.372)	0.211 (0.505)	1.095*** (0.360)	2.323*** (0.607)
<i>Tobin Q</i>	0.043 (0.041)	−0.025 (0.120)	0.074* (0.044)	0.006 (0.047)	0.210*** (0.081)	0.048 (0.047)	−0.012 (0.072)
<i>Profitability</i>	0.899*** (0.316)	0.909 (1.044)	0.849*** (0.317)	1.049*** (0.331)	0.359 (0.801)	0.693* (0.386)	1.548*** (0.491)
<i>State Ownership</i>	−0.750*** (0.144)	−1.367*** (0.456)	−0.667*** (0.151)	−0.820*** (0.177)	−0.868*** (0.222)	−0.466** (0.185)	−1.307*** (0.207)
<i>Firm Age</i>	−0.653*** (0.142)	−0.400 (0.475)	−0.652*** (0.149)	−0.666*** (0.186)	−0.662*** (0.202)	−0.605*** (0.154)	−0.053 (0.406)
<i>Firm Growth</i>	0.259*** (0.088)	0.477* (0.278)	0.234** (0.093)	0.290** (0.116)	0.190 (0.119)	0.323*** (0.107)	0.103 (0.122)
<i>International Experience</i>	−0.176*** (0.063)	−0.247 (0.223)	−0.190*** (0.063)	−0.114 (0.075)	−0.304*** (0.114)	−0.287*** (0.073)	0.055 (0.122)
<i>GDP Growth</i>	2.481** (1.258)	4.369 (4.381)	2.258* (1.179)	3.004* (1.579)	1.555 (1.889)	2.786* (1.582)	3.616* (2.164)
<i>Openness</i>	0.061 (0.152)	−0.337 (0.483)	0.129 (0.156)	−0.133 (0.179)	0.660** (0.300)	−0.368* (0.215)	1.212 (1.515)
<i>Year Fixed Effects</i>	YES	YES	YES	YES	YES	YES	YES
<i>Industry Fixed Effects</i>	YES	YES	YES	YES	YES	YES	YES
<i>Constant</i>	−5.730** (2.366)	−13.849** (5.429)	−3.324 (2.737)	−8.524*** (2.840)	0.452 (4.374)	−11.875*** (3.397)	0.671 (3.403)
<i>Observations</i>	3653	620	3033	2525	1128	3004	649
<i>R-squared</i>	0.091	0.145	0.090	0.098	0.096	0.113	0.134
<i>Empirical P-value</i>							
<i>DFD_{OB=0} VS DFD_{OB=1}</i>	—	[0.074]	—	—	—	—	—
<i>DFD_{HT=0} VS DFD_{HT=1}</i>	—	—	—	[0.043]	—	—	—
<i>DFD_{TF=0} VS DFD_{TF=1}</i>	—	—	—	—	—	[0.036]	—

Note: Values in parentheses are robust standard errors. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively; Values in brackets are P-values. 1000 bootstrap replications are used to calculate empirical P-value.

$$DFD_{i,t} = \rho_0 + \rho_1 DFD_{i,t-1} + \rho_1 IPR_{i,t-1}$$

$$+ \vec{\lambda} X_{i,t-1} + \vec{\gamma} I_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where $DFD_{i,t-1}$ and $IPR_{i,t-1}$ are the two instrumental variables. $DFD_{i,t-1}$ is the provincial-level *DFD* in year $t-1$. We use DFD_P as the instrumental variable of *DFD* because *DFD* at the provincial level should be strongly correlated with *DFD* at the city level while *PIS* does not appear to be directly related to *DFD* at the provincial level. $IPR_{i,t-1}$ is the Internet penetration rate in year $t-1$. *IPR* is measured as the number of Internet broadband users divided by the population at the provincial level. We use *IPR* as one of the instrumental variables because the Internet penetration rate only reflects the technological attributes of digital finance (Chen & Zhang, 2021; Li et al., 2022) and is less likely to be correlated with unobservable factors affecting *PIS*. We also include a set of covariates ($X_{i,t-1}$), which are the control variables mentioned in Section 4, and industry and year dummy variables ($I_{i,t-1}$).

Table 7 reports the regression results obtained using the 2SLS method. Column (i) demonstrates the estimates from the first stage. The coefficients of the two instrumental variables are positive and statistically significant at the 1% level, indicating that they are significantly related to *DFD*. In the second stage, we replace *DFD* with its predicted values (DFD_{IV}) from the first stage. Columns (ii) to (viii) in Table 7 report the results of the second stage of the 2SLS regression. The coefficients of DFD_{IV} across all columns still support the conclusions derived from Table 5. Hence, our findings remain robust when endogeneity is considered.

6. Mechanism analysis

In Section 3, we argue that home country *DFD* can promote emerging market SMEs' *PIS* through two channels: easing firm financing constraints (financial constraint easing channel) and improving firm productivity (productivity improvement channel). In this section, we test whether our arguments regarding the two channels are valid.

To test the financial constraint easing channel, we set the following formulas:

$$KZ_{i,t} = \varphi_0 + \varphi_1 DFD_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$PIS_{i,t} = \omega_0 + \omega_1 KZ_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $KZ_{i,t}$ represents the degree of firm financing constraints. *KZ* is measured using the method proposed by Kaplan and Zingales (1997). If the financial constraint easing channel is valid, then the coefficient of *DFD* in Eq. (3) and the coefficient of *KZ* in Eq. (4) should be significantly negative.

To test the productivity improvement channel, we set the following formulas:

$$TFP_{i,t} = \delta_0 + \delta_1 DFD_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$PIS_{i,t} = \rho_0 + \rho_1 TFP_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (6)$$

where $TFP_{i,t}$ measures a firm's total factor productivity. Following prior literature (Zhou, 2021), we calculate *TFP* by using the method proposed by Levinsohn and Petrin (2003). If the productivity improvement channel is true, then the coefficient of *DFD* in Eq. (5) should be

Table 7

Robustness checks: 2SLS regression.

Variable	First-Stage	Second-stage						
	DFD	PIS						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	Full sample	Full sample	OB = 1	OB = 0	HT = 1	HT = 0	TF = 1	TF = 0
<i>DFD_{IV}</i>	–	2.260*** (0.780)	9.742*** (3.600)	1.542** (0.785)	2.995** (1.163)	0.645 (0.789)	2.880*** (0.793)	–1.237 (2.425)
<i>DFD_{P_{t-1}}</i>	0.280*** (0.034)	–	–	–	–	–	–	–
<i>IPR_{t-1}</i>	0.200*** (0.037)	–	–	–	–	–	–	–
<i>Firm Size</i>	0.002 (0.002)	0.152*** (0.027)	0.187 (0.118)	0.164*** (0.029)	0.164*** (0.034)	0.120*** (0.041)	0.199*** (0.033)	0.025 (0.065)
<i>Leverage</i>	0.004 (0.010)	0.449*** (0.140)	0.834 (0.512)	0.278* (0.149)	0.572*** (0.169)	0.101 (0.230)	0.414** (0.167)	0.645** (0.280)
<i>Tobin Q</i>	0.003** (0.001)	–0.008 (0.020)	–0.016 (0.071)	0.003 (0.021)	–0.030 (0.024)	0.095** (0.038)	–0.004 (0.022)	–0.006 (0.055)
<i>Profitability</i>	0.012 (0.009)	0.631*** (0.148)	0.177 (0.689)	0.570*** (0.144)	0.498*** (0.176)	1.003*** (0.277)	0.532*** (0.163)	0.687** (0.326)
<i>State Ownership</i>	0.004 (0.005)	–0.259*** (0.066)	–0.748*** (0.219)	–0.220*** (0.069)	–0.300*** (0.079)	–0.312*** (0.093)	–0.109 (0.084)	–0.523*** (0.114)
<i>Firm Age</i>	–0.007 (0.005)	–0.288*** (0.071)	–0.307 (0.260)	–0.254*** (0.073)	–0.277*** (0.095)	–0.306*** (0.097)	–0.226*** (0.077)	–0.122 (0.236)
<i>Firm Growth</i>	0.001 (0.002)	0.123*** (0.032)	0.212 (0.200)	0.100*** (0.029)	0.124*** (0.041)	0.094* (0.054)	0.168*** (0.039)	0.034 (0.040)
<i>International Experience</i>	0.001 (0.001)	–0.119*** (0.008)	–0.074** (0.031)	–0.126*** (0.008)	–0.112*** (0.009)	–0.135*** (0.014)	–0.132*** (0.009)	–0.097*** (0.020)
<i>GDP Growth</i>	0.261*** (0.068)	–0.477 (0.763)	–3.058 (3.094)	–0.520 (0.812)	–0.219 (0.937)	–1.351 (1.170)	–0.941 (1.196)	0.433 (1.182)
<i>Openness</i>	0.082*** (0.009)	–0.451*** (0.137)	–1.815*** (0.546)	–0.313** (0.135)	–0.653*** (0.190)	0.118 (0.175)	–0.602*** (0.143)	0.722 (0.870)
<i>Year Fixed Effects</i>	YES	YES	YES	YES	YES	YES	YES	YES
<i>Industry Fixed Effects</i>	YES	YES	YES	YES	YES	YES	YES	YES
<i>Constant</i>	3.559*** (0.134)	–12.249*** (4.422)	–54.581*** (20.586)	–8.570* (4.453)	–15.890** (6.558)	–2.722 (4.485)	–16.079*** (4.553)	8.162 (13.423)
<i>Observations</i>	2785	2785	499	2286	1928	857	2303	482
<i>Empirical P-value</i>								
<i>DFD_{OB=0} VS DFD_{OB=1}</i>	–	–	[0.000]		–		–	
<i>DFD_{HT=0} VS DFD_{HT=1}</i>	–	–	–		[0.090]		–	
<i>DFD_{TF=0} VS DFD_{TF=1}</i>	–	–	–		–		[0.039]	

Note: Values in parentheses are robust standard errors. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively; Values in brackets are P-values. 1000 bootstrap replications are used to calculate empirical P-value.

significantly positive while the coefficient of *TFP* in Eq. (6) should be significantly positive.

Table 8 illustrates the empirical results. Columns (i) and (ii) are used to test the financial constraint easing channel. The coefficient of *DFD* in Column (i) has a negative sign ($\varphi_1 = -1.170$) and is statistically significant ($p < 0.01$). Meanwhile, the coefficient of *KZ* in Column (ii) also has a negative sign ($\omega_1 = -0.037$) and is statistically significant ($p < 0.01$). The results suggest that home country DFD could alleviate emerging market SMEs' financial constraints and that financial constraints limit emerging market SMEs' PIS. In this way, our findings support the financial constraint easing channel.

Columns (iii) and (iv) are used to test the productivity improvement channel. The coefficient of *DFD* in Column (iii) has a positive sign ($\delta_1 = 0.794$) and is statistically significant ($p < 0.01$). Meanwhile, the coefficient of *TFP* in Column (iv) also has a positive sign ($\rho_1 = 0.113$) and is statistically significant ($p < 0.01$). These results suggest that home country DFD could improve SMEs' productivity and that productivity improvement could increase emerging market SMEs' PIS. In this way, our findings support the productivity improvement channel.

7. Discussion and conclusion

7.1. Discussion of the results

In China, digital finance has recently undergone rapid development and profoundly impacts on various economic entities. In this study, we

explored the impact of home country DFD on emerging market SMEs' PIS. We constructed a unique empirical sample by gathering the DFD data released by the digital finance research center of Peking University and the data of A-share manufacturing SMEs listed in the SME Board and GEM from 2011 to 2020. Based on this unique sample, our empirical study finds that home country DFD has a significantly positive impact on emerging market SMEs' PIS and thus suggests that home country DFD could accelerate emerging market SMEs' PIS. The mechanism analysis indicates that home country DFD enhances emerging market SMEs' PIS by reducing their financing constraints and increasing their productivity. The findings also reveal that home country DFD could improve the availability of external funds for SMEs from emerging countries such as China and support these firms' expansion in a complex international market, thereby increasing their PIS.

Our empirical results demonstrate that the impact of home country DFD on emerging market SMEs' PIS is affected by several heterogeneous factors. First, we find that the significantly positive relationship between home country DFD and PIS is more pronounced in SMEs led by CEOs with overseas experience than in SMEs led by CEOs without overseas experience. Hence, SMEs led by CEOs with overseas experience in the internationalization process could benefit more from home country DFD than SMEs led by CEOs without overseas experience. This finding supports two possible arguments. One argument is that SMEs led by CEOs with overseas experience are more open to using digital finance to boost their PIS. The other argument is that CEOs with overseas experience could enhance SMEs' ability to effectively use digital finance in

Table 8

Mechanism analysis: Financial constraint easing channel vs productivity improvement channel.

Variable	Financial constraint easing channel		Productivity improvement channel	
	KZ	PIS	TFP	PIS
	(i)	(ii)	(iii)	(iv)
DFD	-1.170*** (0.306)	—	0.794*** (0.090)	—
KZ	—	-0.037*** (0.013)	—	—
TFP	—	—	—	0.113*** (0.040)
Firm Size	-0.397*** (0.032)	0.159*** (0.026)	0.372*** (0.011)	0.132*** (0.027)
Leverage	8.572*** (0.182)	0.724*** (0.166)	0.695*** (0.057)	0.324** (0.129)
Tobin Q	0.335*** (0.032)	0.017 (0.019)	-0.038*** (0.009)	0.008 (0.018)
Profitability	-2.999*** (0.308)	0.178 (0.128)	0.831*** (0.080)	0.197 (0.128)
State Ownership	0.173* (0.095)	-0.251*** (0.057)	0.063* (0.034)	-0.265*** (0.057)
Firm Age	-0.015 (0.087)	-0.280*** (0.067)	-0.138*** (0.027)	-0.264*** (0.067)
Firm Growth	0.003 (0.054)	0.084*** (0.029)	-0.007 (0.013)	0.084*** (0.030)
International Experience	0.191*** (0.043)	-0.562*** (0.029)	0.086*** (0.014)	-0.579*** (0.029)
GDP Growth	-2.220*** (0.801)	-0.140 (0.451)	0.090 (0.238)	-0.079 (0.451)
Openness	-0.061 (0.106)	-0.023 (0.058)	0.047 (0.034)	-0.034 (0.059)
Year Fixed Effects	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES
Constant	6.431*** (1.795)	0.669** (0.291)	6.139*** (0.528)	-0.523 (0.522)
Observations	3653	3653	3653	3653
R-squared	0.527	0.158	0.542	0.158

Note: Values in parentheses are robust standard errors. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively.

accelerating PIS.

Second, we find that the significantly positive relationship between home country DFD and PIS is more pronounced in SMEs in high-tech industries than in low-tech industries. Hence, SMEs in high-tech industries benefit more from home country DFD than SMEs in low-tech industries. We attribute this finding to the fact that SMEs in high-tech industries tend to rely heavily on the support of external financing because they need a large amount of capital to invest in long-term and uncertain R&D activities (Zhang & Kong, 2022; Zhou, 2021). Moreover, home country DFD could increase the availability of external financing for SMEs.

Third, we find that the significantly positive relationship between home country DFD and PIS is pronounced in SMEs in home country regions with a high level of traditional finance development. Hence, home country DFD could greatly benefit firms in home country regions with high traditional finance development. We also suggest that digital finance will face significant competition in regions with a high level of traditional finance development because the traditional financial institutions in these regions could provide diversified financial services. In these regions, digital finance mainly serves long-tail customers such as SMEs, which traditional financial services are reluctant to reach, using its unique technological advantages (Lee & Shin, 2018). In other words, digital finance is complementary to traditional finance, which can make up for financial market deficiency that impacts SMEs in regions with a high level of traditional finance development.

7.2. Theoretical and practical implications

7.2.1. Theoretical implications

Our findings have the following research implications. First, our findings emphasize and prove the importance of financial development in hastening the internationalization of SMEs. This underscores the significance of financial resources and demonstrates the need for external financial support in facilitating the internationalization process. Future research endeavors should place due importance on exploring and understanding how external financial backing influences and shapes the internationalization process of SMEs.

Second, it is worth highlighting that our study predominantly focuses on the DFD from the standpoint of home country. This emphasis underscores the profound impact of the domestic operating environment on molding the trajectory of internationalization for firms, including their PIS. Consequently, researchers delving into the determinants of firms' internationalization strategies should explore the multifaceted dimensions within the home country context that exhibit intricate connections with PIS.

Third, our research highlights that the influence of DFD on the PIS of emerging market SMEs is not uniform across all organizations; it is significantly influenced by the capabilities of decision-makers within those organizations. This finding underscores the critical role that managers play in harnessing the potential benefits of DFD. Consequently, future research should delve deeper into the intricate dynamics between decision-makers and DFD, exploring how various managerial competencies can enhance or hinder the realization of DFD's advantages.

Fourth, our study indicates that DFD has varying impacts on high-tech and low-tech SMEs. This distinction highlights the necessity for future research to carefully consider the industry context when investigating the implications of DFD. It is imperative to discern how DFD's impact differs across various sectors and to uncover the unique challenges and opportunities it presents in each case. By doing so, researchers can provide valuable insights into the tailored strategies that SMEs in high-tech and low-tech industries should employ to optimize their utilization of DFD.

Fifth, our research findings underscore the potential of digital finance to complement traditional financial systems in expediting a firm's global expansion efforts. This highlights the significance of further exploration into the intricate dynamics between digital finance and traditional financial mechanisms in various contexts. Future research endeavors could delve deeper into understanding the multifaceted relationship between digital finance and traditional finance, shedding light on their collaborative potential across diverse scenarios. This could offer valuable insights into how firms can harness the synergies between these two financial paradigms to fuel their international expansion strategies.

7.2.2. Practical implications

Our findings also have several policy implications. First, our findings suggest that DFD significantly facilitates emerging market SMEs' internationalization speed. Thus, emerging countries such as China, which are pursuing rapid internationalization, should formulate policies that support their home country DFD. In this way, they can address shortcomings within their traditional financial systems, improve the allocation of financial resources, and ultimately cultivate a financial environment conducive to firms' international expansion, especially benefiting vulnerable market participants like SMEs.

Second, our findings suggest that overseas experience can enhance CEOs' ability to take advantage of digital finance in their home country to speed up SMEs' international expansion. Considering these findings, SMEs aspiring for rapid global expansion should proactively consider recruiting top managers with overseas experience or sending their top managers to other countries to study or undergo training. By adopting this strategic approach, SMEs can significantly augment their ability to

effectively take advantage of the financial resources offered by DFD to facilitate their internationalization strategy.

Third, our research underscores the pivotal role of digital finance in expediting the internationalization efforts of high-tech SMEs. Consequently, governments should take an active role in developing the necessary infrastructure to promote the use of digital finance tools among high-tech SMEs. This entails improving Internet accessibility and payment systems, thereby affording high-tech SMEs easier access to and utilization of digital financial instruments, consequently facilitating their global expansion.

Fourth, it is essential to recognize that digital finance and traditional finance are complementary components of a robust financial system. Consequently, harmonizing the development of digital finance and traditional finance is imperative for ensuring financial system stability while harnessing the positive impact of digital finance on the international expansion of SMEs. Governments should dedicate efforts to construct an ecosystem that fosters the coordinated advancement of both digital finance and traditional finance, thus promoting the effective functioning of the financial system.

7.3. Limitations

Our study has some limitations. First, owing to data restrictions, we take the firms listed in the SME Board and GEM as the sample of SMEs in our empirical study. Although this approach has been widely used in research on Chinese SMEs (Ren et al., 2015; Zhou, 2023), these firms are usually excellent leaders. Hence, they may not effectively represent the various types of SMEs. Future research could investigate whether our findings remain applicable across diverse SME samples, such as listed and unlisted SMEs, thus verifying the robustness of our results. Second, we only include SMEs from China in our investigation. In this case, our findings may depend on China's unique context. Therefore, future research employing SMEs from other emerging nations as empirical datasets has the potential to offer substantial evidence and extend the applicability of our findings.

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Data availability

Data will be made available on request.

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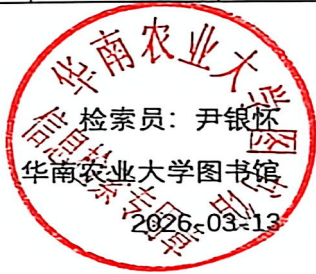
检索证明

根据委托人提供的论文材料，委托人华南农业大学经济管理学院 周超(学科类型:人文社科) 1 篇论文收录情况如下表。

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Internationalization and donations allocated to domestic market: Evidence from emerging market SMEs

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ABSTRACT

This study investigates the effect of internationalization on the donations allocated to domestic markets in small and medium-sized enterprises (SMEs) from China. By adopting the resource dependence theory, we suggest that more internationalized firms are less dependent on the resources provided by stakeholders in the domestic market for survival, and therefore, are likely to donate less to domestic markets. Based on a sample of Chinese SMEs from 2008 to 2021, we find that internationalization negatively affects donations allocated to the domestic market, supporting the logic of the resource dependence theory. Moreover, our analysis reveals that host country characteristics, such as cultural distance, political risk, and economic growth, significantly strengthen this negative effect. This suggests that the host country context significantly impacts the relationship between internationalization and donations allocated to the domestic market among SMEs from emerging markets.

1. Introduction

With the expansion of economic globalization, internationalization has been suggested as a valuable strategy for firms to enhance their sustainable competitiveness by providing opportunities to access new global resources (Nachum and Zaheer, 2005; Porter, 1990). However, internationalization also compels firms to face new employees, customers, and government bodies in the host market (Chapple and Moon, 2005; Sharfman et al., 2004), which increases the firm's stakeholder pressures. The strategic view of corporate social responsibility (CSR) suggests that corporate philanthropy, as an important component of CSR, plays a strategic role in addressing the pressure from various stakeholder groups (Hogarth et al., 2018; Porter and Kramer, 2002; Saiia et al., 2003; Wang et al., 2008; Wu et al., 2021). Specifically, researchers suggest that corporate philanthropy can create several advantages for firms, such as helping them establish a good reputation (Elfenbein et al., 2012), cultivate successful relationships with customers (Collins, 1994), create favorable operating conditions (Werther Jr and Chandler, 2005), and maintain legitimacy with host bureaucrats (Zhou, 2022). In this context, the intensified pressure from international operations in general, and calls from a range of international stakeholders in particular, can likely induce internationalized firms to expand their CSR efforts, such as charitable donations (Brammer et al., 2009).

Extant literature has presented several insights into the relationship between internationalization and corporate donations (Brammer et al., 2009; Zhou, 2022). However, how internationalization affects the donation allocation toward a specific market in emerging market small and medium-sized enterprises (SMEs) has been scarcely explored. Liu et al. (2018) suggest that a firm tends to allocate its donations to different markets and the effect of internationalization on donations allocated to the domestic market (DDM) differs from that on overall corporate donations. In line with this argument, this study seeks to expand the existing literature by

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investigating the effect of internationalization on DDM in emerging market SMEs.

It is well acknowledged that SMEs and large firms face distinct external constraints. For example, large firms typically have stronger financial positions because they have longer operational histories and more diverse financing options, such as bond issuance or public equity offerings. In contrast, SMEs often struggle to obtain financing due to their smaller size, limited financial history, and higher perceived risk by lenders. For SMEs from emerging countries such as China, they may encounter even more significant external constraints owing to the immature markets in these countries (Chan et al., 2012). This situation is likely to yield differing implications for the relationship between internationalization and corporate donations, as well as the relationship between internationalization and DDM.

According to the resource dependence theory, a firm's survival depends on external stakeholder groups to obtain critical resources and that the firm tends to prioritize claims from the stakeholder group that can provide more critical resources (Pfeffer and Salancik, 1978). In line with this theoretical logic, the degree of internationalization could indicate a firm's dependence on either the foreign or domestic market and would affect the firm's strategic decisions regarding the distribution of charitable donations within and outside the country (Liu et al., 2018). Specifically, when a firm has a higher degree of internationalization, the firm will be less likely to depend on domestic markets. Thus, the firm is likely to contribute less donations to the home market because home market stakeholders become less important than host market stakeholders. This may be especially true for emerging market SMEs because these firms face significant external constraints and are likely to experience budget constraints on philanthropic activities. Therefore, it is expected that emerging market SMEs are likely to allocate their limited charitable budgets according to the relative importance of markets and their DDM is likely to decrease with an increase in internationalization.

This study constructs a sample of SMEs in China during the period spanning from 2008 to 2021, and empirically analyzes the relationship between internationalization and DDM. We discover that internationalization negatively affects DDM. Furthermore, this study empirically examines how host country characteristics—including cultural distance, political risk, and economic growth—affect the internationalization-DDM relationship. The results demonstrate that these characteristics strengthen the negative internationalization-DDM relationship.

This study contributes to existing literature in several ways. First, this study contributes to the research on philanthropic behavior of SMEs by investigating the effect of internationalization on DDM. Extant literature on this relationship has primarily focused on large corporations. However, it is widely recognized that SMEs face a distinctive business environment such as serious external financial constraints compared with large firms (Park and Ghauri, 2015; Russo and Perrini, 2010). Our empirical findings indicate that SMEs in emerging markets, which face external constraints, tend to allocate donations to different markets based on their relative importance. The findings evidence that the general corporate donation patterns of SMEs may not necessarily align with their corporate donation behavior within a particular market. Therefore, this study, investigating internationalized SMEs' philanthropic strategies in home market, could enrich our understanding of internationalized SMEs' philanthropic behavior.

Second, this study empirically investigates the moderating effects of host country characteristics, including cultural distance, political risk, and economic growth, on the relationship between internationalization and corporate donations. Prior studies in international business suggest that host country environments are critical to internationalized firms' behavior (Javalgi and Grossman, 2014; Quer et al., 2012; Rahko, 2021). However, the research connecting host country environments to the relationship between internationalization and corporate donations is lacking. Our empirical analysis includes the host country's cultural distance, political risk, and economic growth, and verifies that these are significant factors in the relationship between internationalization and corporate donations. Thus, the current study provides new evidence for further understanding internationalized firms' philanthropy.

Third, our findings could have significant policy implications for SMEs, especially in the Chinese context. Our results indicate that SMEs in emerging markets such as China are likely to allocate their limited charitable budgets according to the relative importance of markets and their DDM is likely to decrease with an increase in internationalization. The findings suggest that SMEs are likely to face budget constraints when dealing with pressure from external stakeholders owing to their difficulty in obtaining funds from external capital markets. This challenge is particularly true in emerging markets such as China where the markets are relatively nascent. Our findings suggest that the governments in emerging markets such as China should implement policies aimed at alleviating the external constraints faced by SMEs and facilitating their access to domestic resources, if they aim to incentivize domestic philanthropic contributions from these firms.

The remainder of this paper is organized as follows: Section 2 reviews the literature relating to the relationship between internationalization and corporate donations and develops the research hypotheses. Section 3 then presents the data and variable definitions. Section 4 discusses the empirical results. Section 5 concludes with our research findings, implications, and possible directions for future research.

2. Literature review and hypotheses development

2.1. Resource dependence theory and corporate philanthropy

The resource dependence theory suggests that a firm is an open system, and its survival and development depend on various resources in the external environment (Pfeffer and Salancik, 1978). Typically, these resources are provided by external stakeholder groups, and the firm depends on these groups; in turn, these stakeholders have the power to influence or control the firm (Pfeffer and Salancik, 1978). For instance, stakeholders who provide resources can make claims about the firm, and the firm must respond to these claims to guarantee their resources. The extent to which a firm is influenced by these external stakeholder groups depends on the resources' importance to the firm's survival and development. If an external stakeholder group can provide critical resources for the

firm, the firm will depend heavily on this external stakeholder group (Freeman, 1999). Firms can secure the availability of critical resources by managing resource dependencies in various ways, such as mergers and acquisitions (Casciaro and Piskorski, 2005), establishing inter-organizational relationships (Park and Mezias, 2005), engaging in corporate political action (Lester et al., 2008; Peng and Luo, 2000), and seeking alternative resources (Hillman et al., 2009).

From the perspective of the resource dependence theory, corporate philanthropy is important in guaranteeing access to critical resources from stakeholders (Gao and Hafsi, 2017; Kabongo et al., 2013; Wang and Qian, 2011). For example, corporate philanthropy can help gain support from stakeholders in the local community (Kabongo et al., 2013) and facilitate access to political resources from local governments (Gao and Hafsi, 2017). Given the importance of interactions with stakeholder groups for the availability of resources, a firm heavily dependent on local stakeholders will contribute more philanthropic resources to the local community (Qian, 2016).

2.2. Internationalization and DDM in emerging market SMEs

Prior research suggests that a firm's degree of internationalization reflects the extent to which the firm depends on foreign markets (Du and Luo, 2016; Gaffney et al., 2013; Rodrigues and Dieleman, 2018). Specifically, a firm with a larger share of sales in overseas markets relies more heavily on overseas markets to achieve survival and growth, while the domestic market's importance decreases accordingly (Finkelstein, 1997). Consequently, overseas stakeholders have a greater influence on internationalized firms, while the stakeholders' influence in the home market decreases (Agle et al., 1999).

According to the resource dependence theory, the extent to which a firm is dependent on a stakeholder group determines the resources assigned to this group (Pfeffer and Salancik, 1978). Thus, internationalization is likely to significantly affect the allocation of a firm's strategic resources. If stakeholders in international markets can exert a greater influence on the firm's performance, the firm's allocation of strategic resources will prioritize their demands over those of domestic market stakeholders (Griffin and Mahon, 1997).

Extant literature generally regards corporate donations as a critical and strategic way to develop and maintain favorable relationships with various stakeholders (Hillman and Keim, 2001; Park and Ghauri, 2015). For example, firms can augment their reputation and increase their legitimacy within the local market by increasing their involvement in corporate philanthropic activities (Chen et al., 2015; Hornstein and Zhao, 2018; Minor and Morgan, 2011). In this regard, the allocation of a firm's charitable donations to different markets could be an important way for the firm to maximize its ability to access critical resources.

For an internationalized firm, the distribution area of charitable donations depends on the stakeholders' relative importance in the domestic and foreign markets. As firms become more dependent on foreign sales, obtaining critical resources from international stakeholders becomes increasingly important. Additionally, firms expanding into foreign markets will encounter diverse stakeholders with distinct needs and heightened legitimacy expectations. These disparities arise from variations in legal systems, cultures, and stages of economic development across host countries (Attig et al., 2016; Brammer et al., 2006; Campbell, 2007). In this case, firms are incentivized to prioritize socially responsible behavior, such as engaging in charitable donations. Consequently, a more internationalized firm is likely to make more charitable donations to international markets, while the home market will receive fewer charitable donations if the firm has budget constraints on its philanthropic activities.

The negative effect of internationalization on DDM may be especially true for emerging market SMEs. It is widely recognized that SMEs experience more serious external constraints than large firms (Dhanaraj and Beamish, 2003; Fairlie and Fossen, 2021). Furthermore, SMEs in emerging markets may face even more serious resource constraints owing to the immature markets in these countries (Chan et al., 2012). Consequently, SMEs operating in emerging markets are subject to heightened fiscal constraints in the realm of philanthropic endeavors. This situation is further compounded by the likelihood that SMEs will have to navigate their philanthropic allocation decisions between domestic markets and overseas arenas. Under the constraints of a specific budget, decisions are typically made by evaluating the relative significance of the stakeholders associated with each market. This creates a conflict of priorities for emerging market SMEs, in which the allocation of philanthropic resources within the host and home markets becomes a competing consideration. Consequently, SMEs are inclined to strategize and allocate their philanthropic donations in alignment with the hierarchical significance of stakeholders under the confines of budgetary constraints. As emerging market SMEs extend their international reach to host countries, they tend to decrease their reliance on their domestic market, and consequently, allocate fewer resources to charitable activities within their home country.

Given this analysis, we propose our first hypothesis:

Hypothesis 1. In emerging market SMEs, internationalization negatively relates to DDM.

2.3. The role of cultural distance

National culture is deeply embedded in various aspects of a country, including its social norms, beliefs, and values (Hofstede, 2003). National culture plays a pivotal role within the informal institutional environment (Shenkar, 2012). It can hardly be directly observed, but has a wide, profound, and lasting impact on every person and market entity (Xu and Hao, 2021). Cultural distance is the cultural difference between two nations; it is widely recognized that this significantly influences a firm's international behaviors (Cho and Padmanabhan, 2005; Quer et al., 2012).

With an increase in cultural distance, interactive communication with a host country's stakeholders tends to be difficult. Therefore, internationalized firms operating in countries with dissimilar cultural environments face substantial barriers in gaining legitimacy from the local society or addressing complicated stakeholder demands (Kang and Jiang, 2012; Zaheer and Mosakowski, 1997). Given

the certain extent of firms' dependence on host markets, a greater cultural distance will cause firms to devote more effort to responding to local stakeholders' claims and gaining local legitimacy.

Corporate philanthropy is expected to manifest as an active response to stakeholder claims (Zhou, 2022). Subsequently, internationalized firms will have a significant incentive to participate in philanthropic activities, such as corporate donations, to secure resources from host countries and maintain positive relationships with stakeholders when operating in culturally distant host nations. Accordingly, internationalized firms are likely to decrease DDM to increase their ability to donate to host markets. Therefore, we propose the following hypothesis:

Hypothesis 2. In emerging market SMEs, the cultural distance between the home and host country strengthens the negative effect of internationalization on DDM.

2.4. The role of political risk

Political risk is the uncertainty of a nation's political environment (Jensen, 2008; Simon, 1984), and is a key factor affecting an internationalized firm's business (Quer et al., 2012). Specifically, when a firm operates in a politically risky country, a significant challenge exists for the firm to manage its business because the political environment is likely to bring more salient threats (Wang et al., 2021; Zhou, 2022). To secure a stable and successful business in a country characterized by high political risk, the firm with business in the country is likely to prioritize claims from the local market.

Previous studies suggest that CSR could be an important tool for addressing a firm's risks (Godfrey et al., 2009). For instance, Jo and Na (2012) observed that CSR could be a tool for mitigating systematic risk. Bouslah et al. (2018) noted that firms investing in more social responsibility experienced less risk during a global financial crisis. Hence, if a firm conducts business in a host country with higher political risk, the firm is likely to contribute more charitable donations to this area to lower the possibility of adverse effects arising from political risk.

Therefore, we argue that firms with a certain degree of internationalization and exposed to higher political risk in a host country are likely to allocate more charitable donations to the international market, while charitable donations to the home market will decrease accordingly.

Hypothesis 3. In emerging market SMEs, the host country's political risk strengthens the negative effect of internationalization on DDM.

2.5. The role of economic growth

As countries with high economic growth generally have positive prospects for future development, many profitable investment opportunities exist in these countries (Temiz and Gökmen, 2014). When a firm conducts business in a host market with high economic growth, it will have more valuable growth opportunities. Consequently, the host country's high economic growth compels firms to rely more heavily on foreign markets for future development.

Researchers suggest that local stakeholders' legitimacy is important in seizing investment opportunities embedded in the host country. This is because internationalized firms often experience a "liability of foreignness" because of their unfamiliarity with the roots in the host environment (Lu and Xu, 2006; Sethi and Guisinger, 2002; Zaheer and Mosakowski, 1997). Therefore, the greater the host country's economic growth, the more important it is for the firm to gain legitimacy from the host country's stakeholders. Accordingly, given a certain degree of internationalization, the host markets' high economic growth increases the host stakeholders' importance to the firm conducting business in the host country.

Literature on corporate philanthropy suggests that charitable donations could provide social legitimacy in local markets, as such donations can facilitate the development of positive relationships with local stakeholders (Collins, 1994; Hall, 2006; Zhou, 2022). Subsequently, firms operating in high-growth host markets tend to allocate more charitable donations to international markets to cultivate favorable business conditions in the host country. This would maximize the firm's ability to access future development opportunities in international markets. In contrast, domestic charitable donations are likely to decrease because of the relatively lower importance of home-market stakeholders.

Given this analysis, we propose our third hypothesis:

Hypothesis 4. In emerging market SMEs, the host country's economic growth strengthens the negative effect of internationalization on DDM.

3. Methodology

3.1. Data

To test our hypotheses, we focus on internationalized SMEs in China, which is one of the most influential emerging market countries (Peng et al., 2008). Following the existing research on Chinese SMEs (Liu et al., 2022; Zhou, 2023), we consider only manufacturing firms publicly listed on the Small and Medium Enterprise Board and Growth Enterprise Board. We collected firm data in the following ways. First, we obtained a firm's charitable donation data from its CSR reports. The CSR report disclosures of A-share-listed firms began in China in 2006. Since then, A-share-listed companies have issued CSR reports for more than 10

consecutive years. However, few A-share-listed firms have issued CSR reports in recent years. Second, detailed information on firms' overseas host countries was collected manually from their annual financial reports. Third, we obtained other firm-level data from the widely used Chinese Stock Market and Accounting Research database, which provides the most accurate and detailed firm-level data for all publicly listed Chinese firms. Fourth, we obtained the national cultural data from Hofstede Insights, to calculate the cultural distance between the home and host countries. Fifth, we collected original data on each country's political risk from the International Country Risk Guide, which was created by the PRS Group and is a popular data source for calculating a nation's political risk. Sixth, we measured the host country's economic growth by gathering data on each country's economic growth from the World Development Indicators dataset, which includes abundant national economic barometers.

Finally, we matched the data to obtain our final sample, which was an unbalanced panel dataset comprising 853 firm-year observations from 2008 to 2021.

3.2. Measures

3.2.1. Dependent variable

DDM_Ratio. We followed prior research on corporate philanthropy (Wei et al., 2018) and measured a firm's DDM using the DDM amount relative to total sales (*DDM_Ratio*). Specifically, *DDM_Ratio* is measured as the ratio of the DDM amount to total sales, multiplied by 100. When measuring the DDM amount, we excluded donations made outside mainland China from the total donations. The firms' CSR reports provide details of the location of donations.

3.2.2. Independent variables

Internationalization. Although previous research proposed several measures to capture the degree of international involvement, the ratio of foreign sales to total sales was the most widely used indicator (e.g., Attig et al., 2016). Thus, the current study measured a firm's degree of internationalization (*Internationalization*) with the ratio of foreign sales to total sales. Following prior studies (Cheung et al., 2015; Wei and Nguyen, 2020), we define the foreign sales of firms in mainland China as sales to countries outside mainland China, and to Hong Kong, Macao, and Taiwan.

3.2.3. Moderating variables

Cultural Distance. The *Cultural Distance* faced by each internationalized firm in the host country is measured in two steps. First, we measured the cultural distance between China and the host country in which the firm conducts business, employing a method used widely in prior studies (Harzing and Pudelko, 2016; Kogut and Singh, 1988), and set the following formula:

$$Cultural\ Distance_j = \frac{1}{6} \left[\sum_i \frac{(I_{ij} - I_{iCH})^2}{V_i} \right], i = 1 \dots 6 \quad (1)$$

where I_{ij} and I_{iCH} represent the values of Hofstede's i th dimension for country j and China, respectively; V_i represents the variance in the value of Hofstede's i th dimension. This study uses the six dimensions of Hofstede's cultural scores to calculate each host country's cultural distance. This study then measures the *Cultural Distance* faced by each internationalized firm by averaging the cultural distance of the host countries in which the firm's subsidiaries conduct business activities.

Political Risk. This study measured *Political Risk* as the average political risk of each host country in which the firm conducts business. We created a proxy for each host country's political risk using the political risk index from the International Country Risk Guide, a metric extensively referenced in prior research (Buckley et al., 2007; Quer et al., 2012). The political risk index has twelve political risk dimensions; in every dimension, a high number of risk points indicates low risk. The total number of risk points of the 12 political risk dimensions was 100. We calculated each host country's political risk as one minus the ratio of the total risk points of the 12 political risk dimensions to 100. According to this method, the higher the value of *Political Risk*, the higher the political risk in the host country.

Economic Growth. This study measured the *Economic Growth* faced by each internationalized firm as the average economic growth of the host countries where the firm's foreign subsidiaries conduct business. This study measured each host country's economic growth as the growth rate of gross domestic product (GDP) per capita, an extensively employed indicator in prior research (Acemoglu et al., 2019).

3.2.4. Control variables

It is important to recognize that charitable donations are also affected by other specific factors; thus, we must control for these factors in statistical models. Following the findings of prior empirical research on charitable donations, this study controls for the following variables that may influence a firm's DDM:

The first variable was *Firm Size*. Prior literature suggests that larger firms generally have more resources (Zhou, 2018) and are more visible to the relevant public (Udayasankar, 2008). Thus, large firms are likely to make more philanthropic corporate donations. We computed *Firm Size* by taking the logarithm of total assets. The second was *State Ownership*. Prior research argues that state ownership significantly impacts emerging market firms' CSR (Li and Zhang, 2010). Following extant literature (Zhou, 2023), we used a dummy variable (*State Ownership*) to measure a firm's state ownership; specifically, *State Ownership* assumes a value of one if the ultimate controller of a firm is the Chinese government, and zero otherwise. The third variable was *Firm Growth*. A firm with high growth may greatly pressure its liquidity, thus weakening its ability to donate to the public (Zhou, 2022). We defined *Firm Growth* as the annual

sales growth rate. The fourth variables were *Debt Level* and *Profitability*. Earlier research demonstrated that firms' financial performance, such as profitability and leverage, significantly influence philanthropy (Brammer and Millington, 2005). Thus, we controlled for a firm's *Debt Level*, which was equal to total liabilities divided by total assets; and *Profitability*, which was equal to the ratio of net profits to equity. The fifth variable was *Firm Age*. We controlled for a firm's age because an older firm is likely to be embedded in broad philanthropic networks (Marquis and Lee, 2013) that influence the firm's philanthropic behavior. *Firm Age* equals the natural logarithm of the years of establishment. The sixth variable was *Market Competition*. Prior studies indicate that the intensity of product market competition is a crucial determinant of corporate donations, with heightened competitive pressure potentially increasing firms' willingness to engage in charitable giving (Choi et al., 2023). Hence, we included *Market Competition* as a control variable, measured as one minus the Herfindahl-Hirschman index of the main operational income of firms in the industry. The seventh variable was *Female Director*. Literature suggests that the board of directors plays a significant role in making major decisions in a firm (Zhou, 2019), and the presence of female directors tends to be positively associated with charitable donations (Wang and Coffey, 1992). Thus, we controlled for the *Female Director*, defined as the ratio of female directors on a firm's board. The eighth factor was *Political Connection*; the political connections of a firm's Chief Executive Officer (CEO) or chairperson may significantly affect the firm's decision to donate (Hao et al., 2020). Thus, we controlled for *Political Connection*. If any of the chairpersons or CEO of a firm is or has been a government official, the value of *Political Connection* was one, and zero otherwise.

As firms' DDM may vary systematically across provinces, industrial sectors, and years, even after controlling for these factors, we also controlled for province-, industry-, and period-level fixed effects.

4. Analysis and findings

4.1. Descriptive analyses

Table 1 presents the main variables' descriptive statistics. The mean value of *DDM_Ratio* is approximately 0.025, indicating that the average DDM of Chinese SMEs accounts for 0.025 % of their total sales. The mean value of *Internationalization* is 0.285, indicating that, on average, Chinese SMEs' foreign sales account for 28.5 % of their total sales. *Cultural Distance* has a mean value of 1.526, demonstrating that the average cultural distance of the host countries in which the Chinese SMEs operate is 1.526. *Political Risk* has a mean value of 0.219, suggesting that Chinese SMEs operate in foreign countries with relatively low political risk. *Economic Growth* has a mean value of 2.350, suggesting that the average growth rate of GDP per capita of the host countries in which Chinese SMEs operate is 2.35 %.

The correlation matrix in Table 2 reveals that the correlations between *Internationalization* and the other control variables are all less than 0.2, and that multicollinearity is not a serious problem in our empirical study.

4.2. Multivariate regression results

Considering the nature of our dependent variable ($DDM_Ratio \geq 0$), we used the Tobit regression technique in our empirical analysis. This empirical method is in line with prior research on corporate donations (Hoi et al., 2020; Hossain and Lamb, 2012; Li et al., 2015).

Table 3 presents the regression results of *DDM_Ratio* for the main variables. We report the baseline model's empirical results, which is comprised of the control variables in Model 1; as Model 1 demonstrates, the coefficient of *Firm Size* is negative (-0.003), exhibiting statistical significance at the 1 % level. This indicates that larger Chinese SMEs tend to donate less to the domestic market. The coefficient of *State Ownership* is negative (-0.039), exhibiting statistical significance at the 1 % level. This suggests that state-owned SMEs in China donate less to the domestic market than privately owned SMEs. The coefficient of *Debt Level* is negative (-0.116) and exhibits remarkable statistical significance at the 1 % level, suggesting that Chinese SMEs with high levels of debt donate less. The coefficient of *Profitability* has a negative sign (-0.061) and exhibits remarkable statistical significance at the 5 % level, suggesting that Chinese SMEs

Table 1
Descriptive statistics.

Variables	N	Mean	SD	Min	Max
<i>DDM_Ratio</i>	853	0.025	0.089	0	1.508
<i>Internationalization</i>	853	0.285	0.245	0.001	0.912
<i>Cultural Distance</i>	853	1.526	1.321	0.157	5.164
<i>Political Risk</i>	853	0.219	0.051	0.120	0.480
<i>Economic Growth (%)</i>	853	2.350	1.657	-5.281	8.256
<i>Firm Size</i>	853	22.487	1.140	19.663	26.000
<i>State Ownership</i>	853	0.120	0.325	0	1
<i>Debt Level</i>	853	0.408	0.168	0.053	0.773
<i>Firm Growth</i>	853	0.154	0.374	-0.564	2.643
<i>Profitability</i>	853	0.085	0.126	-0.633	0.331
<i>Firm Age</i>	853	2.749	0.344	1.253	3.672
<i>Market Competition</i>	853	0.911	0.069	0.341	0.986
<i>Female Director</i>	853	0.158	0.130	0	0.571
<i>Political Connection</i>	853	0.432	0.496	0	1

Table 2
Correlation matrix.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. <i>DDM_Ratio</i>	1												
2. <i>Interantionalization</i>	−0.028	1											
3. <i>Cultural Distance</i>	−0.004	0.078 *	1										
4. <i>Political Risk</i>	−0.024	−0.073 *	−0.325 ***	1									
5. <i>Economic Growth</i>	0.036	0.002	−0.161 ***	0.267 ***	1								
6. <i>Firm Size</i>	−0.020	−0.186 ***	0.107 **	0.123 ***	0.038	1							
7. <i>State Ownership</i>	−0.065	−0.128 ***	−0.059	−0.033	−0.048	0.141 ***	1						
8. <i>Debt Level</i>	−0.088 **	−0.123 ***	0.030	0.034	0.006	0.534 ***	−0.016	1					
9. <i>Firm Growth</i>	−0.013	−0.136 ***	0.100 **	−0.038	−0.026	0.119 ***	0.142 ***	0.013	1				
10. <i>Profitability</i>	−0.007	0.001	−0.071 *	0.090 **	0.023	0.117 ***	0.102 **	−0.177 ***	0.119 ***	1			
11. <i>Firm Age</i>	−0.067	−0.03	−0.103 **	0.157 ***	0.007	−0.006	−0.125 ***	−0.042	−0.048	−0.146 ***	1		
12. <i>Market Competition</i>	0.022	0.034	0.126 ***	−0.147 ***	−0.042	0.059	0.160 ***	−0.127 ***	−0.000	0.117 ***	−0.041	1	
13. <i>Female Director</i>	−0.043	0.032	−0.088 **	0.096 **	0.092 **	0.171 ***	−0.180 ***	0.066	0.031	−0.045	0.143 ***	−0.079 *	1
14. <i>Political Connection</i>	0.115 ***	−0.084 **	−0.021	0.036	0.027	−0.044	−0.095 **	0.028	−0.089 **	−0.049	−0.029	0.034	0.017

N = 853, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3
Tobit regression results.

Variable	DDM_Ratio= 100 × Donation amount/Total sales					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Internationalization</i>		−0.065 *** (0.012)	−0.033 *** (0.012)	0.407 *** (0.013)	−0.004 (0.012)	0.395 *** (0.014)
<i>Internationalization</i> × <i>Cultural Distance</i>			−0.031 *** (0.004)			−0.011 *** (0.004)
<i>Internationalization</i> × <i>Political Risk</i>				−2.299 *** (0.062)		−2.094 *** (0.067)
<i>Internationalization</i> × <i>Economic Growth</i>					−0.024 *** (0.003)	−0.020 *** (0.004)
<i>Cultural Distance</i>	0.009 *** (0.002)	0.009 *** (0.002)	0.002 (0.002)	0.006 *** (0.002)	0.008 *** (0.002)	0.003 (0.002)
<i>Political Risk</i>	−0.157 *** (0.031)	−0.157 *** (0.031)	−0.178 *** (0.031)	0.205 *** (0.031)	−0.160 *** (0.031)	0.165 *** (0.031)
<i>Economic Growth</i>	0.013 *** (0.002)	0.012 *** (0.002)	0.013 *** (0.002)	0.011 *** (0.002)	0.017 *** (0.002)	0.015 *** (0.002)
<i>Firm Size</i>	−0.003 *** (0.000)	−0.004 *** (0.000)	−0.005 *** (0.000)	−0.004 *** (0.000)	−0.004 *** (0.000)	−0.004 *** (0.000)
<i>State Ownership</i>	−0.039 *** (0.006)	−0.050 *** (0.006)	−0.048 *** (0.006)	−0.050 *** (0.006)	−0.052 *** (0.006)	−0.051 *** (0.006)
<i>Debt Level</i>	−0.116 *** (0.014)	−0.115 *** (0.014)	−0.116 *** (0.014)	−0.115 *** (0.014)	−0.114 *** (0.014)	−0.115 *** (0.014)
<i>Firm Growth</i>	0.006 (0.004)	0.006 (0.004)	0.004 (0.004)	0.010 * (0.004)	0.006 (0.004)	0.009 * (0.004)
<i>Profitability</i>	−0.061 *** (0.018)	−0.061 *** (0.018)	−0.058 *** (0.018)	−0.060 *** (0.017)	−0.061 *** (0.018)	−0.059 *** (0.018)
<i>Firm Age</i>	−0.058 *** (0.003)	−0.059 *** (0.003)	−0.054 *** (0.003)	−0.051 *** (0.003)	−0.056 *** (0.003)	−0.048 *** (0.003)
<i>Market Competition</i>	0.199 *** (0.047)	0.246 *** (0.047)	0.238 *** (0.047)	−0.288 *** (0.047)	0.232 *** (0.047)	0.268 *** (0.047)
<i>Female Director</i>	−0.153 *** (0.028)	−0.149 *** (0.028)	−0.148 *** (0.028)	−0.163 *** (0.028)	−0.154 *** (0.028)	−0.164 *** (0.027)
<i>Political Connection</i>	0.010 * (0.006)	0.012 ** (0.006)	0.011 * (0.006)	0.011 * (0.006)	0.011 * (0.006)	0.010 * (0.006)
<i>Time dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Province dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−0.834 *** (0.007)	−0.748 *** (0.007)	−0.769 *** (0.007)	−0.868 *** (0.007)	−0.792 *** (0.007)	−0.901 *** (0.007)
<i>N</i>	853	853	853	853	853	853

Robust standard errors are within the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

with high profits participate less in corporate philanthropic activities. The coefficient of *Firm Age* is negative (−0.058) and exhibits remarkable statistical significance at the 1 % level, indicating that older emerging market SMEs donate less. The coefficient of *Market Competition* is negative (0.199) and exhibits remarkable statistical significance at the 1 % level, indicating that emerging SMEs facing greater market competition participate more in corporate philanthropic activities. The coefficient of *Female Director* is negative (−0.153) and exhibits remarkable statistical significance at the 1 % level, indicating that female directors on boards of emerging market SMEs tend to donate less. The coefficient of *Political Connection* is positive (0.010) and exhibits remarkable statistical significance at the 10 % level, indicating that emerging market SMEs with political connections tend to participate in more corporate philanthropic activities.

To test [Hypothesis 1](#), we include *Internationalization* in the baseline model, and Model 2 reports the empirical results. The regression results reveal that the coefficient of *Internationalization* is negative (−0.065), and it exhibits statistical significance at the 1 % level. This suggests a negative relationship between internationalization and DDM. Thus, the results support [Hypothesis 1](#), in that emerging market SMEs with higher international sales make fewer donations to the domestic market.

To test [Hypothesis 2](#), this study includes the terms *Internationalization* and *Internationalization*×*Cultural Distance* in the baseline model. [Hypothesis 2](#) proposes that a host country's cultural distance negatively moderates the relationship between internationalization and DDM. Model 3 reports the regression results and reveals that the coefficient of *Internationalization*×*Cultural Distance* is negative (−0.031) and exhibits statistical significance at the 1 % level, supporting [Hypothesis 2](#). The results suggest that emerging market SMEs with higher sales in host countries with large cultural distances donate less to domestic markets.

To test [Hypothesis 3](#), this study includes the terms *Internationalization* and *Internationalization*×*Political Risk* in the baseline model. Model 4 in [Table 3](#) presents the regression results, in that the coefficient of *Internationalization*×*Political Risk* is negative (−2.299) and exhibits statistical significance at the 1 % level. These results suggest that the negative relationship between internationalization and DDM tend to be stronger when Chinese SMEs operate in host countries characterized by higher political risk. Thus, [Hypothesis 3](#) is supported.

To test [Hypothesis 4](#), this study includes the terms *Internationalization* and *Internationalization*×*Economic Growth* in the baseline model. Model 5 in [Table 3](#) presents the regression results; the coefficient of *Internationalization*×*Economic Growth* is negative (-0.024) and exhibits statistical significance at the 1 % level. These results indicate that the negative relationship between internationalization and DDM tend to be stronger when Chinese SMEs operate in host countries characterized by higher economic growth. These results support [Hypothesis 4](#).

Finally, we regress *DDM_Ratio* on all variables simultaneously; Model 6 provides the regression results, which support the findings in the preceding columns.

4.3. Robustness analysis

In this section, we confirm whether the findings regarding the internationalization-DDM relationship in emerging market SMEs are robust by providing the following three additional analyses.

4.3.1. Alternative measurement of dependent variable

In this part, we calculate an alternative indicator to measure a firm's DDM. Specifically, we measure the dependent variable as the ratio of the donation amount to total assets, multiplied by 100. [Table 4](#) reports the Tobit regression results obtained using the new measurement indicators. These results suggest that the coefficients of *Internationalization*, *Internationalization*×*Cultural Distance*, *Internationalization*×*Political Risk*, and *Internationalization*×*Economic Growth* align with those in [Table 3](#). The findings in [Table 4](#) further corroborate the proposed hypotheses, suggesting that our results are robust.

4.3.2. Heckman two-stage method

In this study, we only use internationalized firms as samples to test our hypotheses. There is a possibility of sample selection bias

Table 4
Robustness check: Alternative measurement of dependent variable.

Variable	DDM_Ratio= 100 ×Donation amount/Total Assets					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Internationalization</i>		-0.024 * ** (0.006)	-0.014 * * (0.007)	0.242 * ** (0.007)	0.007 (0.007)	0.245 * ** (0.008)
<i>Internationalization</i> × <i>Cultural Distance</i>			-0.016 * ** (0.002)			-0.005 * ** (0.002)
<i>Internationalization</i> × <i>Political Risk</i>				-1.299 * ** (0.034)		-1.201 * ** (0.037)
<i>Internationalization</i> × <i>Economic Growth</i>					-0.012 * ** (0.002)	-0.010 * ** (0.002)
<i>Cultural Distance</i>	0.004 * ** (0.001)	0.004 * ** (0.001)	0.000 (0.001)	0.002 * * (0.001)	0.003 * ** (0.001)	0.001 (0.001)
<i>Political Risk</i>	-0.115 * ** (0.017)	-0.116 * ** (0.017)	-0.126 * ** (0.017)	0.083 * ** (0.017)	-0.117 * ** (0.017)	0.065 * ** (0.017)
<i>Economic Growth</i>	0.007 * ** (0.001)	0.007 * ** (0.001)	0.007 * ** (0.001)	0.006 * ** (0.001)	0.009 * ** (0.001)	0.008 * ** (0.001)
<i>Firm Size</i>	-0.007 * ** (0.000)	-0.008 * ** (0.000)	-0.008 * ** (0.000)	-0.008 * ** (0.000)	-0.007 * ** (0.000)	-0.008 * ** (0.000)
<i>State Ownership</i>	-0.013 * ** (0.003)	-0.017 * ** (0.003)	-0.016 * ** (0.003)	-0.017 * ** (0.003)	-0.018 * ** (0.003)	-0.018 * ** (0.003)
<i>Debt Level</i>	-0.031 * ** (0.008)	-0.031 * ** (0.008)	-0.032 * ** (0.008)	-0.030 * ** (0.008)	-0.031 * ** (0.008)	-0.031 * ** (0.008)
<i>Firm Growth</i>	-0.009 * ** (0.002)	-0.008 * ** (0.002)	-0.010 * ** (0.002)	-0.006 * ** (0.002)	-0.008 * ** (0.002)	-0.007 * ** (0.002)
<i>Profitability</i>	-0.017 * (0.010)	-0.017 * (0.010)	-0.016 (0.010)	-0.017 * (0.010)	-0.017 * (0.010)	-0.016 * (0.010)
<i>Firm Age</i>	-0.047 * ** (0.001)	-0.047 * ** (0.001)	-0.045 * ** (0.001)	-0.043 * ** (0.001)	-0.046 * ** (0.001)	-0.041 * ** (0.001)
<i>Market Competition</i>	0.107 * ** (0.026)	0.125 * ** (0.026)	0.124 * ** (0.026)	0.151 * ** (0.026)	0.120 * ** (0.026)	0.143 * ** (0.026)
<i>Female Director</i>	-0.069 * ** (0.016)	-0.068 * ** (0.015)	-0.067 * ** (0.015)	-0.075 * ** (0.015)	-0.070 * ** (0.015)	-0.075 * ** (0.015)
<i>Political Connection</i>	0.010 * ** (0.003)	0.011 * ** (0.003)	0.010 * ** (0.003)	0.010 * ** (0.003)	0.010 * ** (0.003)	0.010 * ** (0.003)
<i>Time dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Province dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	-0.834 * ** (0.007)	-0.748 * ** (0.007)	-0.769 * ** (0.007)	-0.868 * ** (0.007)	-0.792 * ** (0.007)	-0.901 * ** (0.007)
<i>N</i>	853	853	853	853	853	853

Robust standard errors are within the parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

due to potential systematic differences between non-internationalized firms and internationalized firms. Following extant literature (Heckman, 1979; Zhou, 2022), we apply the Heckman two-stage method to address this type of estimation bias. Specifically, we first estimate the inverse Mills ratio (γ) by constructing the following formula as selection equations:

$$pr(FD_{it} = 1) = \omega_0 + \omega_1 Productivity_{it} \vec{\lambda} X_{it} + \vec{\varphi} Y_{it} + \varepsilon_{it} \quad (2)$$

where FD_{it} takes the value of one if firm i has sales in foreign markets, and zero otherwise. We use *Productivity* as the key variable in the selection equation. This is because a firm's productivity is the key factor determining its entry into foreign markets (Helpman et al., 2004), while a firm's productivity is not likely to affect its decision to donate (Zhou, 2022). *Productivity* is measured as the log of the ratio of sales to the total number of employees. Furthermore, X_{it} represents the control variables, including *Firm Size*, *State Ownership*, *Debt Level*, *Firm Growth*, *Profitability*, *Firm Age*, *Market Competition*, *Female Director*, and *Political Connection*; Y_{it} represents the dummy variables used to control for province-, industry-, and period-level fixed effects.

We then take the inverse Mills ratio (γ) as an additional variable in our regression model to address any potential estimation bias. Table 5 reports the empirical results, and indicates that the estimated coefficients of *Internationalization*, *Internationalization*×*Cultural Distance*, *Internationalization*×*Political Risk*, and *Internationalization*×*Economic Growth* still support the findings in Table 3. Therefore, the previous section's results are robust.

4.3.3. Two-stage least squares regressions

Our findings, as presented in the previous section, may be subject to potential endogeneity issues owing to a reverse causality

Table 5
Robustness check: Heckman two-stage method.

Variable	DDM_Ratio = 100 × DDM amount / Total Sales					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Internationalization</i>		−0.055 * ** (0.012)	0.007 (0.012)	0.395 * ** (0.013)	0.005 (0.012)	0.367 * ** (0.014)
<i>Internationalization</i> × <i>Cultural Distance</i>			−0.035 * ** (0.004)			−0.014 * ** (0.004)
<i>Internationalization</i> × <i>Political Risk</i>				−2.201 * ** (0.062)		−1.955 * ** (0.067)
<i>Internationalization</i> × <i>Economic Growth</i>					−0.024 * ** (0.003)	−0.019 * ** (0.004)
<i>Cultural Distance</i>	0.008 * ** (0.002)	0.008 * ** (0.002)	−0.000 (0.002)	0.005 * * (0.002)	0.007 * ** (0.002)	0.001 (0.002)
<i>Political Risk</i>	−0.177 * ** (0.032)	−0.177 * ** (0.032)	−0.201 * ** (0.032)	0.173 * ** (0.032)	−0.179 * ** (0.032)	0.124 * ** (0.032)
<i>Economic Growth</i>	0.013 * ** (0.002)	0.012 * ** (0.002)	0.013 * ** (0.002)	0.011 * ** (0.002)	0.017 * ** (0.002)	0.015 * ** (0.002)
<i>Firm Size</i>	−0.008 * ** (0.000)	−0.009 * ** (0.000)	−0.012 * ** (0.000)	−0.005 * ** (0.000)	−0.009 * ** (0.000)	−0.006 * ** (0.000)
<i>State Ownership</i>	−0.032 * ** (0.006)	−0.042 * ** (0.006)	−0.039 * ** (0.006)	−0.045 * ** (0.006)	−0.044 * ** (0.006)	−0.045 * ** (0.006)
<i>Debt Level</i>	−0.101 * ** (0.014)	−0.101 * ** (0.014)	−0.102 * ** (0.014)	−0.105 * ** (0.014)	−0.101 * ** (0.014)	−0.105 * ** (0.014)
<i>Firm Growth</i>	0.002 (0.004)	0.003 (0.004)	0.002 (0.004)	0.003 (0.004)	0.004 (0.004)	0.002 (0.004)
<i>Profitability</i>	0.056 * ** (0.008)	0.048 * ** (0.008)	0.050 * ** (0.008)	0.044 * ** (0.008)	0.048 * ** (0.008)	0.045 * ** (0.008)
<i>Firm Age</i>	−0.028 (0.018)	−0.031 * (0.018)	−0.026 (0.018)	−0.036 * * (0.018)	−0.031 * (0.018)	−0.034 * (0.018)
<i>Market Competition</i>	0.059 * ** (0.003)	0.060 * ** (0.003)	0.055 * ** (0.003)	0.052 * ** (0.003)	0.057 * ** (0.003)	0.048 * ** (0.003)
<i>Female Director</i>	−0.226 * ** (0.048)	−0.268 * ** (0.048)	−0.267 * ** (0.048)	−0.288 * ** (0.048)	−0.253 * ** (0.048)	−0.273 * ** (0.048)
<i>Political Connection</i>	−0.178 * ** (0.029)	−0.171 * ** (0.028)	−0.170 * ** (0.028)	−0.182 * ** (0.028)	−0.175 * ** (0.028)	−0.183 * ** (0.028)
γ	0.012 * (0.006)	0.013 * (0.006)	0.012 * (0.006)	0.012 * (0.006)	0.012 * (0.006)	0.012 * (0.006)
<i>Time dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Province dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−0.668 * ** (0.007)	−0.578 * ** (0.007)	−0.549 * ** (0.007)	−0.869 * ** (0.007)	−0.625 * ** (0.007)	−0.864 * ** (0.007)
<i>N</i>	853	853	853	853	853	853

Robust standard errors are within the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

problem. For instance, Aldashev and Verdier (2009) suggest that the decision to expand globally is significantly influenced by the development of the domestic market for donations. In this case, DDM is expected to impact firms' internationalization. To mitigate this endogeneity concern, we employ a two-stage least-squares regression, which is a widely used approach in the existing literature (Zhou, 2023). We employ the one-year lagged mean degree of internationalization within an industry (*IND_Internationalization*) as the instrumental variable for *Internationalization*. This is because a greater level of internationalization within the same industry signifies a substantial demand for the industry's products in global markets (Attig et al., 2016). Consequently, this serves as a strong incentive for firms within the same industry to embark on internationalization efforts (Zhang et al., 2021).

Therefore, in the first stage, we regress *Internationalization* on the instrumental variable (*IND_Internationalization*), covariates (the previously mentioned control variables X_{it}), and industry and year dummy variables. Following this, we replace the actual value of *Internationalization* with the predicted value (*Internationalization_IV*), derived from the first stage. Table 6 presents the empirical results using *Internationalization_IV* as an independent variable. These results align with the conclusions drawn from Table 3, reinforcing our findings' robustness even after addressing any endogeneity concerns.

5. Discussion and conclusion

Extant literature suggests that corporate philanthropy plays a strategic role in internationalized firms operating in various international environments (Brammer and Millington, 2004; Saiia et al., 2003). However, prior studies have mainly investigated the effect of internationalization on overall corporate donations (Brammer et al., 2009; Wei et al., 2018; Zhou, 2022), while its effect on donations in a specific market, such as the home market, has remained poorly investigated (Liu et al., 2018). Hence, this study

Table 6

Robustness check: Two-stage least squares regressions.

Variable	First stage	Second stage				
	<i>Internationalization</i>	<i>DDM_Ratio</i> = $100 \times \text{DDM amount} / \text{Total Sales}$				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Internationalization_IV</i>		−0.034 * ** (0.014)	0.007 (0.015)	0.158 * ** (0.015)	−0.030 * * (0.015)	0.224 * ** (0.017)
<i>Internationalization_IV</i> × <i>Cultural Distance</i>			−0.030 * ** (0.005)			−0.026 * ** (0.005)
<i>Internationalization_IV</i> × <i>Political Risk</i>				−0.710 * ** (0.076)		−0.518 * ** (0.080)
<i>Internationalization_IV</i> × <i>Economic Growth</i>					−0.008 * (0.004)	−0.009 * * (0.004)
<i>Cultural Distance</i>		−0.006 * ** (0.002)	−0.013 * ** (0.002)	−0.006 * ** (0.002)	−0.005 * ** (0.002)	−0.013 * ** (0.002)
<i>Political Risk</i>		−0.165 * ** (0.025)	−0.179 * ** (0.025)	−0.016 (0.025)	−0.161 * ** (0.025)	−0.065 * ** (0.025)
<i>Economic Growth</i>		0.005 * ** (0.001)	0.006 * ** (0.001)	0.004 * ** (0.001)	0.003 * * (0.002)	0.003 * * (0.002)
<i>IND_Internationalization</i>	0.795 * * (0.345)					
<i>Firm Size</i>	0.028 (0.021)	−0.010 * ** (0.000)	−0.010 * ** (0.000)	−0.010 * ** (0.000)	−0.010 * ** (0.000)	−0.010 * ** (0.000)
<i>State Ownership</i>	−0.131 * ** (0.039)	−0.054 * ** (0.006)	−0.053 * ** (0.006)	−0.052 * ** (0.006)	−0.055 * ** (0.006)	−0.053 * ** (0.006)
<i>Debt Level</i>	−0.147 (0.096)	−0.068 * ** (0.011)	−0.064 * ** (0.011)	−0.065 * ** (0.011)	−0.069 * ** (0.011)	−0.063 * ** (0.011)
<i>Firm Growth</i>	−0.024 (0.026)	0.026 * ** (0.004)	0.026 * ** (0.004)	0.027 * ** (0.004)	0.025 * ** (0.004)	0.026 * ** (0.004)
<i>Profitability</i>	−0.038 (0.104)	−0.116 * ** (0.014)	−0.114 * ** (0.014)	−0.114 * ** (0.014)	−0.116 * ** (0.014)	−0.112 * ** (0.014)
<i>Firm Age</i>	−0.027 (0.051)	−0.084 * ** (0.002)	−0.079 * ** (0.002)	−0.084 * ** (0.002)	−0.085 * ** (0.002)	−0.080 * ** (0.002)
<i>Market Competition</i>	0.229 (0.382)	0.543 * ** (0.041)	0.535 * ** (0.042)	0.525 * ** (0.042)	0.540 * ** (0.042)	0.519 * ** (0.042)
<i>Female Director</i>	0.101 (0.114)	−0.161 * ** (0.020)	−0.166 * ** (0.020)	−0.163 * ** (0.020)	−0.159 * ** (0.020)	−0.164 * ** (0.020)
<i>Political Connection</i>	0.037 (0.024)	−0.022 * ** (0.005)	−0.022 * ** (0.005)	−0.022 * ** (0.005)	−0.022 * ** (0.005)	−0.022 * ** (0.005)
<i>Time dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Province dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−0.657 (0.495)	−0.931 * ** (0.006)	−0.951 * ** (0.006)	−0.979 * ** (0.006)	−0.927 * ** (0.006)	−0.980 * ** (0.006)
<i>N</i>	717	717	717	717	717	717

Robust standard errors are within the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

investigated the extent to which DDM is affected by firm internationalization by adopting the resource dependence theory and using a unique sample of Chinese SMEs from 2008 to 2021.

Our empirical results show that the relationship between internationalization and DDM is negative for Chinese SMEs. Therefore, Chinese SMEs with more foreign sales are more dependent on foreign markets than domestic markets for survival and development and are likely to contribute fewer donations to the domestic market. This finding parallels the resource-dependent logic that a firm is likely to allocate its donations according to the relative importance of stakeholders in different markets to maximize its ability to obtain resources from important stakeholders. This finding also confirms that the primary motivation for Chinese SMEs' donations is to maximize their economic benefits rather than a sense of morality. This is consistent with the perspective that a firm's donations are generally taken as a strategic method of handling stakeholder pressures, gaining stakeholder support, attracting strategic resources, and building a favorable reputation (Chen et al., 2018; Hogarth et al., 2018).

Regarding the impact of the host country environment on the internationalization-DDM relationship, we observed the following: First, Chinese SMEs are likely to contribute fewer donations to the domestic market when they operate in a host country characterized by a larger cultural distance, given a certain degree of firm internationalization. This finding indicates that cultural distance is a challenge for a foreign firm to gain local legitimacy and makes it difficult to secure the availability of critical resources. Corporate philanthropy could play a strategic role in handling the stakeholder pressure arising from cultural differences. Second, our study finds that the host country's political risk negatively moderates the internationalization-DDM relationship. The results demonstrate that corporate philanthropy can be a tool for mitigating external risk and that a firm will shift more donations to the host country with higher political risk to secure critical resources. Third, our study finds that the host country's economic growth amplifies the negative effect of internationalization on DDM. The results indicate that firms conducting business in high-growth foreign countries are likely to pay less attention and, therefore, donate less to the domestic market. We argue that this is because higher-growth countries can provide more opportunities for a firm's future development, and the firm will depend more on that country for survival. The findings regarding the impact of the host country environment further advance extant literature by demonstrating the host country environment's importance in the internationalization-DDM relationship.

Our findings provide important implications for researchers in this field. First, they indicate that internationalization's effect on specific market donations, such as DDM differs from that of overall corporate philanthropy. Therefore, researchers seeking to determine the mechanism by which internationalization influences corporate philanthropy should consider internationalization's effect on corporate philanthropy in segmental markets. Second, we emphasize the negative relationship between internationalization and DDM in emerging market SMEs because these firms experience more external constraints than large firms. Thus, we suggest that researchers consider the distinctive characteristics of SMEs and large firms when analyzing the relationship between internationalization and DDM. Third, our findings emphasize the host country characteristics' role in determining internationalization's corporate philanthropic effect. We suggest that scholars who focus on this field consider the role of host country factors when exploiting the relationship between internationalization and DDM.

Our findings also have practical implications for future research. First, given that cultural distance and political risk in the host country are likely to cause internationalized SMEs to donate less to the home country, policymakers in the home country, who intend to encourage internationalized SMEs to contribute more to home communities, should formulate policies or provide resources for these SMEs to handle the dissimilar cultures and political risks in host countries and mitigate their adverse impact on DDM. Second, SMEs tend to face high budget constraints involving philanthropic activities owing to their serious external financial constraints. Policymakers in the home country should ease the external constraints faced by SMEs and make domestic resources more accessible for SMEs if they want to encourage them to donate at home.

This study has several limitations that provide directions for future research. First, we capture firm internationalization from foreign sales to total sales, but Sullivan (1994) suggests that firm internationalization may be reflected in multiple dimensions. Future studies can expand on this study by identifying other dimensions of internationalization or constructing a composite internationalized index with broad dimensions of internationalization. Second, this study emphasizes that internationalized SMEs' domestic philanthropic behavior is largely affected by the host country's environment. Thus, future studies could incorporate other factors related to the host country's environment into their examination of internationalized firms' charitable donations, which may further enhance the knowledge of corporate philanthropy in internationalized firms. Finally, this study's sample is limited to SMEs in China. Therefore, future research could offer new evidence by expanding the scope of samples to other countries or industries. More specifically, researchers could conduct comparative studies by focusing on firms from other developing countries or service industries to generalize this study's findings.

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Author statement

Manuscript title: Internationalization and donations allocated to domestic market: Evidence from emerging market SMEs
I have made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND

I have drafted the work or revised it critically for important intellectual content; AND I have approved the final version to be published; AND

I agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

All persons who have made substantial contributions to the work reported in the manuscript, including those who provided editing and writing assistance but who are not authors, are named in the Acknowledgments section of the manuscript and have given their written permission to be named. If the manuscript does not include Acknowledgments, it is because the authors have not received substantial contributions from nonauthors.

CRedit authorship contribution statement

Chao Zhou: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

I have nothing to declare.

Data availability

Data will be made available on request.

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检索证明

根据委托人提供的论文材料，委托人华南农业大学经济管理学院 周超(学科类型:人文社科) 1 篇论文收录情况如下表。

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Does investing in countries along the belt and road reduce firms' downside risk? Evidence from Chinese manufacturing firms

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ABSTRACT

Investing in Belt and Road countries (BR countries) has emerged as an important strategic choice for Chinese firms seeking to integrate into the global economy. Using a sample of Chinese A-share listed manufacturing firms from 2000 to 2021, this study investigates whether investments in BR countries can reduce firms' downside risks. We discover that investing in BR countries can help Chinese firms reduce their downside risks. Furthermore, our analysis reveals that state ownership weakens and institutional ownership strengthens the downside risk reduction effect of investment in BR countries.

1. Introduction

During trips to neighboring nations in Central and Southeast Asia in September and October 2013, China's leader proposed the Silk Road Economic Belt and 21st Century Maritime Silk Road initiatives, collectively known as the Belt and Road (BR) Initiative. Since then, an increasing number of Chinese firms have responded to the initiative by investing in countries along the BR (hereinafter BR countries). Non-financial direct investment by Chinese domestic investors in 172 countries and areas globally reached US \$116.9 billion in 2022, up 2.8% annually, according to Ministry of Commerce statistics. Non-financial direct investment in 58 BR countries was US \$20.97 billion, a 3.3% annual increase, accounting for 17.9% of overall investment in the same period. Therefore, investing in BR countries has emerged as a major strategic option for Chinese firms seeking to integrate into the global economy in the new era. In this light, it is advantageous to investigate the impact of BR investments on Chinese firms.

Existing research on the impact of Chinese firms' investment in BR countries is primarily based on theories such as the monopoly advantage theory, internalization theory, international production compromise theory, and international technology spillover theory, and examines how investments in BR countries affect firms' profitability or productivity (Cai et al., 2023; Haiyue and Manzoor, 2020; Wu and Si, 2022). Although scholars provide several valuable insights, they disregard the global network built by investments in BR countries, which could provide firms with greater operational flexibility by moving business activity across affiliates in BR countries.

According to the real options theory, multinational investment enables firms to establish a global network with operational flexibilities (Ragozzino et al., 2016). This allows them to cooperate and reallocate resources among affiliates in different countries, thereby helping firms mitigate downside risk (Aloui et al., 2022; Trigeorgis and Reuer, 2017). Inspired by the real options theory, several empirical researchers have investigated the downside risk implications of multinational investment. Some studies find that

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multinational investment does indeed enable firms to achieve operational flexibilities and reduce downside risk (Driouchi and Ben-nett, 2011). However, multinational investment may not necessarily reduce downside risk (Zhou, 2019). Further, extant studies have explored additional factors such as real option awareness, host country environment, and market uncertainty on the downside risk effect of multinational investment (Iouliauou et al., 2021; Zhou, 2023).

Although scholars provide some evidence regarding the downside risk implications of multinational investment, their findings are mixed. To further explore the potential impact of multinational investment on firms' downside risk, we study whether investments in BR countries can help mitigate such risk. By focusing on a sample of Chinese A-share listed manufacturing firms from 2000 to 2021 and employing a Tobit model, our baseline regression analysis results reveal that investments in BR countries can help Chinese firms reduce their downside risk. When the propensity score matching method and an alternative measurement of downside risk are used, this finding remains robust. Further, our additional analyses demonstrate that the impact of investments in BR countries on firms' downside risk is greater in privately owned firms and firms with high institutional ownership as compared to their counterparts.

The following are the study's contributions. First, we contribute to the literature on the effect of BR investments. In contrast to the existing literature, which primarily examines the impact of investment in BR countries on firm profitability or productivity, this study focuses on how the global network established by Chinese firms in BR countries can provide them with more operating options in an uncertain environment, thereby reducing their downside risk. Our research contributes to further understanding the value of investments in BR countries. Second, contrary to previous research that has focused on the impact of host country factors such as cultural distance and labor cost, on the downside risk reduction effect of multinational investment (Tong and Reuer, 2007), this study examines how state and institutional ownership affect the real options flexibility provided by investments in BR countries. Our findings contribute to a better understanding of how business ownership affects multinational investors' capacity to attain real options flexibility.

2. Hypothesis development

According to real options theory, multinational investments can create a global network that gives firms more alternatives for adapting their operations to unforeseen circumstances (Trigeorgis and Reuer, 2017). In an uncertain environment, the core function of these alternatives enable firms to have the right, but not the obligation, to pursue specific future development strategies. This asymmetric decision-making right allows firms to navigate adverse external environments, seize future growth opportunities, and deliver asymmetric benefits to firms (Zhou, 2023). Multinational investments, in particular, enable firms to better manage adverse external conditions and, consequently, reduce their downside risks (Iouliauou et al., 2021).

In the logic of real options theory, investment in BR nations can provide Chinese firms with more options to navigate through adverse external environments, reducing their downside risk for two reasons. First, BR countries and China are highly complementary in terms of production factors, market demand, and technical level (Zou et al., 2022). BR countries can offer Chinese firms a wide range of options for optimizing their business activities between home and BR countries. Second, the BR countries are located in Southeast Asia, South Asia, Central Asia, West Asia, Central and Eastern Europe, and North Africa. The resource endowment and economic development of these countries differ (Yang and Ni, 2022). Business networks built through investments in BR countries can assist Chinese firms in adjusting their commercial activities by taking advantage of the heterogeneity of the BR countries' economic environments, decreasing their susceptibility to external environmental uncertainties.

H1: The investments in BR countries can reduce Chinese firms' downside risks.

3. Research design

3.1. Empirical model

To investigate whether investments in BR countries can reduce firms' downside risk, we develop the following model:

$$DRisk_{i,t} = \alpha_0 + \alpha_1 BRI_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $DRisk_{i,t}$ represents the downside risk of performance, $BRI_{i,t}$ represents firm i 's investment in BR countries, $X_{i,t}$ represents a set of control variables, $I_{i,t}$ represents a set of dummy variables that control for industry- and time-specific effects, and $\varepsilon_{i,t}$ represents a random disturbance term. If investment in BR countries reduces firms' downside risk, the estimated coefficient of BRI in Model (1) is significantly negative.

3.2. Definition of variables

3.2.1. Dependent variable: $DRisk$

According to the method proposed by Tong and Reuer (2007), this study estimates $DRisk$ as follows:

$$\xi_{it} = \begin{cases} IROA_{i,t-1} - ROA_{i,t}, & \text{if } IROA_{i,t-1} > ROA_{i,t} \\ 0, & \text{if } IROA_{i,t-1} \leq ROA_{i,t} \end{cases} \quad (2)$$

$$DRisk_{i,t} = \sqrt{\left(\frac{1}{5}\right) \sum_{t=0}^{-4} (\xi_{it})^2} \quad (3)$$

where $ROA_{i,t}$ is firm i 's return on assets in year t , and $IROA_{i,t-1}$ is the average return on assets of all the firms in the industry in which firm i resides in $t-1$ year.

3.2.2. Independent variable: BRI

BRI is a dummy variable to indicate whether a firm has investments in BR countries. Specifically, *BRI* is assigned a value of 1 if a firm invests in BR countries, otherwise 0.

3.2.3. Control variables

We also control for several variables that may related to firms' downside risk. These variables include firm size (*SIZE*), financial leverage (*LEV*), firm growth (*GROWTH*), Tobin's Q (*TOBINQ*), organizational slack (*SLACK*), firm age (*AGE*) and systemic risk (*BETA*). The definition of above control variables can be found in Table 1.

3.3. Data source

The research sample comprises manufacturing firms listed on the A-share market in Shanghai and Shenzhen from 2000 to 2021. The original data are sourced from the China Stock Market & Accounting Research Database—a widely used database among Chinese researchers. We winsorized all continuous variables at the 1% and 99% quantiles to mitigate the potential impact of outliers. The final sample comprises 9948 firm-year observations.

4. Empirical results

4.1. Descriptive analysis

Table 2 reports the descriptive statistics of the main variables. The mean *BRI* value is 0.2465, indicating that approximately 24.65% of the firms in our sample invested in BR countries. The correlation matrices for the main variables are presented in Table 3. *DRisk* and *BRI* has a -0.0689 correlation coefficient that is significant ($p < 0.01$). This finding provides preliminary evidence that investing in BR countries can significantly lower downside risks. Further, the correlation coefficients between *BRI* and other variables indicate that there is no substantial evidence of multicollinearity in our study.

4.2. Baseline results

Considering that the *DRisk* is a restricted variable greater than or equal to zero, we use a Tobit model for estimation (Belderbos et al., 2014). Tobit estimate results for regression Model (1) are shown in Table 4. According to the results in Columns (i)–(iii), the estimated coefficients of the independent variable *BRI* are consistently negative and significant ($p < 0.01$). This implies that investing in BR countries can greatly reduce the downside risks that Chinese firms face. Notably, the estimated coefficient of *BRI* in Column (iii) is -0.0051, implying that investing in BR countries reduces downside risk by 0.51%. These findings support H1 and indicate the potential benefits of BR investment in Chinese firms for risk management.

4.3. Robustness test

4.3.1. Propensity score matching method

The investment of a firm in BR countries may not be random but is determined by its own features. The propensity score matching method is the widely employed approach in existing literature to address this endogeneity issue (Zhou, 2021). In this study, firms that invest in BR countries are the treatment group, whereas firms that do not invest in BR countries are the control group. Model (1)'s control variables are utilized as covariates for propensity score matching, and the nearest neighbor matching method is employed to

Table 1
Definitions of the control variables.

Variable	Definition
<i>SIZE</i>	<i>SIZE</i> is measured as the natural logarithm of a firm's total assets.
<i>LEV</i>	<i>LEV</i> is measured as the ratio of liabilities to total assets.
<i>GROWTH</i>	<i>GROWTH</i> is measured as the growth rate of sales revenue.
<i>TOBINQ</i>	<i>TOBINQ</i> equals to the market value of a firm divided by the total assets.
<i>SLACK</i>	<i>SLACK</i> equals to the ratio of sum of accounts receivable, inventory, selling expenses, and administrative expenses to sales revenue.
<i>AGE</i>	<i>AGE</i> is measured as the natural logarithm of the number of years a firm has been in existence.
<i>BETA</i>	<i>BETA</i> is measured as the beta coefficient in the capital asset pricing model. The beta coefficient is estimated by using the most recent one-year data.

The values of control variables correspond to the five-year moving average, which is consistent with the calculation of the dependent variable.

Table 2
Summary statistics.

Variable	N	Mean	Std. Dev.	Min	Max
<i>DRisk</i>	9948	0.0297	0.0404	0	0.3381
<i>BRI</i>	9948	0.2465	0.4310	0	1
<i>SIZE</i>	9948	22.1083	1.1488	17.9040	27.3737
<i>LEV</i>	9948	0.4531	0.1767	0.0565	0.9540
<i>GROWTH</i>	9948	0.2135	0.4370	-0.7384	4.7953
<i>TOBINQ</i>	9948	2.0187	0.9821	0.8921	8.5787
<i>SLACK</i>	9948	0.6880	0.4571	0.0999	6.3775
<i>AGE</i>	9948	2.7086	0.3595	1.3159	3.9509
<i>BETA</i>	9948	1.1454	0.2936	-0.4592	2.4375

Table 3
The correlation matrices for the main variables.

Variable	1	2	3	4	5	6	7	8
1. <i>DRisk</i>	1							
2. <i>BRI</i>	-0.0689***	1						
3. <i>SIZE</i>	-0.1687***	0.3245***	1					
4. <i>LEV</i>	0.2193***	0.0913***	0.3505***	1				
5. <i>GROWTH</i>	0.0752***	0.0100	-0.0430***	0.0007	1			
6. <i>TOBINQ</i>	0.0328***	-0.0678***	-0.3803***	-0.3800***	0.0864***	1		
7. <i>SLACK</i>	0.2752***	-0.0297***	-0.2031***	-0.0635***	0.3233***	0.1634***	1	
8. <i>AGE</i>	0.0670***	0.1186***	0.2167***	0.0503***	0.006	0.0839***	-0.0293***	1
9. <i>BETA</i>	-0.0483***	0.0547***	0.0347***	-0.0020	0.0334***	-0.0059	-0.0072	0.0262***

N=9948. *p < 0.1, **p < 0.05,

*** p < 0.01.

Table 4
Baseline results.

Variable	(i)	(ii)	(iii)
<i>BRI</i>	-0.0090*** (0.0012)	-0.0041*** (0.0011)	-0.0051*** (0.0011)
<i>SIZE</i>		-0.0118*** (0.0005)	-0.0171*** (0.0006)
<i>LEV</i>		0.0991*** (0.0031)	0.1196*** (0.0034)
<i>GROWTH</i>		-0.0006 (0.0013)	-0.0012 (0.0013)
<i>TOBINQ</i>		-0.0034*** (0.0006)	-0.0076*** (0.0007)
<i>SLACK</i>		0.0282*** (0.0016)	0.0292*** (0.0018)
<i>AGE</i>		0.0201*** (0.0013)	0.0061*** (0.0015)
<i>BETA</i>		-0.0002 (0.0016)	-0.0054*** (0.0020)
Industry dummy	No	No	Yes
Year dummy	No	No	Yes
Constant	0.0250*** (0.0005)	0.1732*** (0.0106)	0.3330*** (0.0144)

N = 9948. Standard errors are in parentheses. *p < 0.1, **p < 0.05,

*** p < 0.01.

match control groups with similar characteristics. In this investigation, the matching ratio was set at 1:1.

Fig. 1 shows the density plots of the propensity score before and after matching the treatment and control groups at a 1:1 matching ratio. The density curves of the matched treatment and control groups in Fig. 1 almost overlap, indicating no significant difference in the density curves between them after matching.

Based on the matched samples, we estimate Model (1) through regression analysis, and Table 5 presents the regression analysis results. The results demonstrate that the coefficient estimates for *BRI* are consistently negative and significant ($p < 0.01$). This indicates that even after controlling for endogeneity issues using propensity score matching, the conclusion that Chinese firms' investments in BR countries can significantly reduce downside risk remains valid.

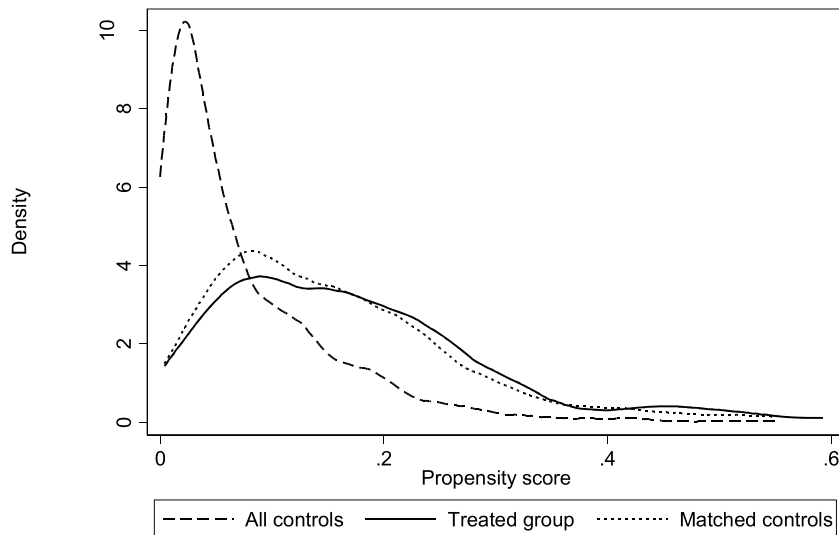


Fig. 1. Propensity score density of treatment group and control group.

Table 5
Propensity score matching method.

Variable	(i)	(ii)	(iii)
<i>BRI</i>	-0.0060*** (0.0014)	-0.0048*** (0.0012)	-0.0046*** (0.0012)
<i>SIZE</i>		-0.0121*** (0.0006)	-0.0154*** (0.0007)
<i>LEV</i>		0.0962*** (0.0046)	0.1174*** (0.0050)
<i>GROWTH</i>		0.0004 (0.0017)	0.0000 (0.0017)
<i>TOBINQ</i>		-0.0065*** (0.0010)	-0.0104*** (0.0011)
<i>SLACK</i>		0.0304*** (0.0020)	0.0317*** (0.0023)
<i>AGE</i>		0.0138*** (0.0018)	0.0014 (0.0019)
<i>BETA</i>		0.0017 (0.0023)	0.0018 (0.0027)
Industry dummy	No	No	Yes
Year dummy	No	No	Yes
Constant	0.0225*** (0.0009)	0.2007*** (0.0145)	0.3123*** (0.0185)

N = 4904. Standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$,

*** $p < 0.01$.

4.3.2. Alternative measurement of dependent variable

This study employs return on equity as an alternative performance metric to quantify a firm's downside risk and then substitutes the dependent variable *DRisk* of Model (1) for a new regression analysis, so as to determine if the outcome of our study is robust when utilizing different performance indicators. The coefficient estimates for *BRI* in Table 6 are consistently negative and significant ($p < 0.01$). It indicates that when a different measure of downside risk is adopted, the finding that Chinese firms' investments in BR countries could significantly reduce downside risk remains valid.

4.4. Further analysis

4.4.1. The effect of state ownership

Firms with different property rights often exhibit distinct business objectives. Typically, the primary objective of privately owned firms is to maximize their economic benefits. Conversely, owing to their state-owned properties, state-owned firms tend to have multiple objectives in their operations rather than solely focusing on maximizing economic benefits (Dai et al., 2023). When operating in BR countries, the distinction in business objectives between privately owned and state-owned firms leads to privately owned firms

Table 6

The results by using alternative measurement of downside risk.

Variable	(i)	(ii)	(iii)
<i>BRI</i>	-0.0294*** (0.0038)	-0.0138*** (0.0034)	-0.0152*** (0.0035)
<i>SIZE</i>		-0.0362*** (0.0015)	-0.0506*** (0.0018)
<i>LEV</i>		0.3771*** (0.0124)	0.4241*** (0.0134)
<i>GROWTH</i>		-0.0052 (0.0040)	-0.0072* (0.0041)
<i>TOBINQ</i>		-0.0032 (0.0019)	-0.0127*** (0.0021)
<i>SLACK</i>		0.0807*** (0.0050)	0.0897*** (0.0059)
<i>AGE</i>		0.0474*** (0.0039)	0.0130*** (0.0044)
<i>BETA</i>		-0.0077 (0.0049)	-0.0240*** (0.0060)
Industry dummy	No	No	Yes
Year dummy	No	No	Yes
Constant	0.0494*** (0.0015)	0.5077*** (0.0331)	0.9717*** (0.0446)

N = 9948. Standard errors are in parentheses. *p < 0.1, **p < 0.05, *** p < 0.01.

being more market oriented than their state-owned counterparts. Consequently, privately owned firms are better positioned to capitalize on variations in economic environments across BR countries, maximizing the downside risk reduction effect of investment in BR countries. To verify the argument above, we use the following formula:

$$DRisk_{i,t} = \beta_0 + \beta_1 BRI_{i,t} \times STO_{i,t} + \beta_2 BRI_{i,t} + \beta_3 STO_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (4)$$

where *STO* is a dummy variable used to measure a firm's state of ownership. If the ultimate controller of a firm is the government, the variable *STO* takes the value of 1; otherwise, it is 0.

The empirical results in Columns (i)–(iii) of Table 7 show that the coefficient estimates of *BRI* × *STO* are consistently positive and significant (p < 0.1). The above results show that compared with privately owned firms, state-owned firms' investment in BR countries exhibits a stronger impact on reducing downside risk.

4.4.2. The effect of institutional ownership

Institutional investors typically possess a significant proportion of shares in a firm, which makes it challenging for them to easily withdraw their investments (McCahery et al., 2016). Consequently, they could face substantial losses when firm performance is poor. To mitigate the risk of poor firm performance, institutional investors have strong incentives to effectively monitor managers' behavior and encourage them to make strategic decisions that enhance firm performance and minimize downside risks. Further, institutional investors often have portfolios that are diverse across industries and countries. They possess extensive experience in international investment, which helps multinational firms become acquainted with the institutional environment and political risks of foreign countries (Hsu and Chien, 2022; Lee et al., 2023). This knowledge enables them to build effective multinational strategies and maximize the value of international investments. Consequently, firms with high institutional ownership are expected to be better positioned to leverage the variations in economic environments across BR countries, thereby maximizing the potential reduction of downside risk.

To verify the argument above, we use the following formula:

$$DRisk_{i,t} = \varphi_0 + \varphi_1 BRI_{i,t} \times INST_{i,t} + \varphi_2 BRI_{i,t} + \varphi_3 INST_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (5)$$

where *INST* is the proportion of institutional investors in a firm.

The empirical results in Table 8 indicate that the coefficient estimates of *BRI* × *INST* are consistently negative and significant (p < 0.1) in Columns (i)–(iii). These results suggest that institutional ownership strengthens the effect of investments in BR countries on firms' downside risk.

5. Conclusion

This study investigates the impact of investments in BR countries on the downside risk of Chinese firms. The findings reveal that investing in BR countries can effectively mitigate the downside risk faced by Chinese firms. The finding supports the argument that such investments help Chinese firms establish more robust global business networks and enhance their operational flexibility, subsequently reducing their downside risk. Further, this study finds that the negative impact of investment in BR countries on downside

Table 7

The effect of state ownership.

Variable	(i)	(ii)	(iii)
<i>BRI</i>	-0.0106*** (0.0016)	-0.0054*** (0.0014)	-0.0068*** (0.0014)
<i>BRI</i> × <i>STO</i>	0.0047** (0.0023)	0.0036* (0.0020)	0.0060*** (0.0020)
<i>STO</i>	0.0010 (0.0011)	-0.0008 (0.0011)	0.0045*** (0.0011)
<i>SIZE</i>		-0.0119*** (0.0005)	-0.0178*** (0.0006)
<i>LEV</i>		0.0991*** (0.0032)	0.1176*** (0.0034)
<i>GROWTH</i>		-0.0007 (0.0013)	-0.0016 (0.0013)
<i>TOBINQ</i>		-0.0034*** (0.0006)	-0.0078*** (0.0007)
<i>SLACK</i>		0.0281*** (0.0016)	0.0296*** (0.0018)
<i>AGE</i>		0.0200*** (0.0013)	0.0046*** (0.0015)
<i>BETA</i>		-0.0001 (0.0016)	-0.0057*** (0.0020)
Industry dummy	No	No	Yes
Year dummy	No	No	Yes
Constant	0.0246*** (0.0008)	0.1751*** (0.0107)	0.3543*** (0.0147)

N = 9948. Standard errors are in parentheses.

* p < 0.1,

** p < 0.05,

*** p < 0.01.

Table 8

The effect of institutional ownership.

Variable	(i)	(ii)	(iii)
<i>BRI</i>	-0.0012 (0.0028)	0.0006 (0.0025)	-0.0016 (0.0025)
<i>BRI</i> × <i>INST</i>	-0.0002*** (0.0001)	-0.0001*** (0.0000)	-0.0001* (0.0000)
<i>INST</i>	-0.0003*** (0.0000)	-0.0002*** (0.0000)	-0.0001*** (0.0000)
<i>SIZE</i>		-0.0101*** (0.0005)	-0.0160*** (0.0006)
<i>LEV</i>		0.1024*** (0.0031)	0.1195*** (0.0034)
<i>GROWTH</i>		-0.0004 (0.0013)	-0.0010 (0.0013)
<i>TOBINQ</i>		-0.0026*** (0.0006)	-0.0071*** (0.0007)
<i>SLACK</i>		0.0268*** (0.0016)	0.0287*** (0.0018)
<i>AGE</i>		0.0182*** (0.0013)	0.0063*** (0.0015)
<i>BETA</i>		-0.0022 (0.0016)	-0.0058*** (0.0020)
Industry dummy	No	No	Yes
Year dummy	No	No	Yes
Constant	0.0397*** (0.0014)	0.1500*** (0.0108)	0.3115*** (0.0147)

N = 9948. Standard errors are in parentheses., **p < 0.05,

* p < 0.1

*** p < 0.01.

risk is weakened by state ownership and strengthened by institutional ownership. Our findings suggest that investments in BR nations can provide Chinese firms with more options for navigating adverse external environments, reducing their downside risk, and that this effect is affected by firms' ownership such as state ownership and institutional ownership.

CRedit authorship contribution statement

Chao Zhou: Conceptualization, Methodology, Supervision, Writing – original draft. **Feng Lin:** Software, Visualization, Investigation, Data curation, Writing – review & editing.

Data availability

Data will be made available on request.

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检索证明

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The effects of outward FDI and export on firm productivity in emerging markets: Evidence from matching approach

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ABSTRACT

This study disentangles the effects of outward foreign direct investment (OFDI) and export on the productivity of Chinese manufacturing firms by using the propensity score matching approach with multiple treatments. Results show that just OFDI has a significant positive impact on firm productivity, but that the productivity effect of just export is insignificant. A complementarity exists between OFDI and export in improving firm productivity. Further, the effects of OFDI and export on firm productivity are different in high-tech and low-tech firms.

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1. Introduction

Recent decades have seen an upsurge in outward foreign direct investment (OFDI) and export from firms in emerging markets. There has been significant scholarly interest in the benefits that such firms could achieve from these activities. One focus is on their productivity effects (Helpman et al., 2004). Studies suggest that OFDI and export facilitate emerging market firms to access useful technological information about the manufacturing process and product innovations by providing more opportunities for contact with foreign customers and employees, thus improving firm productivity (Branstetter, 2006). However, empirical studies show mixed evidences supporting the productivity-improvement effect of OFDI and export (Dai et al., 2018; Liu and Manzoor, 2020).

Previous studies generally regard OFDI and export as independent, and investigate the productivity effects of OFDI and export separately. However, the two international involvements are interdependent, and they can jointly affect firms' productivity; for example, more than 50% of OFDI firms participate in the export

activities in my dataset. Therefore, it is necessary to consider the confounding effects of OFDI and export when evaluating their productivity effects. To disentangle the confounding effects, this study attempts to simultaneously investigate the effects of OFDI and export individually and together on firm productivity by employing a propensity score matching approach with multiple treatments (MPSM). This approach allows for two treatments in contrast with the standard propensity score matching (PSM) approach. The disentanglement will provide further evidence for understanding the productivity effects of OFDI and export.

Further, this study attempts to investigate whether the effects of OFDI and export on firm productivity are different in high-tech and low-tech firms because their absorptive capacity is different (Yasar, 2013). More specifically, compared with low-tech firms, high-tech firms rely heavily on technology to compete, and they have significant incentives to invest in research and development, enabling them to have a greater capacity to absorb international technological knowledge. Therefore, high-tech firms are expected to achieve higher productivity gain from OFDI and export than low-tech firms. This analysis will provide additional evidence for the impact of firm heterogeneity on the productivity effects of international involvements.

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Table 1
Number of firms among treated groups.

Group	Export starter (0,E)	OFDI starter (F,0)	OFDI and export starter (F,E)
Full sample	154	63	69
High-tech sample	75	40	47
Low-tech sample	79	23	22

Table 2
Effects of OFDI and export on firm productivity based on MPSM and DID estimator.

Period	t-1/t	t-1/t+1	t-1/t+2	t-1/t+3
Full sample				
(1) (0,E)/(0,0)	-0.0007 (0.0022)	0.0029 (0.0027)	0.0014 (0.0029)	0.0074* (0.0039)
(2) (F,0)/(0,0)	0.0050** (0.0024)	0.0071** (0.0033)	0.0082* (0.0044)	0.0106* (0.0055)
(3) (F,E)/(0,0)	0.0078** (0.0035)	0.0157*** (0.0052)	0.0140** (0.0067)	0.0178** (0.0080)
Low-tech sample				
(4) (0,E)/(0,0)	0.0043 (0.0036)	0.0032 (0.0080)	0.0016 (0.0050)	0.0130 (0.0086)
(5) (F,0)/(0,0)	0.0055 (0.0038)	0.0057 (0.0052)	0.0104 (0.0068)	0.0108 (0.0076)
(6) (F,E)/(0,0)	0.0113** (0.0048)	0.0134* (0.0070)	0.0142* (0.0082)	0.0148 (0.0089)
High-tech sample				
(7) (0,E)/(0,0)	0.0005 (0.0024)	0.0002 (0.0043)	0.0075* (0.0043)	0.0056 (0.0049)
(8) (F,0)/(0,0)	0.0057** (0.0027)	0.0115*** (0.0037)	0.0130** (0.0063)	0.0193*** (0.0058)
(9) (F,E)/(0,0)	0.0120** (0.0051)	0.0168*** (0.0059)	0.0176*** (0.0058)	0.0194*** (0.0066)

Notes: Standard errors in brackets.

***Indicate significance at 1% level.

**Indicate significance at 5% level.

*Indicate significance at 10% level.

2. Methodology

A major challenge in capturing OFDI and export effects on firm productivity is overcoming the endogeneity problem arising from selection bias because the productivity effect can be attributed either to the self-selection of more productive firms into OFDI and export or to the productivity improvement through OFDI and export. The PSM method is a widely used approach to address the selection bias. As this study has two treatment indicators, namely, firms' status of OFDI and export, and that OFDI and export can be a firm's mutually exclusive choices as well as a joint choice, I employ MPSM to control for the selection on both observables and unobservables (Lechner, 2002; Dai et al., 2018).

More specifically, I first set F and E as proxy for OFDI and export, respectively. I then define the following four mutually exclusive states:

- (0, 0): the state with no treatment, neither OFDI nor export;
- (F, 0): the state of starting OFDI only;
- (0, E): the state of starting export only;
- (F, E): the state of starting export and OFDI.

I then calculate the average treatment effect on the treated (ATT) for the following pairs:

- (F, 0)/(0, 0): OFDI starters versus no treatment;
- (0, E)/(0, 0): export starters versus no treatment;
- (F, E)/(0, 0): OFDI and export starters versus no treatment.

Further, the average effect of treatment k relative to treatment l can be defined as:

$$ATT_{k,l} = E(Y^k|S = k) - E(Y^l|S = k) \quad (1)$$

where Y denotes a firm's productivity, which is the outcome after the treatment. S represents the status of the firm. k represents three states of treatments. l represents the state of no treatment.

However, the counterfactual Y^l cannot be observed directly. To deal with this problem, this study employs matching techniques to select, from a pool of firms with the state of l , a control group to match for firms with the state of k condition on a set of observable variables (X) affecting the entry into each specific treatment. Then $E(Y^l|S = k)$ can be proxied by the matched firms undergoing treatments l because these firms have the same characteristics with firms involved in treatments k . Thus, Eq. (1) can be rewritten as:

$$ATT_{k,l} = E(Y^k|S = k) - E[E(Y^l|X, S = l), S = k] \quad (2)$$

The matching between firms receiving treatments k and l is done based on the probability of choosing treatment k . Then the probability is estimated as:

$$p^k(X) = P(S = k, X) \quad (3)$$

where $p^k(X)$ denotes the probability of selecting treatment k conditional on X . Since there are four states, I estimate Eq. (3) with a multinomial logit model. Then, Eq. (2) can be rewritten as:

$$ATT_{k,l} = E(Y^k|S = k) - E_{p^k(X), p^l(X)}[E(Y^l|p^k(X), p^l(X), S = l), S = k] \quad (4)$$

As the matching procedure may not capture the effects of time invariant unobservable characteristics on firms' probability of choosing the treatments, I further combine MPSM with the difference-in-differences (DID) estimator:

$$ATT_{k,l} = \left\{ E(Y^k|S = k)_{post} - E(Y^k|S = k)_{pre} \right\} - \left\{ E_{p^k(X), p^l(X)}[E(Y^l|p^k(X), p^l(X), S = l), S = k]_{post} - E_{p^k(X), p^l(X)}[E(Y^l|p^k(X), p^l(X), S = l), S = k]_{pre} \right\} \quad (5)$$

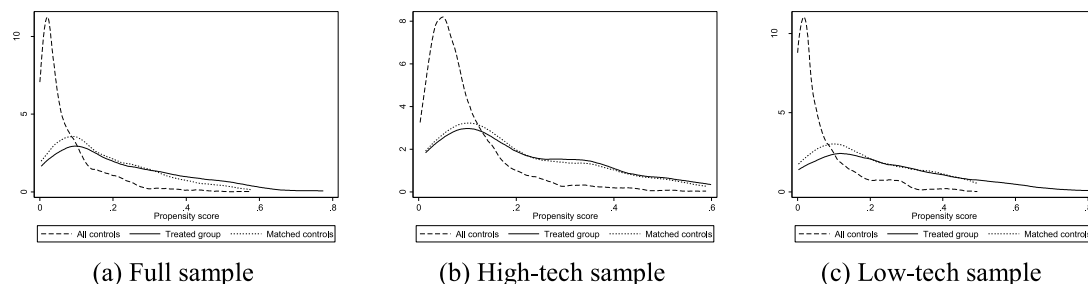
To implement the above approach, I estimate Firm productivity by using a flexible translog production function and by employing the method proposed by Akerberg et al. (2015). The explanatory variables X in the multinomial logit regression include: Firm productivity; Total asset, measured as the logarithm of total asset; ROA, measured as return to assets; Capital intensity, measured as the logarithm of the fixed asset to the number of employees; Firm age, measured as the logarithm of a firm's age; and a vector of time and industry dummy variables.

3. Data

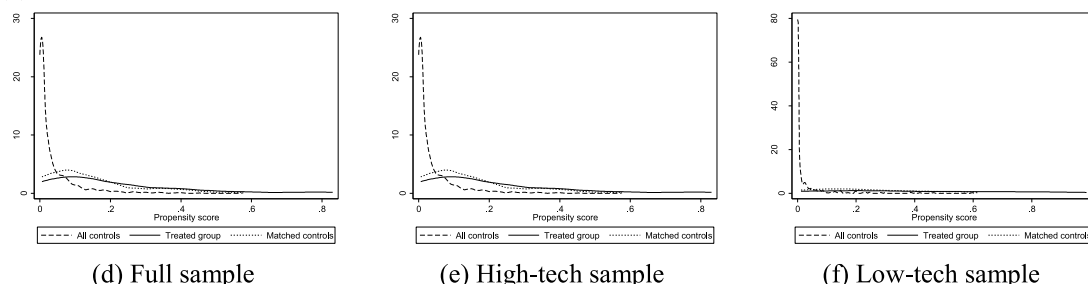
To achieve the research goals, I manually collected OFDI data of all A-share listed Chinese manufacturing firms during the period 2001–2016 from their annual financial reports. Other required data (e.g., firms' export and characteristics data) were all obtained from the China Stock Market & Accounting Research Database (CSMAR), a major provider of Chinese data.

The classification of high-tech and low-tech groups is based on a firm's industry characteristics (Czarnitzki and Thorwarth, 2012). Firms that fall under industries such as manufacturing chemicals, pharmaceuticals, general and special equipment, transportation

(1) Export starters versus no treatment



(2) OFDI starters versus no treatment



(3) OFDI and export starters versus no treatment

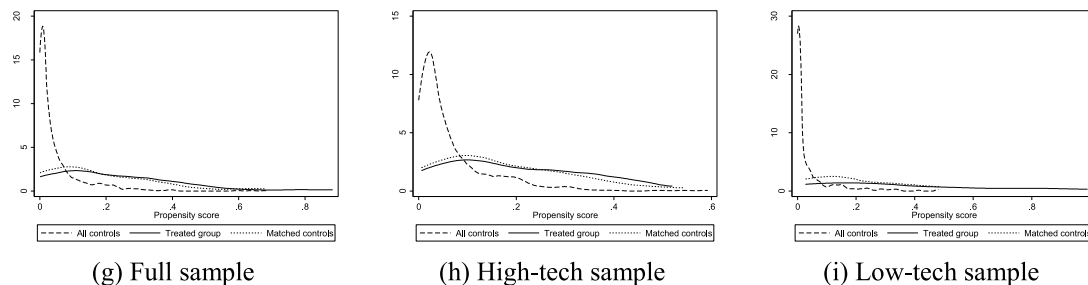


Fig. 1. Density distributions of estimated propensity scores among the treated, matched, and unmatched controls.

equipment, electrical and optical products, computers, and instruments are categorized under the high-tech group. The other firms are categorized under the low-tech group. Table 1 reports the distribution of firms among treated groups in the final sample.

4. Results

Fig. 1 displays density distributions of estimated propensity scores among the treated, unmatched, and matched controls. The density distributions of the treated group and matched controls almost overlap after matching, suggesting that the matching process can increase comparability between the treated group and matched controls.

Table 2 reports the estimated ATTs for three pairs of comparisons based on three samples. Results in the full sample section show that ATTs are insignificant for three periods in Row 1, suggesting little evidence supports the productivity-improvement effect of just export. The ATTs are positive and significant for four periods in Rows 2 and 3, suggesting just OFDI or OFDI and export, simultaneously, significantly benefits firm productivity. Moreover, compared with Rows 1 and 2, the ATTs are the largest in Row 3, suggesting there is a complementarity between OFDI and export in improving firm productivity.

Results in the low-tech sample section show that ATTs are insignificant for four periods in Rows 4 and 5, suggesting that both just export and just OFDI cannot benefit the productivity of low-tech firms. The ATTs are significant for three periods in Row 6, suggesting OFDI and export, simultaneously, can significantly

benefit the productivity of low-tech firms. The comparison of ATTs in Rows 4, 5, and 6 suggests that complementarity between OFDI and export exists in low-tech firms.

Results in the high-tech sample section show that ATTs are insignificant for three periods in Row 7, suggesting little evidence supports the productivity-improvement effect of just export in high-tech firms. The ATTs are positive and significant for four periods in Rows 8 and 9, suggesting that just OFDI or OFDI and export, simultaneously, significantly benefits the productivity of high-tech firms. The comparison of ATTs in Rows 7, 8, and 9 suggests that complementarity between OFDI and export also exists in high-tech firms.

Further, the comparison of ATTs in the high-tech and low-tech sample suggests that high-tech firms achieve greater productivity improvement through just OFDI or OFDI and export, simultaneously, which supports the view that high-tech firms have greater absorptive capacity to achieve higher productivity gain from international involvements.

5. Conclusion

This study disentangles the effects of OFDI and export on the productivity of Chinese manufacturing firms by employing MPSM. I find that just OFDI or OFDI and export, simultaneously, has a significant positive impact on firm productivity, and that the productivity effect of just export is insignificant. Further, the productivity effects of OFDI and export are different in high-tech and low-tech firms.

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实物期权理论视角下中国企业在“一带一路” 沿线国家的投资价值

周 超

(华南农业大学,广东 广州 510642)

摘 要:基于2000—2021年中国制造业上市公司数据,从实物期权理论视角对中国企业在“一带一路”沿线国家的投资价值进行理论和实证分析,研究发现:中国企业在“一带一路”沿线国家投资可显著降低其业绩下行风险并提升其业绩上行潜力。机制分析表明:上述影响是由于投资“一带一路”沿线国家构建的全球经营网络有助于企业增强成本控制能力和市场需求可持续性。异质性分析表明:CEO具有海外背景的企业、民营企业、传统制造企业和东部地区企业在“一带一路”沿线国家投资对业绩下行风险的降低作用和对业绩上行潜力的提升作用更强。“一带一路”倡议的政策效应分析表明,倡议的实施有助于提升中国企业在“一带一路”沿线国家投资对业绩下行风险的降低作用。研究结果从实物期权理论视角为中国政府和企业推动“一带一路”建设高质量发展提供了新的理论与经验支持。

关键词:“一带一路”;实物期权理论;业绩下行风险;业绩上行潜力;跨国投资

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一、引言

2023年,共建“一带一路”倡议已经提出十年。十年来,中国对“一带一路”沿线国家(以下简称“沿线国家”)投资取得了显著的成绩。据中国商务部发布的统计数据,2022年,中国境内投资者对全球172个国家和地区非金融类直接投资1169亿美元,同比增长2.8%,其中,对“一带一路”沿线58个国家非金融类直接投资209.7亿美元,同比增长3.3%,占同期总额的17.9%,较上年提升1.7个百分点。可见,投资“沿线国家”正成为新时期中国企业融入全球经济的重要战略选择。在此背景下,深入认识中国企业在“沿线国家”的投资价值对中国政府和企业推动“一带一路”建设高质量发展具有重要的理论和现实意义。

现有关于中国企业在“沿线国家”投资价值的研究主要基于垄断优势理论、内部化理论、国际生产折衷理论以及国际技术溢出理论等,探讨对“沿线国家”投资如何影响企业盈利能力、生产率并为企业创造价值(诸竹君等,2016;王桂军等,2020),忽视了投资“沿线国家”构建的全球网络能够为企业在不

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确定环境下动态调整生产经营提供更多选择权这一特性并因此产生的实物期权价值。如 Kogut (1985) 指出,跨国投资构建的全球网络能够为企业动态调整生产经营提供更多选择权,降低外部不确定性的不利影响,从而增加企业价值。De Meza et al.(1987)以成本结构为跨国投资的不确定因素,构建了一个单期模型分析跨国投资实物期权,表明跨国投资为企业选择在成本更低的国家从事生产活动提供了更多决策选择权,能够为企业创造实物期权价值。Kogut et al.(1994)构建了一个多期模型分析汇率波动不确定条件下企业跨国投资的实物期权价值,表明跨国投资构建的全球网络赋予了管理者更多经营选择权,可增强各子公司间相互协作和资源再配置能力,从而使企业在不确定的国际市场环境中能够有效应对外部环境对企业产生的不利影响。可见,实物期权理论强调不确定环境下跨国投资构建的全球网络赋予企业更多经营选择权所产生的价值,可为认识不确定环境下中国企业在“沿线国家”的投资价值提供新的理论视角。

现有研究尚未从实物期权角度研究中国企业在“沿线国家”投资对企业价值的作用。随着“一带一路”倡议的深入推进和全球不确定性显著增加,如何推动“一带一路”建设高质量发展是业界和学界面临的一个重要现实问题。为此,本文基于实物期权理论,分析中国企业在“沿线国家”投资的实物期权价值实现机制。

根据实物期权理论,实物期权的核心功能是在不确定环境中赋予企业选择未来某种发展战略的权利而非义务,这一非对称决策权有助于增强企业应对外部不利环境和把握未来增长机会的能力,为企业带来非对称收益,即实物期权价值体现在降低业绩下行风险和提升业绩上行潜力 (McGrath,1997;周超等,2019;Ioulilianou et al.,2021;Song,2022)。鉴于此,本文构建业绩下行风险和上行潜力两个指标为被解释变量,以企业在“一带一路”沿线投资国家数和区域数两个指标为解释变量,在此基础上研究中国企业在“沿线国家”投资的实物期权价值,并分析 CEO 海外背景异质性、产权异质性、行业异质性、国内区域异质性以及“一带一路”倡议如何影响中国企业在“沿线国家”投资的实物期权价值。

本文可能的贡献或创新如下:第一,本文基于实物期权理论,强调中国企业在“沿线国家”投资构建的全球网络能够赋予企业在未来不确定性环境中更多经营选择权,有助于降低其业绩下行风险和提升其业绩上行潜力,可进一步拓展关于“沿线国家”投资价值研究的理论视角。第二,本文基于中国企业对“沿线国家”这一特定区域的投资探讨跨国投资的实物期权价值,能够为现有相关研究提供新的证据。第三,本文结合中国企业特征探讨 CEO 海外背景、产权性质、行业特征、国内区域差异等如何影响中国企业在“沿线国家”投资的实物期权价值,能够为进一步认识不同企业在“沿线国家”投资价值的形成机制提供新证据,并为推动“一带一路”建设高质量发展提供新的经验支持。第四,本文从实物期权理论视角探讨了“一带一路”倡议对中国企业在“沿线国家”投资价值的影响,可为认识“一带一路”倡议的政策效果提供新的证据。

二、文献综述

(一)关于中国企业在“沿线国家”投资价值的研究

关于中国企业在“沿线国家”投资价值的研究主要聚焦于两方面:一是直接探讨企业在“沿线国家”的投资价值。如诸竹君等(2016)发现中国企业在“沿线国家”投资可显著提升企业盈利能力;张吉鹏等(2020)发现地理、文化、制度以及经济距离均可影响中国企业在“沿线国家”的投资绩效;张宁宁等(2020)研究发现东道国制度、境外经贸合作区、母国特定优势均可显著影响中国企业在“沿线国家”的投资绩效。二是研究“一带一路”倡议对企业价值的政策效应。如王桂军等(2019)发现“一带一路”倡议能够显著提高中国企业创新水平;刘晓丹等(2020)发现“一带一路”倡议可通过降低企业过度投资提升中国企业投资效率,且企业所有制、资本密集度、东道国经济发展水平和企业投资类型均会影响这种作用;王桂军等(2020)发现“一带一路”倡议显著提高了中国企业投资非“一带一路”沿线发达国家的

“逆向溢出”效应;李建军等(2020)发现“一带一路”倡议通过降低信息不对称和改善财务状况提高了相关企业信贷融资规模。

(二)关于跨国投资实物期权价值的研究

现有研究对跨国投资的实物期权价值展开了一系列可供借鉴的实证研究。如 Allen et al.(1996)基于1991年美国海外投资公司的截面数据研究发现,境外投资东道国数越多,跨国公司的经营弹性越强,表明跨国投资具有显著的实物期权价值。但 Reuer et al.(2000)基于1984—1994年美国跨国公司海外投资面板数据却发现,企业投资于多个国家反而增加了业绩下行风险,换言之,跨国投资降低了企业的实物期权价值。为进一步揭示跨国投资实物期权价值的形成机制,一些学者试图从企业内外部环境差异分析跨国投资实物期权价值的异质性。如 Tong et al.(2007)利用1985—1996年美国企业跨国投资的面板数据发现,母国与东道国的文化距离削弱了跨国投资对业绩下行风险的降低作用。Belderbos et al.(2014)利用1985—2006年日本企业跨国投资面板数据发现,东道国较高的劳动成本可替代性,可显著降低跨国投资实物期权组合的有效性,从而削弱企业跨国投资对业绩下行风险的降低作用;Iouliaou et al.(2021)利用1996—2009年美国跨国制造公司数据研究发现,东道国市场需求不确定性越高,经理人的实物期权意识越强,越能对跨国投资的实物期权价值产生正面影响。Song(2022)基于1985—2014年韩国企业数据发现,从母国向东道国外派人员、聘请东道国专家以及跨文化培训项目可以增进文化理解,促进海外子公司间的有效协调,从而提高跨国投资对业绩下行风险的降低作用,增加跨国投资的实物期权价值。随着中国跨国投资迅猛增长,国内学者对中国企业跨国投资价值进行了大量经验研究,但从实物期权视角探讨跨国投资价值的研究较少。目前仅周超等(2019)从实物期权视角分析了跨国投资如何为产能过剩行业企业带来价值,他们的研究发现,跨国投资有助于产能过剩行业内相关企业降低业绩下行风险并提升业绩上行潜力,从而为企业带来实物期权价值。

由上可知,现有研究尚未从实物期权角度研究中国企业在“沿线国家”投资对企业价值的作用。随着“一带一路”倡议深入推进和全球不确定性显著增加,如何推动“一带一路”建设高质量发展是业界和学界面临的一个重要现实问题。根据实物期权理论,不确定环境下跨国投资的实物期权价值更加凸显。为此,本文根据“沿线国家”、中国和非“沿线国家”的经济环境异质性关系,分析中国企业在“沿线国家”投资的实物期权价值实现机制,从而为新形势下中国政府和企业实施符合中国国情和“沿线国家”现实情况的跨国投资战略提供有针对性的政策建议。

三、理论分析与研究假说

根据实物期权理论,中国企业在“沿线国家”投资价值形成机制如下:

第一,“沿线国家”与中国之间的经济环境异质性程度高、互补程度大,中国企业可利用国内和“沿线国家”两个市场实现生产经营优化,获得更多经营选择权,从而提高企业价值。“一带一路”沿线以经济发展水平相对较低的发展中国家为主,技术相对落后,劳动力等生产要素成本低,经济发展具有很强的后发优势,而中国经济进入新常态后,技术能力有了较大提升,以劳动力为代表的传统比较优势明显弱化,因此,“沿线国家”与中国在生产要素、市场需求、技术水平等方面具有良好的互补性(韩永辉等,2015;李敬等,2017),可为中国企业在国内和“沿线国家”之间优化经营活动提供广阔空间。换言之,通过在“沿线国家”投资,中国企业可利用“沿线国家”与中国之间的经济环境差异获得更多经营转换机会和增长机会,增强企业成本控制能力和市场需求可持续性,从而有效降低企业业绩下行风险并获得更大业绩增长潜力。

第二,“一带一路”沿线各个国家之间经济环境异质性程度高,中国企业可利用沿线各国间异质性的经济环境灵活调整生产经营活动,获得更多经营选择权,从而增加企业价值。“沿线国家”分布于东南亚、南亚、中亚、西亚、中东欧及北非等地区,在资源禀赋方面存在差异,同时在经济发展模式、发展水

平、发展活力和发展效率等多方面也呈现不同特征,具有多元化经济环境。换言之,“一带一路”沿线各国经济环境具有显著异质性特征。因此,在“沿线国家”投资构建的经营网络有助于中国企业利用“沿线国家”间经济环境异质性调整经营活动,增强企业成本控制能力和市场需求可持续性,从而降低外部环境不确定性的不利影响。

第三,通过在“沿线国家”投资,中国企业还可在“沿线国家”与非“沿线国家”(特别是欧美发达国家)之间优化调整生产经营活动,把握不同国家增长机会,实现价值提升。由于发展理念、社会文化、经济发展程度等多方面因素的影响,以欧美发达国家为代表的非“沿线国家”之间存在多种经济协调机制,如经济合作与发展组织、八国集团等,使得欧美发达国家之间在经济政策方面具有较高联动性,但其与发展中国家之间则缺乏类似协调机制。这意味着以欧美发达国家为代表的非“沿线国家”内部经济关联性强,而非“沿线国家”与以发展中国家为主的“沿线国家”之间经济关联弱、经济环境异质性程度高。因此,外部环境发生变化时,在“沿线国家”投资构建的全球网络可为中国企业在“沿线国家”与非“沿线国家”之间寻求转换机会和增长机会提供更多选择,增强企业成本控制能力和市场需求可持续性,从而为企业创造实物期权价值。

基于以上分析,本文认为,中国企业在“沿线国家”投资有助于构建更加完善的全球经营网络,在更广阔的区域进行资源配置,从而赋予中国企业一系列转换期权和增长期权,增强其经营弹性和未来增长机会,提高其成本控制能力,保证其市场需求可持续性,进而降低其业绩下行风险并提升业绩上行潜力。因此,本文提出:

基准假说:中国企业在“一带一路”沿线国家进行投资,将拥有更多的转换期权和增长期权,有助于增强其经营弹性并提供更多增长机会,提高其成本控制能力和市场需求可持续性,从而降低业绩下行风险并提升业绩上行潜力。

四、研究设计

(一) 模型构建

为验证上述假说,本文分别以业绩下行风险和上行潜力作为因变量,以企业在“沿线国家”的投资作为自变量,构建以下估计模型:

$$\text{Downside Risk}_{i,t}/\text{Upside Potential}_{i,t} = \alpha_0 + \alpha_1 \text{BRI}_{i,t} + \lambda X_{i,t} + \gamma I_{i,t} + \varepsilon_{i,t} \quad (1)$$

其中: i 为企业, t 为年份;被解释变量 $\text{Downside Risk}_{i,t}$ 为企业业绩下行风险, $\text{Upside Potential}_{i,t}$ 为企业业绩上行潜力;核心解释变量 $\text{BRI}_{i,t}$ 为企业在“沿线国家”投资的代理变量; $X_{i,t}$ 为控制变量,包括产权性质(STATE)、公司规模(SIZE)、资产负债率(LEV)、现金持有水平(CASH)、销售增长率(GROWTH)、托宾 Q 值(TOBIQ)、组织冗余(SLACK)、公司成立时间(AGE)等。此外, $I_{i,t}$ 为省份、行业和时间控制变量,本文根据公司注册地省份设置省份虚拟变量,根据公司所属行业类别设置行业虚拟变量,同时根据样本包含的数据年度设置时间虚拟变量。 $\varepsilon_{i,t}$ 为随机扰动项。若基准假说成立,因变量为 Downside Risk 时,模型(1)中 BRI 的系数估计值显著为负;因变量为 Upside Potential 时,模型(1)中 BRI 的系数估计值显著为正。

(二) 变量定义

1. 业绩下行风险(Downside Risk)

本文参考已有研究(Tong et al.,2007;Belderbos et al.,2014),以企业当年总资产收益率低于其目标总资产收益率的五年移动平均值估计业绩下行风险(Downside Risk),具体如下:

$$\xi_{i,t} = \begin{cases} \text{IROA}_{i,t-1} - \text{ROA}_{i,t} & \text{若 } \text{IROA}_{i,t-1} > \text{ROA}_{i,t} \\ 0 & \text{若 } \text{IROA}_{i,t-1} \leq \text{ROA}_{i,t} \end{cases} \quad (2)$$

$$\text{Downside Risk}_{i,t} = \sqrt{\frac{1}{5} \sum_{t=0}^{-4} \xi_{i,t}^2} \quad (3)$$

其中:ROA_{i,t}为企业的总资产收益率,IROA_{i,t-1}为 t-1 年度企业所在行业内所有企业总资产收益率的均值。

2. 业绩上行潜力(Upside Potential)

本文参考现有方法(Andersen,2012;Iouliauou et al.,2021),以企业当年总资产收益率高于其目标总资产收益率的五年移动平均值估计业绩上行潜力(Upside Potential),具体如下:

$$\phi_{i,t} = \begin{cases} 0 & \text{若 } IROA_{i,t-1} > ROA_{i,t} \\ ROA_{i,t} - IROA_{i,t-1} & \text{若 } IROA_{i,t-1} \leq ROA_{i,t} \end{cases} \tag{4}$$

$$Upside\ Potential_{i,t} = \sqrt{\frac{1}{5} \sum_{t=0}^{-4} \phi_{i,t}^2} \tag{5}$$

其中:ROA_{i,t}和 IROA_{i,t-1}的定义与前文一致。

3. 企业在“沿线国家”投资(BRI)

参考现有文献(Driouchi et al.,2011;Belderbos et al.,2014),本文构建两个变量捕捉企业在“一带一路”沿线投资的实物期权特性。一是企业在“一带一路”沿线投资涉及的东道国数量(BRI(CNT));二是企业在“一带一路”沿线投资涉及的区域数(BRI(RGN))。参考赵书博等(2019),将“一带一路”沿线 64 个国家分为 6 个区域,分别是:中亚、东南亚、独联体、南亚、西亚北非、中东欧。受业绩下行风险和业绩上行潜力计算方法的影响,BRI(CNT) 和 BRI(RGN) 的值均为五年移动均值,通过五年移动数据计算得到。

4. 控制变量

本文控制了可能影响企业实物期权价值的其他因素,具体见表 1。此外,为控制省份固定效应、行业固定效应和年度固定效应,本文根据上市公司注册省份设置 31 个省份虚拟变量,根据上市公司行业分类指引中的二级行业分类设置 28 个行业虚拟变量,同时考虑样本包含 17 个混合截面数据,设置 16 个时间虚拟变量。

表 1 控制变量说明

变量名称	变量符号	变量定义
产权性质	STATE	以虚拟变量 STATE 作为公司产权性质的代理变量,若政府机构为上市公司实际控制人,STATE 取值为 1,否则为 0
公司规模	SIZE	公司期末总资产的自然对数
负债水平	LEV	期末负债/期末总资产
现金持有水平	CASH	现金及现金等价物/(总资产-现金-现金等价物)
销售收入增长率	GROWTH	销售收入年度增长率
托宾 Q 值	TOBINC	公司市场价值/资产总额
组织冗余	SLACK	应收账款、存货、销售费用、管理费用之和/销售收入
成立时间	AGE	企业成立年数的自然对数

注:由于业绩下行风险和业绩上行潜力通过五年移动数据计算得到,为保持一致,上述变量的值均为五年移动均值。

(三) 数据来源与描述性分析

本文以中国沪深两市 A 股制造业上市公司构建研究样本,研究中所使用上市公司在“沿线国家”投资的详细数据以及公司各项财务和治理数据等原始数据均来自国泰安数据库。本研究的样本时间跨度为 2000—2021 年。在数据处理过程中,本文剔除了在“沿线国家”的非经营性投资,如投资目的为进行投资管理或者获取矿产资源。由于本文使用到公司业绩的行业均值,为了减少因企业所在行业公司数较少带来的误差,使行业均值具有代表性,本文参考 Miller et al.(1996)处理样本的方法,在样本中仅包含制造业二级行业每年公司数量不少于 10 家公司的行业。2000 年的数据仅用于计算业绩下行风险和上行潜力时,获得 2001 年企业目标业绩,由于本文使用的变量均为五年滚动平均值,因此,本文在实证回归中的数据为 17 年面板数据。

表2 提供了主要变量的描述性统计结果。由表中结果可知:BRI(CNT) 和 BRI(RGN) 的均值分别为 0. 3771 和 0. 3127,表明中国企业在“沿线国家”投资较少。各主要变量的皮尔森相关性分析表明^①:BRI (CNT) 和 BRI(RGN) 与 Downside Risk 的相关系数分别为 - 0. 0746 和 - 0. 0762,且均在 1% 水平上显著,BRI(CNT) 与 Upside Potential 的相关系数为 0. 0531,且在 1% 水平上显著,表明中国企业在“一带一路”沿线投资对业绩下行风险具有显著降低作用并对业绩上行潜力具有显著提升作用。因此,基准假说得到初步验证。此外,模型中主要变量间的相关系数均在合理范围。

表 2 主要变量的描述性统计结果

变量符号	观测值	均值	标准差	最小值	最大值
Downside Risk	10268	0. 0325	0. 0452	0. 0000	0. 4122
Upside Potential	10268	0. 0261	0. 0290	0. 0000	0. 1693
BRI(CNT)	10268	0. 3771	0. 9805	0. 0000	20. 0000
BRI(RGN)	10268	0. 3127	0. 6948	0. 0000	6. 0000
STATE	10268	0. 4091	0. 4917	0. 0000	1. 0000
SIZE	10268	22. 0692	1. 1681	17. 3924	27. 3737
LEV	10268	0. 4618	0. 1856	0. 0565	0. 9989
CASH	10268	0. 1681	0. 0936	0. 0086	0. 6658
GROWTH	10268	0. 2256	0. 4734	- 0. 7384	7. 5395
TOBINQ	10268	2. 0377	1. 0149	0. 8921	8. 5787
SLACK	10268	0. 7029	0. 4844	0. 0999	7. 0905
AGE	10268	2. 7089	0. 3614	1. 3159	3. 9509

注:本文对上述连续型变量值的最大和最小 1% 进行了缩尾处理。

五、实证结果

(一) 基准回归

考虑到被解释变量为大于等于零的受限变量,本文参考已有研究使用 Tobit 模型进行估计(Driouchi et al., 2011;Belderbos et al.,2014)。表 3 提供了对基准模型(1)的 Tobit 估计结果。

列(1)、(2)的结果显示:变量 BRI(CNT) 和 BRI(RGN) 的系数估计值均在 1% 水平上显著为负,表明中国制造业上市公司在“沿线国家”投资可显著降低业绩下行风险,且公司在“一带一路”沿线新增一投资东道国,业绩下行风险就下降约 0. 21%,在“一带一路”沿线新增一投资区域,业绩下行风险就下降约 0. 31%。此外,变量 STATE、LEV、SLACK 和 AGE 的系数估计值均在 1% 水平上显著为正,表明国有控股、较高负债率、组织冗余程度较高、成立时间较长的企业应对不利环境和把握增长机会的能力较低,具有较高业绩下行风险;变量 SIZE、CASH 和 TOBINQ 的系数估计值均在 1% 水平上显著为负,表明具有更大规模、更高流动性和更多投资机会的企业应对不利环境和把握增长机会的能力更强,具有更低业绩下行风险。

列(3)、(4)的结果显示:变量 BRI(CNT) 和 BRI(RGN) 的系数估计值均在 1% 水平上显著为正,表明中国制造业上市公司在“沿线国家”投资可显著提高业绩上行潜力,且公司在“一带一路”沿线新增一投资东道国,业绩上行潜力就提高约 0. 18%,在“一带一路”沿线新增一投资区域,业绩上行潜力就提高约 0. 21%。此外,变量 STATE、LEV 和 SLACK 的系数估计值均在 1% 水平上显著为负,进一步表明国有控股、较高负债率和组织冗余程度较高的企业应对不利环境和把握增长机会的能力较低,具有较低业绩上行潜力;变量 SIZE、CASH、GROWTH 和 TOBINQ 的系数估计值均在 1% 水平上显著为正,表明具有更大规模、更高流动性、更高成长性和更多投资机会的企业应对不利环境和把握增长机会的能力较高,具有更高业绩上行潜力。

^① 篇幅所限,未列示,留存备索。

表3 基准回归结果

	Downside Risk		Upside Potential	
	(1)	(2)	(3)	(4)
BRI(CNT)	-0.0021*** (0.0007)		0.0018*** (0.0005)	
BRI(RGN)		-0.0031*** (0.0010)		0.0021*** (0.0008)
STATE	0.0056*** (0.0015)	0.0056*** (0.0015)	-0.0097*** (0.0012)	-0.0097*** (0.0012)
SIZE	-0.0181*** (0.0014)	-0.0181*** (0.0014)	0.0111*** (0.0012)	0.0112*** (0.0012)
LEV	0.1323*** (0.0066)	0.1324*** (0.0066)	-0.0667*** (0.0050)	-0.0668*** (0.0050)
CASH	-0.0397*** (0.0126)	-0.0396*** (0.0125)	0.0300*** (0.0085)	0.0300*** (0.0085)
GROWTH	-0.0002 (0.0017)	-0.0002 (0.0017)	0.0032** (0.0013)	0.0032** (0.0013)
TOBINQ	-0.0051*** (0.0012)	-0.0051*** (0.0013)	0.0158*** (0.0014)	0.0158*** (0.0013)
SLACK	0.0281*** (0.0033)	0.0281*** (0.0033)	-0.0116*** (0.0016)	-0.0116*** (0.0016)
AGE	0.0043** (0.0020)	0.0044** (0.0020)	0.0009 (0.0019)	0.0008 (0.0018)
省份固定效应	控制	控制	控制	控制
行业固定效应	控制	控制	控制	控制
时间固定效应	控制	控制	控制	控制
常数项	0.3493*** (0.0320)	0.3487*** (0.0329)	-0.2184*** (0.0257)	-0.2207*** (0.0256)
N	10268	10268	10268	10268

注:括号内数值为聚类稳健标准误;***、**和*分别表示双尾t检验在1%、5%和10%水平上显著。

上述结果表明,中国企业在“沿线国家”投资有助于公司构建更完善的全球经营网络,以此提供更多转换期权和增长期权,赋予其更强经营弹性和更多未来增长机会,从而降低业绩下行风险并提高业绩上行潜力。因此,上述结果无法拒绝基准假说。

(二) 稳健性检验

1. 倾向得分匹配方法

企业在“沿线国家”投资可能并非随机发生,而是与企业自身特质有关。为了更大程度地降低投资“沿线国家”的企业组(处理组)与未投资“沿线国家”的企业组(控制组)之间存在的特征差异,同时降低两组样本观测值相差悬殊(投资“沿线国家”的企业组观测值占比仅21.61%)可能对研究结果产生的影响,本文以首次投资“沿线国家”的企业为处理组,以未曾投资“沿线国家”的企业为控制组,以模型(1)的控制变量作为协变量进行倾向得分匹配,以最邻近匹配法为处理组配对特征相近的控制组。为保证倾向得分匹配的稳健性,本文提供了匹配比例为1:1和1:2的实证结果。

图1分别显示了匹配比例为1:1和1:2时处理组与控制组配对前后的倾向得分密度,可以看到,配对后处理组和控制组的倾向得分密度曲线几乎重合,表明配对后两组间的密度曲线无显著差异,满足共同支撑假设。本文比较配对前后协变量在控制组与处理组之间的均值差异发现^①,无论匹配比例为1:1还是1:2,各协变量的组间均值差异在配对后均统计上不显著。换言之,各变量均通过了平衡性检验。

① 篇幅所限,未列示,留存备索。

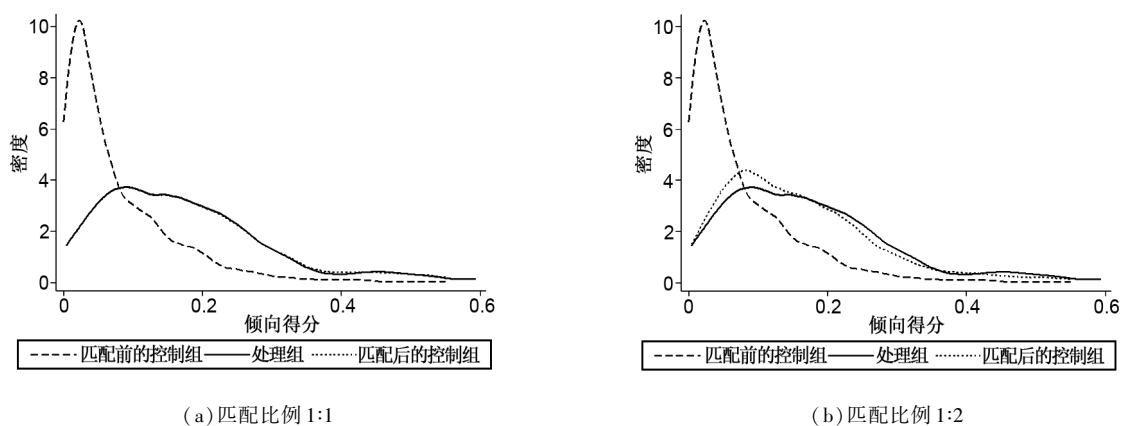


图1 处理组和控制组的倾向得分密度

基于配对后的样本,本文对模型(1)重新进行回归,表4分别提供了匹配比例为1:1和1:2的回归结果。表中结果显示,被解释变量为Downside Risk时,变量BRI(CNT)和BRI(RGN)的系数估计值均为负,且在5%水平上显著,而被解释变量为Upside Potential时,变量BRI(CNT)和BRI(RGN)的系数估计值均为正,且也在5%水平上显著,表明在使用倾向得分匹配方法控制内生性和解决处理组和控制组两组样本观测值比例相差悬殊的问题后,中国企业在“沿线国家”投资能够显著降低企业业绩下行风险并提高业绩上行潜力的结论依然成立。

表4 PSM方法回归结果

	匹配比例 1:1				匹配比例 1:2			
	Downside Risk		Upside Potential		Downside Risk		Upside Potential	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BRI(CNT)	-0.0060** (0.0025)		0.0038*** (0.0007)		-0.0058** (0.0028)		0.0037*** (0.0009)	
BRI(RGN)		-0.0072* (0.0038)		0.0041* (0.0021)		-0.0068* (0.0040)		0.0041* (0.0023)
控制变量	控制	控制	控制	控制	控制	控制	控制	控制
常数项	0.0330*** (0.0018)	0.0330*** (0.0017)	0.0179*** (0.0022)	0.0155*** (0.0009)	0.0331*** (0.0008)	0.0330*** (0.0009)	0.0145*** (0.0005)	0.0152*** (0.0005)
N	268	268	268	268	350	350	350	350

注:括号内的数值为聚类稳健标准误;***、**和*分别表示双尾t检验在1%、5%和10%水平上显著;回归时加入了控制变量,且控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

2. 两阶段最小二乘法

为减轻反向因果关系导致的内生性问题可能对研究结果的影响,本文参考现有文献,进一步采用两阶段最小二乘法进行稳健性分析(Zhou, 2023)。具体如下:本文采用企业所在行业平均对“沿线国家”投资国家数(IND_BRI(CNT))和平均对“沿线国家”投资地区数(IND_BRI(RGN))分别作为企业在“沿线国家”投资国家数(BRI(CNT))和企业在“沿线国家”投资地区数(BRI(RGN))的工具变量。这是因为同一行业对“沿线国家”投资越多,意味着“一带一路”沿线市场对该行业产品的需求就越大(Attig et al., 2016)。这对同行业内的企业在“沿线国家”进行投资将起到强烈的激励作用(Zhou, 2023)。在第一阶段,本文将BRI(CNT)(或BRI(RGN))对IND_BRI(CNT)(或IND_BRI(RGN))进行回归。在第二阶段,将BRI(CNT)(或BRI(RGN))的实际值替换为从第一阶段派生的预测值BRI(CNT)_IV(或BRI(RGN)_IV),并再次对基本模型进行回归。

表5提供了运用两阶段最小二乘法控制反向因果关系后的回归结果。表中结果显示,控制反向因果关系后得到的回归结果仍然支持前文研究结论。

表 5 两阶段最小二乘法回归结果

	第一阶段		第二阶段			
	BRI(CNT)	BRI(RGN)	Downside Risk		Upside Potential	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
BRI(CNT)_IV			-0.0081* (0.0047)		0.0056** (0.0026)	
BRI(RGN)_IV				-0.0107* (0.0061)		0.0122*** (0.0034)
IND_BRI(CNT)	1.1612*** (0.0993)					
IND_BRI(RGN)		1.1432*** (0.0800)				
控制变量	控制	控制	控制	控制	控制	控制
常数项	-6.9577*** (0.3385)	-4.8703*** (0.1991)	0.3095*** (0.0340)	0.3142*** (0.0318)	-0.1940*** (0.0188)	-0.1748*** (0.0174)
N	10268	10268	10268	10268	10268	10268

注:括号内的数值为聚类稳健标准误;*** **和* 分别表示双尾t 检验在1%、5%和10%水平上显著;回归时加入了控制变量,且控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

3. 替换被解释变量

本文使用两种方法替换因变量。第一种方法是用净资产收益率(ROE)替代 ROA 计算业绩下行风险和上行潜力(Tong et al.,2007),重新进行回归。第二种方法是以营业利润除以总资产衡量公司业绩重新计算业绩下行风险和上行潜力。ROA 的计算过程中包含了非经常性损益(如政府补贴、投资收益等),但非经常性损益并非是企业经营活动产生的业绩,企业可能通过非经常性损益影响其业绩水平,进而影响业绩下行风险和业绩上行潜力,从而对本文的研究产生影响。为剔除非经常性损益可能对研究结果产生的影响,本文采用营业利润除以总资产衡量公司业绩,然后重新计算业绩下行风险和业绩上行潜力指标,并替换模型(1)的被解释变量,重新进行回归。

表6 结果显示,运用两种方法替换被解释变量后,得到的回归结果仍然支持前文研究结论。

表 6 替换因变量后的回归结果

	ROE 替代 ROA 构建因变量				营业利润除以总资产替代 ROA 构建因变量			
	Downside Risk		Upside Potential		Downside Risk		Upside Potential	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BRI(CNT)	-0.0052*** (0.0020)		0.0026** (0.0010)		-0.0020** (0.0008)		0.0014** (0.0006)	
BRI(RGN)		-0.0074** (0.0032)		0.0032** (0.0015)		-0.0027*** (0.0010)		0.0015* (0.0009)
控制变量	控制	控制	控制	控制	控制	控制	控制	控制
常数项	0.9808*** (0.0820)	0.9801*** (0.0847)	-0.4331*** (0.0421)	-0.4354*** (0.0406)	0.3871*** (0.0388)	0.3876*** (0.0397)	-0.2831*** (0.0342)	-0.2856*** (0.0338)
N	10094	10094	10094	10094	10268	10268	10268	10268

注:括号内的数值为聚类稳健标准误;*** **和* 分别表示双尾t 检验在1%、5%和10%水平上显著;回归时加入了控制变量,且控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

(三) 机制分析

在“沿线国家”投资赋予中国企业的实物期权可能通过两种渠道降低业绩下行风险和提升业绩上行潜力。一是成本控制渠道,即企业可利用不同国家的生产要素差异增强成本控制能力,从而降低业绩下行风险和提升业绩上行潜力。为检验成本控制渠道,本文以企业当年营业成本率高于其所在行业上一年平均营业成本率的五年移动平均值衡量企业成本控制能力(COSTCONTROL),具体计算方式与业绩上行潜力相似。COSTCONTROL 反映了企业营业成本率高于其目标营业成本率的程度,其值越小,表明企业成本控制能力越强。本文将 COSTCONTROL 作为被解释变量代入模型(1)中实证检验成本控制渠道。二是市场需求可持续性渠道,即企业可利用不同国家的需求差异提高市场需求的可持续性,

从而降低业绩下行风险和提升业绩上行潜力。本文以企业当年销售收入增长率低于其所在行业上一年平均销售收入增长率的五年移动平均值测度企业市场需求的可持续性(MARKETSUS),具体计算方式与业绩上行潜力相似。MARKETSUS反映了企业销售收入增长率低于目标销售增长率的程度,其值越大,表明企业市场需求可持续性越弱。本文将 MARKETSUS 作为被解释变量代入模型(1)中实证检验市场需求可持续性。

表 7 提供的实证结果显示:被解释变量为 COSTCONTROL 时,BRI(CNT)和 BRI(RGN)的系数估计值均为负,且均在 1% 水平上显著,表明中国企业在“沿线国家”投资能够显著降低企业营业成本率高于其目标营业成本率的程度,提升企业成本控制能力,即验证了成本控制渠道。被解释变量为 MARKETSUS 时,BRI(CNT)和 BRI(RGN)的系数估计值均为负,且均在 1% 水平上显著,表明中国企业在“沿线国家”投资能够显著降低企业销售收入增长率低于目标销售增长率的程度,提升企业产品市场需求的可持续性,即验证了市场需求可持续性渠道。

表 7 机制分析回归结果

	成本控制渠道		市场需求可持续性渠道	
	COSTCONTROL		MARKETSUS	
	(1)	(2)	(3)	(4)
BRI(CNT)	-0.0029*** (0.0008)		-0.0079*** (0.0017)	
BRI(RGN)		-0.0033*** (0.0012)		-0.0101*** (0.0024)
控制变量	控制	控制	控制	控制
常数项	0.4369*** (0.0235)	0.4410*** (0.0236)	0.2507*** (0.0473)	0.2569*** (0.0472)
N	10268	10268	10268	10268

注:括号内的数值为聚类稳健标准误;***、**和* 分别表示双尾 t 检验在 1%、5% 和 10% 水平上显著;回归时加入了控制变量,并控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

六、异质性分析

(一)CEO 海外背景差异

根据实物期权理论,跨国投资的实物期权价值依赖于决策者的主动管理行为(Kogut et al.,1994)。作为经营决策的主要制定者,CEO 对企业生产经营各项决策具有不可忽视的影响。为此,本文进一步探讨 CEO 海外背景异质性如何影响中国企业在“沿线国家”投资的实物期权价值。现有文献认为,具有海外背景的管理者通常拥有更广阔的海外关系网络(Reuber et al.,1997)和更完善的国际市场知识结构(Tzeng,2018),能够从多个渠道快速获取国际市场信息以及客观和准确地评估国际市场趋势,有助于企业做出及时有效的战略决策(周泽将 等,2017)。鉴于此,本文认为,CEO 拥有海外背景,将有助于企业快速、准确地利用国际市场相关信息评估“一带一路”沿线经济、文化和制度的风险与机会,采取积极有效的措施优化“沿线国家”资源配置,从而降低业绩下行风险并提升业绩上行潜力。

本文构建以下模型检验 CEO 海外背景如何影响中国企业在“沿线国家”投资的实物期权价值:

$$\text{Downside Risk}_{i,t}/\text{Upside Potential}_{i,t} = \beta_0 + \beta_1 \text{BRI}_{i,t} + \beta_2 \text{BRI}_{i,t} \times \text{FR}_{i,t} + \beta_3 \text{FR}_{i,t} + \lambda X_{i,t} + \gamma I_{i,t} + \varepsilon_{i,t} \tag{6}$$

其中:FR 是 CEO 是否具有海外背景的虚拟变量。现存文献通常将海外背景定义为具有在境外国家或地区学习或工作的经历(Lee et al.,2008),本文遵循这一定义,若公司 CEO 具有海外背景,FR 取值为 1,否则为 0。

表 8 列(1)~(4)显示,被解释变量为 Downside Risk 时,BRI(CNT)×FR 和 BRI(RGN)×FR 的系数估计值均在 1% 水平上显著为负;被解释变量为 Upside Potential 时,BRI(CNT)×FR 和 BRI(RGN)×FR 的系数估计值均在 5% 水平上显著为正。上述结果表明,CEO 具有海外背景可显著增强中国企业在“沿线国家”投资对企业业绩下行风险的降低作用和对业绩上行潜力的提升作用。

表8 CEO海外背景差异与产权差异的异质性检验回归结果

	CEO海外背景差异				产权差异			
	Downside Risk		Upside Potential		Downside Risk		Upside Potential	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BRI(CNT)	-0.0014*** (0.0005)		0.0015*** (0.0004)		-0.0040*** (0.0007)		0.0024*** (0.0004)	
BRI(CNT) × FR	-0.0065*** (0.0016)		0.0032*** (0.0010)					
BRI(RGN)		-0.0022*** (0.0007)		0.0017*** (0.0005)		-0.0054*** (0.0009)		0.0026*** (0.0006)
BRI(RGN) × FR		-0.0082*** (0.0022)		0.0036** (0.0014)				
FR	0.0082*** (0.0024)	0.0084*** (0.0025)	-0.0018 (0.0013)	-0.0015 (0.0014)				
BRI(CNT) × STATE					0.0041*** (0.0009)		-0.0012** (0.0006)	
BRI(RGN) × STATE						0.0054*** (0.0012)		-0.0016* (0.0009)
STATE					0.0042*** (0.0011)	0.0041*** (0.0011)	-0.0093*** (0.0007)	-0.0094*** (0.0007)
控制变量	控制	控制	控制	控制	控制	控制	控制	控制
常数项	0.3506*** (0.0151)	0.3502*** (0.0150)	-0.2190*** (0.0086)	-0.2215*** (0.0086)	0.3530*** (0.0151)	0.3532*** (0.0151)	-0.2196*** (0.0086)	-0.2216*** (0.0086)
N	10268	10268	10268	10268	10268	10268	10268	10268

注:括号内的数值为聚类稳健标准误;***、**和*分别表示双尾t检验在1%、5%和10%水平上显著;回归时加入了控制变量,控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

(二) 产权差异

不同产权性质的企业通常具有不同经营目标。民营企业通常以实现自身经济利益最大化为其唯一经营目标,而国有企业因其国有属性,在经营中通常具有多重目标(Cuervo – Cazurra et al., 2014)。因此,民营企业将更加注重市场导向,从而实现更高实物期权价值。

为验证民营企业和国有企业在“沿线国家”投资的实物期权价值差异,本文构建以下模型:

$$\text{Downside Risk}_{i,t}/\text{Upside Potential}_{i,t} = \beta_0 + \beta_1 \text{BRI}_{i,t} + \beta_2 \text{BRI}_{i,t} \times \text{STATE}_{i,t} + \beta_3 \text{STATE}_{i,t} + \lambda X_{i,t} + \gamma I_{i,t} + \varepsilon_{i,t} \quad (7)$$

如表8所示,当被解释变量为Downside Risk时,列(5)、(6)中变量BRI(CNT) × STATE和BRI(RGN) × STATE系数估计值均显著为正;当被解释变量为Upside Potential时,列(7)、(8)中变量BRI(CNT) × STATE和BRI(RGN) × STATE系数估计值均显著为负。上述结果表明,相较于国有企业,民营企业在“沿线国家”投资对业绩下行风险的降低作用和对业绩上行潜力的提升作用均更强。

(三) 行业差异

与其他行业的企业相比,传统制造行业的企业在“沿线国家”投资将具有更高的实物期权价值。具体原因如下:首先,传统制造行业多为劳动密集型行业,凭借较低的劳动成本在全球市场展开竞争。“一带一路”沿线以经济发展相对落后的发展中国家为主,劳动成本较低,中国传统制造企业在“沿线国家”投资可充分利用这些国家劳动成本优势,在国内和“沿线国家”间优化资源配置,增强经营弹性,提高国际市场竞争力,降低业绩下行风险。其次,“沿线国家”正处于工业化初期或中期,亟待通过基础设施建设改善国内经济环境。在此过程中,钢铁、水泥、玻璃等传统制造业产品具有旺盛的市场需求,因此,相关行业内企业的产品能够很好地契合“沿线国家”发展需求。此外,中国传统制造企业在技术、产能等方面具有深厚的积淀,相对于“沿线国家”具有一定的比较优势,在“沿线国家”投资,能够深化产能合作,获得更多的增长机会,从而提高其业绩上行潜力。

为检验传统制造企业与其他类型企业在“沿线国家”投资的实物期权价值差异,本文构建如下模型:

$$\text{Downside Risk}_{i,t}/\text{Upside Potential}_{i,t} = \beta_0 + \beta_1 \text{BRI}_{i,t} + \beta_2 \text{BRI}_{i,t} \times \text{LTH}_{i,t} + \beta_3 \text{LTH}_{i,t} + \lambda X_{i,t} + \gamma I_{i,t} + \varepsilon_{i,t} \quad (8)$$

其中:LTH 为企业所在行业是否属于传统制造行业的虚拟变量。本文参考 Czarnitzki et al.(2002) 的分类方法,对照上市公司行业分类指引,将制造业划分为传统制造行业和非传统制造行业。若上市公司属于传统制造行业,LTH 取值为 1,否则为 0。

表 9 的回归结果显示:被解释变量为 Downside Risk 时,列(1)、(2)中变量 BRI(CNT) × LTH 和 BRI(RGN) × LTH 的系数估计值均显著为负;被解释变量为 Upside Potential 时,列(3)、(4)中变量 BRI(CNT) × LTH 和 BRI(RGN) × LTH 系数估计值均显著为正。上述结果表明,相较于非传统制造企业,传统制造企业在“沿线国家”投资对业绩下行风险的降低作用和对业绩上行潜力的提升作用均更强。

表 9 行业差异与国内区域环境差异的异质性检验回归结果

	行业差异				国内区域环境差异			
	Downside Risk		Upside Potential		Downside Risk		Upside Potential	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BRI(CNT)	-0.0011** (0.0006)		0.0013*** (0.0004)		-0.0008 (0.0008)		-0.0007 (0.0006)	
BRI(CNT) × LTH	-0.0039*** (0.0010)		0.0020*** (0.0007)					
BRI(RGN)		-0.0017** (0.0008)		0.0015*** (0.0005)		-0.0014 (0.0011)		-0.0018*** (0.0007)
BRI(RGN) × LTH		-0.0048*** (0.0014)		0.0021** (0.0009)				
LTH	-0.0126** (0.0056)	-0.0127** (0.0056)	0.0186*** (0.0035)	0.0186*** (0.0035)				
BRI(CNT) × EAST					-0.0017* (0.0010)		0.0032*** (0.0007)	
BRI(RGN) × EAST						-0.0023* (0.0013)		0.0053*** (0.0008)
EAST					0.0012 (0.0010)	0.0013 (0.0011)	-0.0010 (0.0007)	-0.0014** (0.0007)
控制变量	控制	控制	控制	控制	控制	控制	控制	控制
常数项	0.3620*** (0.0149)	0.3626*** (0.0149)	-0.2363*** (0.0086)	-0.2395*** (0.0086)	0.3494*** (0.0151)	0.3486*** (0.0151)	-0.2198*** (0.0086)	-0.2211*** (0.0086)
N	10268	10268	10268	10268	10268	10268	10268	10268

注:括号内的数值为聚类稳健标准误;***、**和* 分别表示双尾 t 检验在 1%、5% 和 10% 水平上显著;回归时加入了控制变量,控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

(四) 国内区域环境差异

企业在复杂多变的国际市场中开展经营活动离不开外部资金的支持(Yan et al.,2018)。金融发展可拓展企业外部融资渠道,提高其外部资金可获得性(施炳展 等,2011)。因此,跨国公司所在的国内区域金融发展程度越高,将越有利于其海外子公司利用国内金融市场替代国际不确定的融资环境,形成资金优势,从而增强公司利用全球经营网络的能力,提高跨国经营对业绩下行风险的降低作用。改革开放以来,中国金融发展程度得到了显著的提升,但由于中国不同地区在历史传统、资源禀赋、政策制定、制度变革、经济发展等多方面存在差异,不同区域的金融发展程度仍存在显著差异。相较于中西部地区,东部地区金融基础设施更加完善、金融发展程度更高(李佳 等,2022)。因此,考虑国内区域异质性,能够更好地认识外部金融环境如何影响中国企业在“沿线国家”投资的实物期权价值。

为此,本文构建以下模型检验国内区域异质性如何影响中国企业在“沿线国家”投资的实物期权价值:

$$\text{Downside Risk}_{i,t}/\text{Upside Potential}_{i,t} = \beta_0 + \beta_1 \text{BRI}_{i,t} + \beta_2 \text{BRI}_{i,t} \times \text{EAST}_{i,t} + \beta_3 \text{EAST}_{i,t} + \lambda X_{i,t} + \gamma I_{i,t} + \varepsilon_{i,t} \quad (9)$$

其中,EAST 为虚拟变量。若上市公司注册地位于东部区域,则 EAST 取值为 1,否则取值为 0。本文将北京、天津、上海、河北、江苏、浙江、福建、山东、广东、海南等地视为东部区域,而将其他区域视为中西部区域。

表 9 的回归结果显示:被解释变量为 Downside Risk 时,列(5)、(6)中变量 BRI(CNT) × EAST 和

BRI(RGN) × EAST 的系数估计值均为负,且在 10% 水平上显著;被解释变量为 Upside Potential 时,列(7)、(8)中变量 BRI(CNT) × EAST 和 BRI(RGN) × EAST 系数估计值均为正,且在 1% 水平上显著。上述结果表明,相较于中西部区域企业,东部区域企业在“沿线国家”投资对业绩下行风险的降低作用和对业绩上行潜力的提升作用均更强。

七、“一带一路”倡议的政策效应

本文之前部分抛开“一带一路”倡议的提出与否,直接探讨中国企业在“沿线国家”投资是否具有实物期权特性,本部分进一步考虑“一带一路”倡议提出后是否增强了该实物期权性质。

“一带一路”倡议提出以来,中国和“一带一路”沿线各国致力于通过加强交通、能源和网络等基础设施建设,实现贸易、投资等多维度的互联互通。现有研究表明,“一带一路”倡议提出后,中国与“一带一路”沿线各国之间的互联互通建设已取得显著成效(吕越等,2019)。张宇(2020)发现,“一带一路”倡议实施过程中的“互联互通”能够显著缓解发展中国家基础设施不足,从而降低中国企业的国际化经营壁垒。因此,“一带一路”倡议的实施可有效提升中国与“一带一路”沿线各国之间的贸易与投资便利化,促进各种生产要素在中国与“一带一路”沿线各国之间实现有序、高效、自由的流动,降低跨国经营活动的优化调整成本。Kogut et al.(1994)指出,在不同国家之间调整经营活动的成本将对跨国公司的契约承诺、合同柔性以及跨国网络内各子公司之间的协调性产生约束,从而降低跨国投资的实物期权价值。因此,本文认为,“一带一路”倡议的实施可增强跨国公司在“沿线国家”与中国之间和在“一带一路”沿线各国之间的经营优化能力,提高跨国公司全球资源配置效率,提高中国企业在“沿线国家”投资的实物期权价值。

为检验“一带一路”倡议的政策效应,本文构建如下实证模型:

$$\begin{aligned} \text{Downside Risk}_{i,t}/\text{Upside Potential}_{i,t} = & \beta_0 + \beta_1 \text{BRI}_{i,t} + \beta_2 \text{BRI}_{i,t} \times \text{DUM2013}_{i,t} + \\ & \beta_3 \text{DUM2013}_{i,t} + \lambda X_{i,t} + \gamma I_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{10}$$

其中,DUM2013 为虚拟变量。若样本对应的时间处于“一带一路”倡议提出之后,即 2013 年之后,则 DUM2013 取值为 1,否则取值为 0。

表 10 的回归结果显示:被解释变量为 Downside Risk 时,列(1)、(2)中变量 BRI(CNT) × DUM2013 和 BRI(RGN) × DUM2013 的系数估计值均显著为负,因此,“一带一路”倡议提出之后,在“沿线国家”投资显著降低了中国企业业绩下行风险。

表 10 “一带一路”倡议的政策效应回归结果

	Downside Risk		Upside Potential	
	(1)	(2)	(3)	(4)
BRI(CNT)	-0.0005 (0.0008)		0.0019*** (0.0005)	
BRI(CNT) × DUM2013	-0.0023** (0.0009)		-0.0001 (0.0006)	
BRI(RGN)		-0.0009 (0.0010)		0.0025*** (0.0007)
BRI(RGN) × DUM2013		-0.0035*** (0.0013)		-0.0006 (0.0009)
DUM2013	0.0168*** (0.0022)	0.0172*** (0.0022)	0.0081*** (0.0013)	0.0084*** (0.0013)
控制变量	控制	控制	控制	控制
常数项	0.3349*** (0.0148)	0.3341*** (0.0147)	-0.2264*** (0.0085)	-0.2286*** (0.0085)
N	10268	10268	10268	10268

注:括号内的数值为聚类稳健标准误;***、**和*分别表示双尾 t 检验在 1%、5% 和 10% 水平上显著;回归时加入了控制变量,且控制了省份固定效应、行业固定效应和年度固定效应,为节约篇幅,表中未列示相关结果。

八、结论与建议

自“一带一路”倡议提出以来,“一带一路”沿线国家正逐渐成为新时期中国企业重要的国际投资区域。本文根据实物期权理论,认为中国企业在“沿线国家”投资有助于构建更加完善的全球经营网络,可赋予企业一系列转换期权和增长期权,增强企业成本控制能力和市场需求可持续性,从而降低业绩下行风险并提升业绩上行潜力。通过构建中国制造业上市公司数据进行实证研究,本文发现:

第一,中国企业在“沿线国家”投资可显著降低其业绩下行风险并提升其业绩上行潜力,验证了实物期权理论的观点。

第二,机制分析表明,中国企业在“沿线国家”投资构建的全球经营网络是通过增强企业成本控制能力和市场需求可持续性对业绩下行风险和上行潜力产生影响。

第三,异质性分析结果表明,CEO 海外背景、产权性质、行业特征和国内区域环境均可对中国企业在“沿线国家”投资的实物期权价值产生影响,且 CEO 具有海外背景的企业、民营企业、传统制造企业和东部地区企业在“沿线国家”投资对业绩下行风险的降低作用和对业绩上行潜力的提升作用更强。

第四,政策效应分析表明,“一带一路”倡议的深入实施有助于增强中国企业在“沿线国家”投资对业绩下行风险的降低作用。

根据研究发现本文提出以下政策建议:

第一,在全球不确定性增加背景下,政府应深入推进与“沿线国家”的国际合作,鼓励中国企业加强对“沿线国家”投资贸易,构建更加完善的全球经营网络,不断提高资源全球化配置能力。

第二,政府应鼓励和支持民营企业积极投资“沿线国家”,为民营企业更好利用国内和“沿线国家”两个市场优化资源配置创造条件。

第三,政府应针对传统制造企业出台相应支持措施,鼓励传统制造企业积极布局“沿线国家”,深化与“沿线国家”产能合作,充分利用技术、产能等方面所具有的比较优势,提高中国传统制造企业国际市场竞争能力。

第四,政府应进一步优化不同区域金融发展,推进现代金融体系建设以适应新时代企业融资需求,通过多举措促进国内各区域金融市场健康发展,改善金融资源配置效率,提升企业融资便利化,从而为中国企业在“沿线国家”投资并参与全球产业分工提供有利的国内金融市场环境。

第五,企业在参与“一带一路”建设的过程中应构建具有丰富海外经验的国际化人才队伍,以有效应对“一带一路”沿线复杂的政治、经济、文化和制度环境,实现在“沿线国家”更优的资源配置。

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Chinese firms from the perspective of real options theory

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Abstract: Based on the data of Chinese listed manufacturing firms over the period of 2000 to 2021, this study discusses the investment value of Chinese firms in countries along the Belt and Road from the perspective of real options theory. Theoretical and empirical analysis shows that the investment in countries along the Belt and Road could help Chinese firms to reduce their downside risk and improve their upside potential. Mechanism analysis shows that the above impact is due to the fact that the global business network established by investing in countries along the Belt and Road helps firms enhance their cost – control capabilities and the sustainability of market demand. Heterogeneity analysis shows that the investment in countries along the Belt and Road for firms with CEOs having overseas background, private firms, traditional manufacturing firms and firms in the eastern region of China has a stronger effect on reducing downside risk and improving upside potential. The policy effect analysis of the Belt and Road initiative shows that the implementation of the initiative helps to improve the role of Chinese firms’ investment in countries along the Belt and Road to reduce the downside risk. This study provides new theoretical and empirical support for the Chinese government and firms to promote the high – quality development of the Belt and Road construction from the perspective of real options theory.

Keywords: the Belt and Road; real options theory; downside risk; upside potential; multinational investment (责任编辑 包婷婷)

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Will the pilot policy for innovative cities reduce the structural divergence between exports and domestic demand?

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Abstract: Taking the innovative pilot policy as a quasi – natural experiment , this paper uses the multi – period difference – in – differences model to test the effect of innovative city pilot policy on the structural deviation between enterprises’ export and domestic demand. The results show that the innovative city pilot policy significantly alleviate the structural deviation between exports and domestic demand. Mechanism analysis reveals that the information sharing effect to reduce the “bullwhip effect”, and the innovation effect jointly driven by factors and efficiency are the channel mechanisms through which the innovative city pilot policy works on the structural deviation of enterprises. However, the inhibitory effect on capital – factor mismatch has not yet become prominent. Heterogeneity analysis shows that the mitigating effect of the pilot policy on enterprise structural deviation is more obvious for enterprises in cities with a high degree of intellectual property protection, non – labour – intensive industries, general trading enterprises, and frontier technology enterprises. Further discussion reveals that the intensive margin of local market share redistribution for surviving enterprises and the expansion margin of enterprises entering and exiting the export market are the dynamic mechanisms through which the pilot policy acts on the inter – enterprise linkages of enterprises’ “export – domestic demand” divergences.

Keywords: innovative cities; pilot policies; export domestic demand divergence

(责任编辑 包婷婷)

检索证明

根据委托人提供的论文材料，委托人华南农业大学经济管理学院 周超(学科类型:人文社科) 1 篇论文收录情况如下表。

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Home country environment and the downside risk implications of multinationality: Empirical evidence from Chinese SMEs

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ABSTRACT

According to real options theory, a global network built through multinational investments endows a firm with a series of options for future development. These options can enhance a firm's operational flexibility, reducing its downside risk. This study aims to investigate the home country conditions necessary to achieve multinationality's downside risk effect in Chinese small and medium-sized enterprises (SMEs). Using data from Chinese manufacturing SMEs from 2003 to 2021 and a Tobit regression model, this study finds that multinationality can significantly reduce the downside risk of Chinese SMEs. Moreover, the degree of home country economic openness and financial development can significantly enhance multinationality's negative effect on downside risk. Further analysis suggests that the moderating effects of the home country environment are more prominent for state-owned firms than for privately-owned firms. Our findings emphasize the important role of a home country environment in achieving the value of multinationality's flexibility.

1. Introduction

Multinational operations or doing business in multiple countries is one of the critical features of multinational corporations (MNCs). The extant literature suggests that having operations across multiple countries enables MNCs to take advantage of heterogeneous environments, such as the production factors and market demand in different foreign locations, to provide them with additional advantages (de Meza and van Der Ploeg, 1987; Grant, 1987; Rugman, 1976; Zhou, 2018). In particular, real options theory posits that cross-country networks composed of affiliates located in multiple countries give MNCs a set of real options. One example is a switching option, which enables an MNC to shift operations and reallocate resources across countries in response to changes in the external environment (Ipsmiller et al., 2019; Kogut and Kulatilaka, 1994; Trigeorgis and Reuer, 2017). The real options nature of multinationality could then provide an MNC with additional operational flexibility, reducing the downside risk (DR hereafter) that performance falls below target (Iouliaou et al., 2021; Zhou, 2023).

Although real options theory has clarified the real options nature of multinationality and its impact on DR, empirical studies on multinationality's DR effect have provided mixed evidence. Some studies have found that multinationality helps firms achieve better performance by shifting operating activities across subsidiaries situated in multiple countries (Allen and Pantzalis, 1996; Rangan, 1998). However, other studies have found that multinationality does not necessarily improve a firm's operational flexibility; moreover, operating in more countries may even increase a firm's DR (Reuer and Leiblein, 2000; Zhou, 2019). In recent years, scholars have focused on the internal and external conditions that are needed to achieve the DR benefits obtained from multinationality. Specifically,

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extant research has found that multinationality's DR benefits could be influenced by internal factors such as managerial real option awareness (Driouchi and Bennett, 2011), ownership structure (Zhou, 2019), and CEO characteristics (Zhou, 2023). Studies have also revealed the impact of external factors such as the host country's cultural distance (Tong and Reuer, 2007), correlations with the host countries' labor costs (Belderbos et al., 2014).

Existing studies have provided valuable insights into the relationship between multinationality and DR. However, they have failed to consider the influence of the home country environment. According to real options theory, effective management of a firm's real options portfolio depends on its resources and capabilities. A firm's resources and capabilities are the important factors that guarantee improvement in multinationality's real options flexibility (Ipsmiller et al., 2019). Resource-based theory points out that the differences among MNCs in international business behaviors are due to their own unique resources, which are largely influenced by their home country environments (Wernerfelt, 1984; Tallman and Shenkar, 1994). This may be especially true for small and medium-sized enterprises (SMEs). SMEs are generally considered resource-constrained, lacking both the managerial ability and financial means to expand their operations across countries (Brouthers et al., 2015; Lahiri et al., 2020). Thus, the home country environment, which is an important source of a firm's unique resources, may be particularly important for an SME in terms of obtaining the resources and capabilities for multinational operations. Consequently, it is worth investigating what home country conditions are most beneficial for SMEs to achieve great DR effects from multinationality.

China is currently undergoing an economic transition, with its market economy and integration system are not yet fully developed (Meyer, 2008; Park et al., 2022). This has resulted in intense inter-regional competition and widespread local protectionism, leading to a highly fragmented and differentiated domestic regional environment in China (Ke, 2015). As a result, Chinese firms located in different regions of the country face varying home country environment, as each region has its own unique economic system (Li et al., 2018). Therefore, it is important to consider the role of the home country environment when studying the multinational management decisions of firms located in different regions of China. In this context, it is worth studying how the home country environment affects the relationship between multinationality and DR in Chinese SMEs.

Based on real options theory and resource-based theory, this study uses data from Chinese A-share listed manufacturing SMEs from 2003 to 2021 to investigate the impact of multinationality on DR. Moreover, the study further examines the impact of the home country's environment, including economic openness and financial development, on the multinationality-DR relationship. The results show that there is a significantly negative multinationality-DR relationship, and the home country's degree of economic openness and financial development significantly enhances the negative multinationality-DR relationship. This study also finds that the moderating effects of the home country environment, such as economic openness and financial development, are more prominent for state-owned firms than privately-owned firms.

This study's findings contribute to the existing literature in the following ways. First, previous studies investigating the external conditions needed to achieve multinationality's DR reduction effect mainly focus on host country environments, while home country environments are neglected. In recent years, the critical role home country environments play in firms' international operations have received increasing attention in the international business literature (Adomako et al., 2020; Boisot and Meyer, 2008; Gammeltoft et al., 2010; Krammer et al., 2018; Mainela et al., 2018). This study's examination of how home country economic openness and financial development impact multinationality's DR effect could advance knowledge of the conditions necessary to achieve real options flexibility stemming from multinationality, as well as the home country environment's role in international business.

Second, our findings extend the literature on SMEs' internationalization behavior. Prior studies on SMEs' internationalization behavior posit that home country environments play an important role in driving SMEs to seek opportunities across countries (Khan and Lew, 2018; Li and Ding, 2017; Musteen et al., 2014). However, it remains unclear what home country factors can facilitate or dampen multinationality's DR reduction effect in SMEs. Thus, this study's examination of how home country economic openness and financial development impact multinationality's DR effect in SMEs could advance understanding of the effects of such environments on SMEs' internationalization behaviors.

Third, our findings contribute to the literature on the international business by focusing on firms from China. Existing studies on multinationality's DR effect mainly focus on firms from countries such as the United States, Japan, and Korea (Belderbos et al., 2014; Driouchi and Bennett, 2011; Tong and Reuer, 2007; Ioulianiou et al., 2021). However, the attention paid to firms from China remains limited. It is well acknowledged that China is currently undergoing an economic transition. Its market economy and integration system are not yet fully developed and each region of China has its own unique economic system. This provides unique condition to study the role of home country environment in the multinationality's DR effect. Therefore, our study's focus on firms from China presents additional evidence leading to better understanding of multinationality's DR effect.

The remainder of this paper is organized as follows. Section 2 reviews the literature about multinationality's DR effect and develops hypotheses about the role of the home country's environment, including economic openness and financial development. Section 3 introduces the data, variables, and economic model. Section 4 presents the empirical results. Section 5 describes further investigation into the different effects of the home country environment (i.e., economic openness and financial development) across state-owned and privately-owned firms. Section 6 summarizes and discusses the study findings.

2. Literature review and hypotheses

2.1. Multinationality and DR

According to real options theory, an investment's real option nature refers to the option it offers for a firm's future development (Myers, 1977). Kogut (1986) pointed out that multinationality has significant real option characteristics, in that in an uncertain

environment, MNCs can flexibly adjust their business activities within the operational network they have established in countries worldwide. Specifically, multinationality endows MNCs with the right to freely choose their operating location based on the different tax provisions, anti-monopoly regulations, and financial constraints across countries, thus helping them achieve great operational flexibility (Niu et al., 2020). For instance, de Meza and van Der Ploeg (1987) took the cost structure of different countries as an uncertain factor and analyzed the value of multinational operations, indicating that multinational operations enable MNCs to choose among countries for the lowest cost for production, providing them with additional operational flexibility. Kogut and Kulatilaka (1994) analyzed the benefits of multinational operations by establishing a stochastic dynamic programming model. Their results indicated that multinational operations enable MNCs to improve their operational flexibility under an uncertain environment through cooperation among subsidiaries in various geographical locations, thus helping them achieve lower cost and better performance.

In the logic of real options theory, when external environments change, global networks constructed by multinational investments can provide options for MNCs to optimize their production and operation activities through three potential paths (see Fig. 1). More specifically, the first path is by shifting their operating activities from their home country to a host country when the host country has a better environment than that of the home country. The second path is by shifting their operating activities from a host country to the home country when the environment in the home country is better. The third path is by shifting operating activities between host countries when environments among host countries differ. Using these three paths, MNCs can make full use of environmental differences across countries to reduce the DR of performance.

SMEs are known for their market-oriented approach and ability to adapt quickly to changes in the market. They are highly responsive to the market environment, enabling them to quickly adjust their business strategies as needed. This ability positions SMEs well to leverage their cross-border business networks, enhancing their business flexibility and mitigating DR. Additionally, SMEs typically have a flat internal structure with a small number of employees, which makes them easy to manage and operate with flexibility. This enables them to make business decisions and adjustments quickly, and respond promptly to the uncertain international market environment. Consequently, SMEs can effectively utilize their global network established through cross-border operations to reduce their DR.

Hypothesis 1. For Chinese SMEs, multinationality is negatively related to their DR.

2.2. The role of the home country environment

Real options theory suggests that the real options flexibility created by multinationality is conditional on effective management of the multinational real options portfolio. The resources and capabilities owned by a firm have critical impact on the effective management of a real options portfolio (Ipsmiller et al., 2019). Resource-based theory argues that the unique resources and capabilities of MNCs are the critical factors that affect their international behaviors. These resources and capabilities are largely influenced by their home country environments, such as their economic and financial environments (Tallman and Shenkar, 1994). Inspired by these arguments, this study considers the role of home country economic openness and financial development in achieving the benefits of DR reduction through multinationality.

2.2.1. Home country economic openness

Home country economic openness can affect multinationality's real options characteristics in two ways. First, a higher degree of economic openness in the home country can make it more convenient for firms to optimize operating activities through both domestic and international markets. According to real options theory, multinationality's value depends on whether a firm can flexibly adjust its business activities in different countries. For instance, Kogut and Kulatilaka (1994) established a theoretical model and showed that adjusting business activities among countries at low cost can significantly enhance multinationality's real options flexibility and improve its reduction effect on DR. Economic openness is an index that reflects a region's degree of trade and investment liberalization. In regions with greater economic openness, barriers to trade and investment are lower, and various factors of production such as goods, capital, and labor can flow freely at lower cost (Meschi et al., 2011). Therefore, being in a region with a higher degree of economic openness will help firms make full use of domestic and international heterogeneous environments, such as production factors and

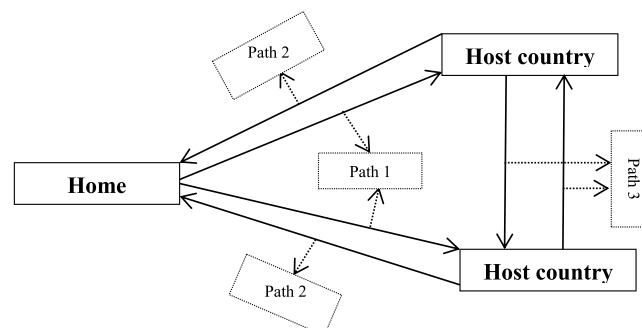


Fig. 1. The three paths for achieving real options flexibility through multinationality.

market demand, helping them form better production and sales networks. In this case, a high degree of home country economic openness is likely to enhance the operational flexibility derived from multinationality and thus improve multinationality's DR reduction benefits.

Second, a higher degree of home country economic openness can enhance firms' international operations adaptability, help them make more effective use of global operating networks, and further enhance their ability to optimize multinational operating activities. The ability to adapt to the external environment is one of the key factors in a firm's successful strategic management (Teece et al., 1997). When the external environment changes, firms with more adaptability can allocate internal and external resources more flexibly and identify and utilize market opportunities in a more timely and effective manner; thus, they have greater market competitiveness (Wang and Ahmed, 2010). In view of the differences in language, culture, institutions, and market environments among foreign countries, the ability of MNCs to adapt to the international market environment will be particularly important for improving the value of multinationality (Prange and Verdier, 2011). The regions of home countries with high degrees of economic opening often have great incentives to introduce trade systems, rules of competition, tax policies, regulatory rules, and other institutional arrangements that are in line with international standards. This helps them attract global trade and investment into their domestic markets while making it more convenient for domestic firms to enter the international market (Bui and Bui, 2020). In this context, home country regions with more economic openness are likely to have a business environment closer to that of the international market. This helps firms in these regions better understand and adapt to the international business environment, which improves their adaptability to the international market environment. In terms of real options flexibility, the stronger a firm's ability to adapt to the international market environment, the more favorable it is for them to optimize their operations distribution by taking advantage of the differentiated business environments across countries.

Since its reform and opening up, China has continuously increased the intensity of internal reform and deepened the level of opening up to the outside world. The degree of economic openness has been constantly improved, forming a new pattern of opening up to the outside world at a higher level. However, due to differences in historical traditions, resource endowment, policy making, economic development, and other aspects in China's regions, there are still differences in economic openness across these regions. Therefore, firms located in regions with greater economic openness are likely to gain a stronger DR reduction benefit from multinational operational flexibility.

Based on this analysis, we propose the following hypothesis:

Hypothesis 2. For Chinese SMEs, the DR reduction from multinationality is more pronounced for firms located in home country regions with higher degrees of economic openness.

2.2.2. Home country financial development

External funding support is important for MNCs that engage in business activities in the complex and uncertain international market (Minetti & Zhu, 2011). For example, Buch et al. (2014) suggested that external financial support is necessary for a firm's multinational operations because doing business in the international market requires investing large amounts in operating costs. It is difficult for firms to rely solely on internal funds to support international operations. Yan et al. (2018) found that a firm's ability to enter the international market is related to its external financing constraints; higher external financing constraints tend to limit a firm's ability to internationalize. Thus, financing constraints limit the ability of MNCs to optimize business activities using global operating networks.

The financial markets of China are still imperfect due to factors such as their financial management systems and levels of economic development (Chan and Kwok, 2017). Financing constraints are a common problem that firms face in China (Lee and Wang, 2021). Financial development is believed to have a significantly negative effect on firms' financing constraints (Ghosh, 2006; Love, 2003). On the one hand, a high degree of financial development can alleviate information asymmetry in financial markets, reduce the adverse impact of imperfect financial market factors on firms' external financing, improve the efficiency of financial resource allocation, and reduce the cost of external capital, thus easing the degree of firms' financing constraints (Asongu et al., 2016; Beck, 2002). On the other hand, a high degree of financial development is likely to increase the intensity of competition among financial intermediaries. This will then encourage financial intermediaries to actively provide firms with diversified financial services to convert idle funds into investments (Chen et al., 2016; Claessens and Laeven, 2003). In other words, a high degree of financial development can expand firms' external financing channels and improve the availability of external funds. In this context, a high degree of financial development is likely to ease a firm's external financing constraints, enhance its capital strength, and increase its international competitiveness, thus helping a firm better grasp the operating options provided by multinationality. Therefore, the degree of financial development tends to enhance multinationality's negative effect on DR.

Regions in China often have different degrees of financial development due to differences in areas such as economic development and institutional change (Han and Shen, 2015). MNCs located in home country regions with high degrees of financial development will have greater ability to help their overseas subsidiaries use their home financial markets to replace the uncertain international financing environment and then form a capital advantage. As such, this study argues that firms located in a home country region with high degree of financial development could have greater ability to exploit the switching opportunities embedded in a cross-country network and then gain a greater DR reduction benefit from multinationality.

Hypothesis 3. For Chinese SMEs, multinationality's DR reduction is more pronounced in firms located in home country regions with a higher degree of financial development.

3. Methodology

3.1. Data and sample

To test the proposed hypotheses, a sample is constructed that includes manufacturing A-share listed MNCs in the Shanghai and Shenzhen stock markets. There are two sources for the study's original data. One is the China Stock Market & Accounting Research Database, a widely used database developed by Shenzhen Xishima Data Technology Co., LTD. This database is used to obtain a firm's detailed multinational operating and financial data. Another source is the statistical yearbook of each province. The total import and export volume, total deposits and loans of financial institutions, and GDP data of each province are obtained from its statistical yearbook. Since the deposit and loan data of financial institutions in the statistical yearbook have only been publicly released after 2003, the study's time span is from 2003 to 2021.

In the process of processing the data, investments in tax havens such as the Cayman Islands and Virgin Islands were excluded because investments in these overseas destinations seem not intended for operational goals. Further, to maintain a reasonable sample size within industry, we only retain industries that have at least 10 firms per year, which is consistent with the method used in prior studies (Miller and Leiblein, 1996; Zhou, 2023). In addition, we focus on manufacturing SMEs in China. Following prior studies on Chinese SMEs (Huang et al., 2016; Liu et al., 2022), we only consider manufacturing firms that are publicly listed on the Small and Medium Enterprise Board and the Growth Enterprise Board. A total of 876 observations from 2003 to 2021 are obtained as the final sample.

3.2. Variables

3.2.1. DR

Numerous existing studies indicate that the core function of real options is to provide firms with a series of alternatives. In an uncertain environment, these options enable them to choose strategies that are conducive to their own development. This helps minimize the negative impact of adverse factors and enhances their ability to deal with downward risk (Tong and Reuer, 2007; Belderbos et al., 2014). Consistent with existing literature (Iouliaou et al., 2021; Zhou, 2023), a firm's DR is estimated based on the five-year moving average of the deviation of its actual performance from its target performance. More specifically, we estimate DR using the formulas in Eqs. (1) and (2).

$$\xi_{it} = \begin{cases} IROA_{i,t-1} - ROA_{i,t}, & \text{if } IROA_{i,t-1} > ROA_{i,t} \\ 0, & \text{if } IROA_{i,t-1} \leq ROA_{i,t} \end{cases} \quad (1)$$

$$DR_{i,t} = \sqrt{\left(\frac{1}{5}\right) \sum_{t=0}^{-4} (\xi_{it})^2} \quad (2)$$

where $ROA_{i,t}$ is firm i 's return on assets (ROA) in year t , and $IROA_{i,t-1}$ is the mean ROA of all firms in the industry firm i is a member of in year $t-1$.

3.2.2. Multinationality

Multinationality's real options nature is reflected in the breadth of a firm's multinational operations (Iouliaou et al., 2021; Kogut and Kulatilaka, 1994). Therefore, in line with prior studies, we measure multinationality using the number of host countries in which a firm has established subsidiaries.

3.2.3. Home country economic openness (HEO)

Following prior literature (Wang et al., 2011; Huynh et al., 2021), a country's level of economic openness is measured by the ratio of its total trade volume (imports plus exports) to its gross domestic product (GDP). Considering the differences in economic openness across China's provinces, the economic openness of the environment faced by MNCs at home is measured using provincial level data.

3.2.4. Home country financial development (HFD)

China's financial system continues to be dominated by banks, and bank credit is the main source of external financing for many Chinese firms (Gunji and Yuan, 2010). Therefore, a variable that seems relevant to the banking system is properly capturing China's financial development. Following prior research (Baltagi et al., 2009; Yuxiang and Chen, 2011), financial development in China is measured using the banking system's total deposits and loans divided by GDP. Since there are differences in financial development across China's provinces, the financial development environment faced by MNCs at home is measured using provincial level data.

3.2.5. Control variables

This study includes the following control variables that may affect a firm's performance risk.

- (1) *State ownership*. Following prior literature (Zhou, 2019), if a firm is ultimately controlled by a government agency, the variable *State ownership* equals 1. Otherwise, *State ownership* equals 0.

- (2) *Firm size*. Larger firms tend to have greater ability to buffer against DR (Tong and Reuer, 2007; Zhou, 2023). Consequently, we set *Firm size* as one of our control variables and measure it using the log of total assets.
- (3) *Slack*. Prior studies suggest the organizational redundancy of a firm can affect its DR. For instance, Miller and Leiblein (1996) indicate that the firm with more organizational redundancy is more likely to have greater ability to cope with DR. Belderbos et al. (2014) suggest that a firm with higher organizational redundancy tends to have lower operating efficiency and thus has less ability to cope with DR. This study measures organizational slack (*Slack*) by dividing the sum of accounts receivable, inventory, and selling and administrative expenses by total sales.
- (4) *Leverage*. Boyle and Guthrie (2003) believe that high leverage tends to reduce a firm's liquid assets, weaken its flexibility when choosing investment opportunities, and thus hinder its effective use of real options. Therefore, this study controls for *Leverage* and measures it using total debt divided by total assets.
- (5) *Tobin's Q*. Belderbos et al. (2014) suggest that a high Tobin's Q indicates a firm with good future investment opportunities, which would positively affect the firm's ability to buffer against DR. This study also uses *Tobin's Q* as one of the control variables.
- (6) *Firm growth*. Studies suggest that a firm with high growth potential usually possesses more growth opportunities and consequently has greater ability to buffer against DR (Zhou, 2023). We therefore control for a firm's growth and measure it using the revenue growth rate.
- (7) *Firm age*. Lemmon and Zender (2010) point out that a firm's future investment opportunities are negatively related to its age. In this case, older firms tend to have weaker ability to buffer against DR. This study thus controls for *Firm age* and measures it with the natural logarithm of the difference between the current year and the firm's founding year.

We provide the definition of above variables in Table 1. In addition, we control for industry-and year-fixed effects by including industry and year dummy variables. About the industry fixed effects, we considered the twenty-six industries in Table 2.

3.3. Economic model

To investigate the relationship between multinationality and DR in Chinese SMEs, we set the following model.

$$DR_{i,t} = \beta_0 + \beta_1 Multinationality_{i,t} + \vec{\omega} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $X_{i,t}$ represents the control variable set including *State ownership*, *Firm size*, *Leverage*, *Slack*, *Tobin's Q*, *Firm growth*, and *Firm age*, as defined above, and $I_{i,t}$ represents the year and industry dummy variables set.

To investigate the role of home country economic openness and financial development in achieving the DR reduction effect benefits from multinationality, the following model is constructed.

$$\begin{aligned} DR_{i,t} = & \theta_0 + \theta_1 Multinationality_{i,t} + \theta_2 Multinationality_{i,t} \times HEO_{i,t} \\ & + \theta_3 Multinationality_{i,t} \times HFD_{i,t} + \theta_4 HEO_{i,t} + \theta_5 HFD_{i,t} \\ & + \vec{\omega} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

where $Multinationality_{i,t} \times HEO_{i,t}$ is the interaction term of $Multinationality_{i,t}$ and $HEO_{i,t}$. $Multinationality_{i,t} \times HFD_{i,t}$ is the interaction term of $Multinationality_{i,t}$ and $HFD_{i,t}$.

Table 1
Definition of variables.

Variable	Definition
<i>DR</i>	The firm's five-year moving average performance deviating from its target performance.
<i>Multinationality</i>	The number of foreign countries in which a firm has business.
<i>HEO</i>	The ratio of the provincial total import and export volume to corresponding provincial GDP.
<i>HFD</i>	The ratio of the provincial total deposits and loans to corresponding provincial GDP.
<i>State ownership</i>	<i>State ownership</i> takes the value of 1 if a firm is ultimately controlled by government agency. Otherwise, <i>State ownership</i> takes the value of 0.
<i>Firm size</i>	The log of total assets.
<i>Leverage</i>	Total debt to total assets.
<i>Slack</i>	The sum of accounts receivable, inventory, selling and administrative expenses to total sales.
<i>Tobin's Q</i>	A firm's market value to its total assets.
<i>Firm growth</i>	A firm's revenue growth rate.
<i>Firm age</i>	The natural logarithm of lag time between the year and the firm's founding year.

Table 2
The industries in our sample.

Industry code	Industry name
C13	Agricultural and Sideline Food Processing Industry
C14	Food Manufacturing Industry
C15	Wine, Beverage and Refined Tea Manufacturing Industry
C17	Textile Industry
C18	Textile, Clothing and Apparel Industry
C19	Leather, Fur, Feather and Their Products and Footwear Manufacturing Industry
C20	Wood Processing and Wood, Bamboo, Rattan, Palm, and Grass Products Industry
C21	Furniture Manufacturing Industry
C22	Papermaking and Paper Products Industry
C23	Printing and Record Medium Reproduction Industry
C24	Cultural, Educational, Artistic, Sporting and Recreational Goods Manufacturing Industry
C26	Chemical Raw Materials and Chemical Products Manufacturing Industry
C27	Pharmaceutical Manufacturing Industry
C28	Chemical Fiber Manufacturing Industry
C29	Rubber and Plastic Products Industry
C30	Non-Metallic Mineral Products Industry
C31	Ferrous Metal Smelting and Rolling Processing Industry
C32	Non-Ferrous Metal Smelting and Rolling Processing Industry
C33	Metal Products Industry
C34	General Equipment Manufacturing Industry
C35	Special Equipment Manufacturing Industry
C36	Automobile Manufacturing Industry
C37	Railway, Shipbuilding, Aerospace and Other Transportation Equipment Manufacturing Industry
C38	Electrical Machinery and Equipment Manufacturing Industry
C39	Computer, Communication and Other Electronic Equipment Manufacturing Industry
C40	Instrumentation Manufacturing Industry

Notes: Industry code and name are from China Securities Regulatory Commission Industry Classification of Listed Companies (2012).

4. Results

4.1. Descriptive analysis results

Table 3 provides the descriptive statistics of the main variables. Table 3 shows that the average value of *Multinationality* is 2.3003, which suggests that, on average, SMEs in our sample operate in more than 2 foreign countries. The Pearson correlation analysis between the main variables is provided in Table 4. As seen in Table 4, the correlation coefficient between *DR* and *Multinationality* is -0.1394 and significant at the 1% statistical level, indicating that *Multinationality* is likely to negatively affect *DR*. Thus, the core argument of real options theory regarding multinationality is preliminarily verified in Chinese SMEs. In addition, the correlation coefficients between *Multinationality* and the other variables are in a reasonable range. Further, we also introduce the Variance Inflation Factor (VIF) test as an additional test for multicollinearity issues. Table 5 shows that VIF for each variable are much less than 10. The results further suggest that multicollinearity is not a significant problem in our study.

4.2. Regression analysis results

Because the dependent variable *DR* is a restricted variable that is greater than or equal to zero, this study employs a Tobit estimation model in the empirical analysis, consistent with prior research (Belderbos et al., 2014; Zhou, 2023). Table 6 presents the Tobit

Table 3
Descriptive statistics for main variables.

Variable	N	Mean	S. D.	Min	Max
<i>DR</i>	876	0.0218	0.0289	0.0000	0.1737
<i>Multinationality</i>	876	2.3003	1.9984	1.0000	13.4000
<i>HFO</i>	876	0.5768	0.4215	0.0195	1.3594
<i>HFD</i>	876	3.3143	1.3938	1.5739	7.4843
<i>State ownership</i>	876	0.3599	0.4806	0.0000	1.0000
<i>Firm size</i>	876	22.6303	1.2498	20.4606	26.1801
<i>Leverage</i>	876	0.5060	0.1651	0.1310	0.9136
<i>Slack</i>	876	0.4931	0.2788	0.1162	1.5697
<i>Tobin's Q</i>	876	1.4629	0.9070	0.1150	6.2722
<i>Firm growth</i>	876	0.1223	0.1373	-0.2458	0.7735
<i>Firm age</i>	876	2.6301	0.3604	1.3863	3.5264

Note: Consistent with the measure of dependent variable, the values of other variables in this table are as the 5-year average as dependent variable.

Table 4
Correlation matrix.

Variable	1	2	3	4	5	6	7	8	9	10
1. <i>DR</i>	1									
2. <i>Multinationality</i>	-0.1394 * **	1								
3. <i>HFO</i>	-0.0115	0.0028	1							
4. <i>HFD</i>	0.1734 * **	0.1626 * **	0.3433 * **	1						
5. <i>State ownership</i>	0.2546 * **	0.0799	-0.2092 * **	0.1290 * *	1					
6. <i>Firm size</i>	-0.1531 * **	0.4555 * **	-0.2727 * **	-0.0412	0.3258 * **	1				
7. <i>Leverage</i>	0.3556 * **	0.1691 * **	-0.279 * **	-0.1455 * **	0.2937 * **	0.4240 * **	1			
8. <i>Slack</i>	0.0833	-0.0847 *	0.0828	0.1707 * **	0.0003	-0.3056 * **	-0.2218 * **	1		
9. <i>Tobin's Q</i>	-0.1417 * **	-0.2175 * **	0.2874 * **	0.1790 * **	-0.2603 * **	-0.5675 * **	-0.6054 * **	0.2497 * **	1	
10. <i>Firm growth</i>	-0.2910 * **	0.0996 * *	0.0130	0.0625	-0.0223	0.0231	-0.0780	0.0588	0.1673 * **	1
11. <i>Firm age</i>	0.1300 * *	0.0966 *	0.0239	-0.0509	0.1663 * **	0.2624 * **	0.2538 * **	-0.1445 * **	-0.2496 * **	-0.2007 * **

Note: There are 876 observations, * ** , * * and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

Table 5
VIF for each variable.

Variable	VIF	1/VIF
<i>Multinationality</i>	1.48	0.6757
<i>HEO</i>	1.60	0.6250
<i>HFD</i>	1.48	0.6757
<i>State ownership</i>	1.58	0.6329
<i>Firm size</i>	2.83	0.3534
<i>Leverage</i>	2.04	0.4902
<i>Slack</i>	1.52	0.6579
<i>Tobin's Q</i>	2.35	0.4255
<i>Firm growth</i>	1.47	0.6803
<i>Firm age</i>	1.44	0.6944
Mean VIF	1.78	—

Note: VIF represents Variance Inflation Factor.

Table 6
Results of Tobit regression analyses.

Variable	(1)	(2)	(3)	(4)
<i>Multinationality</i> × <i>HEO</i>		-0.0065 * *		-0.0077 * **
		(0.0027)		(0.0027)
<i>HEO</i>		0.0193 * **		0.0129 * *
		(0.0065)		(0.0064)
<i>MN</i> × <i>HFD</i>			-0.0006 *	-0.0006 *
			(0.0003)	(0.0003)
<i>HFD</i>			0.0080 * **	0.0084 * **
			(0.0014)	(0.0015)
<i>Multinationality</i>	-0.0023 * **	0.0010	-0.0003	0.0039
	(0.0007)	(0.0016)	(0.0021)	(0.0029)
<i>State ownership</i>	0.0162 * **	0.0154 * **	0.0132 * **	0.0112 * **
	(0.0039)	(0.0040)	(0.0037)	(0.0036)
<i>Firm size</i>	-0.0158 * **	-0.0143 * **	-0.0152 * **	-0.0146 * **
	(0.0020)	(0.0022)	(0.0018)	(0.0019)
<i>Leverage</i>	0.1077 * **	0.1063 * **	0.1115 * **	0.1075 * **
	(0.0152)	(0.0158)	(0.0149)	(0.0155)
<i>Slack</i>	0.0038	0.0055	0.0030	0.0042
	(0.0053)	(0.0054)	(0.0057)	(0.0058)
<i>Tobin's Q</i>	-0.0096 * **	-0.0105 * **	-0.0100 * **	-0.0107 * **
	(0.0025)	(0.0025)	(0.0023)	(0.0024)
<i>Firm growth</i>	-0.0589 * **	-0.0618 * **	-0.0625 * **	-0.0645 * **
	(0.0169)	(0.0177)	(0.0151)	(0.0154)
<i>Firm age</i>	0.0062	0.0055	0.0075	0.0094
	(0.0056)	(0.0059)	(0.0055)	(0.0059)
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Constant	0.3733 * **	0.3329 * **	0.3365 * **	0.3143 * **
	(0.0424)	(0.0475)	(0.0405)	(0.0429)
<i>N</i>	876	876	876	876

Note: Values in parentheses are heteroscedastic robust standard errors, and * **, * * and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

estimation results. Column (1) reports the results of the baseline model, which includes *Multinationality* and all control variables. The estimated coefficient of *Multinationality* is negative ($\beta = -0.0023$) and significant at the 1% statistical level. This suggests that an SME with a higher level of multinationality is likely to have a lower level of DR. Specifically, operating in one more foreign country reduces an SME's DR by about 0.23% points. Thus, these results support the core argument of real options theory in Chinese SMEs and Hypothesis 1 is verified.

Additionally, examining the impact of the control variables on DR shows that the estimated coefficient of *State ownership* is positive ($\beta = 0.0162$) and significant at the 1% statistical level, indicating that state-owned SMEs tend to have higher levels of DR than privately-owned SMEs. The estimated coefficient of *Firm size* is negative ($\beta = -0.0158$) and significant at the 1% statistical level, suggesting that SMEs' DR decreases with firm size. The result evidences that larger firms have greater ability to buffer against DR (Tong and Reuer, 2007; Zhou, 2023). The coefficient estimate of *Leverage* is positive ($\beta = 0.1077$) and significant at the 1% statistical level, indicating that the DR of SMEs with higher leverage tends to be higher. The reason for this result may be that a firm with high leverage weakens its flexibility in choosing investment opportunities, thereby hindering its effective use of real options to buffer against DR. The coefficient estimate of *Tobin's Q* is negative ($\beta = -0.0096$) and significant at the 1% statistical level, indicating that the DR of SMEs with more intangible assets tends to be lower. The result verifies the viewpoint that the firm with good future investment opportunities

positively affects its ability to buffer against DR. The coefficient estimate of *Firm growth* is negative ($\beta = -0.0589$) and significant at the 1% statistical level, indicating that the DR of SMEs with greater growth potential is likely to be lower. The result supports the argument that firms with high growth potential possesses more opportunities for growth, and therefore, possess greater ability to buffer against DR (Zhou, 2023).

In Column (2), the Tobit estimation model includes *Multinationality*, *Multinationality*×*HEO*, *HEO*, and the main control variables. The results in Column (2) show that the estimated coefficient of *Multinationality*×*HEO* is negative and significant at the 1% statistical level. This indicates that firms located in home country regions with higher levels of economic openness are likely to achieve a greater DR reduction from multinationality. In particular, the negative effect of multinationality on DR will be amplified by 0.65% points when the economic openness of a firm's home country region increases by 1% point. Therefore, these findings support [Hypothesis 2](#).

In Column (3), the Tobit estimation model includes *Multinationality*, *Multinationality*×*HFD*, *HFD*, and the main control variables. The results in Column (3) show that the estimated coefficient of *Multinationality*×*HFD* is negative and significant at the 10% statistical level. This indicates that firms located in home country regions with higher levels of financial development are likely to achieve greater DR reduction from multinationality. In particular, the negative effect of multinationality on DR will be amplified by 0.06% points when the financial development of a firm's home country region increases by 1% point. These findings support [Hypothesis 3](#).

Finally, Column (4) provides the Tobit model regression results that include *Multinationality*, *Multinationality*×*HEO*, *HEO*, *Multinationality*×*HFD*, *HFD*, and all control variables. The signs and significance of the estimated coefficients of *Multinationality*×*HEO* and *Multinationality*×*HFD* in Column (4) further verify the findings in Columns (2) and (3). These findings further support [Hypotheses 2 and 3](#).

4.3. Robustness check

4.3.1. Heckman two-stage method

[Tong and Reuer \(2007\)](#) suggest sample selection bias may exist when hypotheses are tested using a sample that includes only MNCs. According to prior literature ([Heckman, 1979](#)), this study uses Heckman's two-stage method to deal with the potential sample selection bias. In particular, we employ a selection equation to estimate the probability of a firm's entry into foreign markets and predict an inverse mills ratio term (*MILLS*) in the first stage. The selection equation is as follows.

$$\Pr(FDI_{i,t} = 1) = \omega_0 + \omega_1 Productivity_{i,t} + \vec{\lambda} X_{i,t} + \vec{\gamma} I_{i,t} + \varepsilon_{i,t} \quad (5)$$

Table 7
Robustness check: Heckman two-stage method.

Variable	(1)	(2)	(3)	(4)
<i>Multinationality</i> × <i>HEO</i>		-0.0063 ** (0.0027)		-0.0076 *** (0.0027)
<i>HEO</i>		0.0174 ** (0.0068)		0.0126 * (0.0065)
<i>Multinationality</i> × <i>HFD</i>			-0.0006 * (0.0003)	-0.0007 ** (0.0003)
<i>HFD</i>			0.0079 *** (0.0015)	0.0084 *** (0.0016)
<i>Multinationality</i>	-0.0021 *** (0.0007)	0.0011 (0.0016)	-0.0002 (0.0021)	0.0040 (0.0028)
<i>State ownership</i>	0.0141 *** (0.0042)	0.0136 *** (0.0041)	0.0129 *** (0.0040)	0.0110 *** (0.0038)
<i>Firm size</i>	-0.0124 *** (0.0025)	-0.0118 *** (0.0025)	-0.0146 *** (0.0026)	-0.0141 *** (0.0025)
<i>Leverage</i>	0.1026 *** (0.0149)	0.1019 *** (0.0154)	0.1105 *** (0.0146)	0.1068 *** (0.0149)
<i>Slack</i>	0.0059 (0.0056)	0.0070 (0.0056)	0.0034 (0.0061)	0.0045 (0.0061)
<i>Tobinq</i>	-0.0103 *** (0.0026)	-0.0110 *** (0.0026)	-0.0102 *** (0.0024)	-0.0108 *** (0.0024)
<i>Firm growth</i>	-0.0766 *** (0.0189)	-0.0757 *** (0.0192)	-0.0657 *** (0.0185)	-0.0671 *** (0.0187)
<i>Firm age</i>	0.0061 (0.0056)	0.0058 (0.0059)	0.0074 (0.0055)	0.0094 (0.0059)
<i>MILLS</i>	0.0208 ** (0.0096)	0.0167 * (0.0096)	0.0038 (0.0105)	0.0031 (0.0104)
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Constant	0.2940 *** (0.0584)	0.2739 *** (0.0579)	0.3228 *** (0.0592)	0.3037 *** (0.0584)
<i>N</i>	876	876	876	876

Note: *MILLS* is Inverse Mill's Ratio; Values in parentheses are heteroscedastic robust standard errors, and ***, ** and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

where $FDIdummy_{i,t}$ is a dummy variable indicating whether a firm has a foreign subsidiary. If a firm has one or more overseas subsidiaries, $FDIdummy_{i,t}$ equals 1; otherwise it equals 0. The existing literature indicates that productivity is the key factor that affects multinational business decisions (Helpman et al., 2004; Zhou, 2019). Therefore, this study adds productivity as an additional variable in the selection equation and measures it using labor productivity. $X_{i,t}$ is a vector containing the control variables mentioned in section 3.2.5, and $I_{i,t}$ is a vector containing year and industry dummy variables.

We then add $MILLS$, obtained from the first stage, to our Tobit regression models. We report the empirical results in Table 7. The signs and significance of the coefficient estimates of the major variables including *Multinationality*, *Multinationality*×*HEO*, and *Multinationality*×*HFD* are in line with the results in Table 6. These results indicate that the conclusions reached in Section 4.2 still hold after controlling for potential sample selection bias.

4.3.2. 2SLS regression

Firms with lower DR might do business across more foreign countries than firms with higher DR. In this case, there may be non-sample-induced endogeneity in our study. Following the method used by Zhou (2023), we adopt two-stage least squares (2SLS) regression to cope with this potential endogeneity problem. In particular, we specify the regression model in the first stage as follows.

$$\begin{aligned} Multinationality_{i,t} = & \rho_0 + \rho_1 Multinationality_{i,t-1} + \rho_1 Productivity_{i,t-1} \\ & + \vec{\lambda}' X_{i,t-1} + \vec{\gamma}' I_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (6)$$

where $Multinationality_{i,t-1}$ and $Productivity_{i,t-1}$ are the lagged versions of *Multinationality* and *Labor productivity* and are the two instrumental variables. $X_{i,t-1}$ contains lagged covariates that are the control variables described in Section 3.2.5. $I_{i,t-1}$ includes industry and year dummy variables.

In the first stage, we find F statistic is larger than 10, and Hansen J statistic is 0.880 ($p > 0.1$). These statistics suggest that the instruments in our study are valid. To save the space, the results in the first stage are not reported. We obtain the predicted score (*Multinationality_{IV}*) of *Multinationality* in the first stage.

In the second stage, we replace *Multinationality* with *Multinationality_{IV}* in our Tobit regression models and report the empirical results in Table 8. The signs and significance of the coefficient estimates of *Multinationality_{IV}*, *Multinationality_{IV}*×*HEO*, and *Multinationality_{IV}*×*HFD* are consistent with the results in Table 6. Thus, the results obtained in Section 4.2 are further supported by the results in Table 8.

Table 8
Robustness check: 2SLS regression.

Variable	(1)	(2)	(3)	(4)
<i>Multinationality_{IV}</i> × <i>HEO</i>		-0.0096 *** (0.0032)		-0.0104 *** (0.0030)
<i>HEO</i>		0.0259 *** (0.0075)		0.0177 *** (0.0071)
<i>Multinationality_{IV}</i> × <i>HFD</i>			-0.0009 *** (0.0004)	-0.0008 *** (0.0003)
<i>HFD</i>			0.0096 *** (0.0016)	0.0098 *** (0.0018)
<i>Multinationality_{IV}</i>	-0.0015 * (0.0008)	0.0030 * (0.0017)	0.0017 (0.0022)	0.0062 *** (0.0024)
<i>State ownership</i>	0.0176 *** (0.0045)	0.0163 *** (0.0045)	0.0146 *** (0.0043)	0.0114 *** (0.0041)
<i>Firm size</i>	-0.0153 *** (0.0024)	-0.0135 *** (0.0026)	-0.0146 *** (0.0021)	-0.0135 *** (0.0022)
<i>Leverage</i>	0.1043 *** (0.0178)	0.1007 *** (0.0185)	0.1100 *** (0.0169)	0.1043 *** (0.0173)
<i>Slack</i>	0.0089 (0.0062)	0.0113 * (0.0063)	0.0096 (0.0067)	0.0115 * (0.0067)
<i>Tobinq</i>	-0.0082 *** (0.0031)	-0.0102 *** (0.0030)	-0.0096 *** (0.0028)	-0.0106 *** (0.0028)
<i>Firm growth</i>	-0.0630 *** (0.0213)	-0.0680 *** (0.0226)	-0.0734 *** (0.0187)	-0.0764 *** (0.0190)
<i>Firm age</i>	0.0061 (0.0073)	0.0047 (0.0078)	0.0059 (0.0072)	0.0079 (0.0077)
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Constant	0.3569 *** (0.0517)	0.3128 *** (0.0564)	0.3190 *** (0.0484)	0.2885 *** (0.0499)
<i>N</i>	876	876	876	876

Note: Values in parentheses are heteroscedastic robust standard errors, and ***, ** and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

4.3.3. Alternative dependent variable

Extant research suggests that return on equity (ROE) could be used instead of ROA as an alternative performance indicator to compute a firm's DR (Driouchi and Bennett, 2011). To verify whether this study's findings remain robust when a different measurement of DR is employed, ROE is used to recalculate the firm's DR. The calculation formula is as follows:

$$\phi_{it} = \begin{cases} IROE_{i,t-1} - ROE_{i,t}, & \text{if } IROE_{i,t-1} > ROE_{i,t} \\ 0, & \text{if } IROE_{i,t-1} \leq ROE_{i,t} \end{cases} \quad (7)$$

$$\text{Downside risk}_{i,t} = \sqrt{\left(\frac{1}{5}\right) \sum_{t=0}^{-4} (\phi_{it})^2} \quad (8)$$

where $ROE_{i,t}$ is firm i 's ROE in year t , and $IROE_{i,t-1}$ is the mean ROE of all firms in the industry firm i is a member of in year $t-1$.

Table 9 provides the robustness test results obtained using the new measurement of the dependent variable. The empirical results in the table show that the signs and significance of the coefficient estimates of the major variables including *Multinationality*, *Multinationality*×*HEO*, and *Multinationality*×*HFD* are consistent with those in Table 6. The results in Table 9 confirm the findings in Section 4.2.

4.3.4. Alternative independent variable

In this part, an alternative independent variable is used to verify the robustness of our findings concerning the role of the domestic economic environment in the DR implications of multinationality. Specifically, following Aggarwal et al. (2011) method, the world is divided into seven regions: Asia, Oceania, the Middle East, Europe, Africa, South America (including Central America), and North America. Then, the number of regions in which a firm has operational activities is used as an alternative variable (*Multinationality_RG*) to measure the degree of multinationality.

Table 10 provides the robustness test results obtained using the new measurement of multinationality. The results in Table 10 show that the signs and significance of the coefficient estimates of the major variables including *Multinationality_RG*, *Multinationality_RG*×*HEO*, and *Multinationality_RG*×*HFD* are consistent with those in Table 6. These results further verify the findings reported in Section 4.2.

Table 9
Robustness check: Alternative dependent variable.

Variable	(1)	(2)	(3)	(4)
<i>Multinationality</i> × <i>HEO</i>		-0.0217 * (0.0125)		-0.0224 * (0.0118)
<i>HEO</i>		0.0686 ** (0.0293)		0.0590 ** (0.0286)
<i>MN</i> × <i>HFD</i>			-0.0024 * (0.0014)	-0.0023 * (0.0013)
<i>HFD</i>			0.0159 *** (0.0049)	0.0146 *** (0.0054)
<i>Multinationality</i>	-0.0125 *** (0.0034)	-0.0016 (0.0078)	-0.0025 (0.0085)	0.0089 (0.0119)
<i>State ownership</i>	0.0549 ** (0.0135)	0.0534 *** (0.0135)	0.0515 *** (0.0136)	0.0494 *** (0.0135)
<i>Firm size</i>	-0.0412 *** (0.0068)	-0.0361 *** (0.0074)	-0.0409 *** (0.0069)	-0.0370 *** (0.0073)
<i>Leverage</i>	0.4167 *** (0.0579)	0.4128 *** (0.0605)	0.4247 *** (0.0585)	0.4175 *** (0.0609)
<i>Slack</i>	-0.0104 (0.0187)	-0.0051 (0.0197)	-0.0116 (0.0196)	-0.0067 (0.0204)
<i>Tobinq</i>	-0.0160 * (0.0091)	-0.0195 * (0.0091)	-0.0180 ** (0.0091)	-0.0207 ** (0.0091)
<i>Firm growth</i>	-0.2136 *** (0.0616)	-0.2250 *** (0.0625)	-0.2259 *** (0.0594)	-0.2347 *** (0.0599)
<i>Firm age</i>	0.0032 (0.0201)	-0.0015 (0.0206)	0.0032 (0.0200)	0.0015 (0.0208)
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Constant	0.9129 *** (0.1551)	0.7806 *** (0.1744)	0.8611 *** (0.1588)	0.7594 *** (0.1738)
<i>N</i>	876	876	876	876

Note: Values in parentheses are heteroscedastic robust standard errors, and ***, **, and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

Table 10

Robustness check: Alternative independent variable.

Variable	(1)	(2)	(3)	(4)
<i>Multinationality_{RG}×HEO</i>		-0.0146 * ** (0.0043)		-0.0152 * ** (0.0042)
<i>HEO</i>		0.0292 * ** (0.0084)		0.0227 * ** (0.0082)
<i>Multinationality_{RG}×HFD</i>			-0.0028 * ** (0.0007)	-0.0022 * ** (0.0007)
<i>HFD</i>			0.0110 * ** (0.0018)	0.0104 * ** (0.0019)
<i>Multinationality_{RG}</i>	-0.0064 * ** (0.0020)	0.0010 (0.0031)	0.0040 (0.0037)	0.0092 * * (0.0042)
<i>State ownership</i>	0.0164 * ** (0.0039)	0.0152 * ** (0.0039)	0.0133 * ** (0.0036)	0.0110 * ** (0.0035)
<i>Firm size</i>	-0.0158 * ** (0.0019)	-0.0143 * ** (0.0021)	-0.0155 * ** (0.0017)	-0.0146 * ** (0.0018)
<i>Leverage</i>	0.1081 * ** (0.0152)	0.1062 * ** (0.0158)	0.1129 * ** (0.0151)	0.1087 * ** (0.0156)
<i>Slack</i>	0.0035 (0.0053)	0.0037 (0.0055)	0.0024 (0.0057)	0.0020 (0.0059)
<i>Tobinq</i>	-0.0099 * ** (0.0026)	-0.0109 * ** (0.0026)	-0.0107 * ** (0.0024)	-0.0111 * ** (0.0025)
<i>Firm growth</i>	-0.0561 * ** (0.0166)	-0.0587 * ** (0.0174)	-0.0608 * ** (0.0148)	-0.0614 * ** (0.0151)
<i>Firm age</i>	0.0063 (0.0056)	0.0050 (0.0056)	0.0071 (0.0055)	0.0082 (0.0056)
Year fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Constant	0.3813 * ** (0.0418)	0.3399 * ** (0.0465)	0.3387 * ** (0.0387)	0.3150 * ** (0.0414)
<i>N</i>	876	876	876	876

Note: Values in parentheses are heteroscedastic robust standard errors, and * **, * * and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

Table 11

Further analysis: The different effects of home country environment across state-owned and privately-owned firms.

Variable	(1) Panel A	(2) Panel B	(3) Panel A	(4) Panel B	(5) Panel A	(6) Panel B
<i>Multinationality×HEO</i>	-0.0085 * ** (0.0029)	0.0021 (0.0033)			-0.0122 * ** (0.0045)	0.0002 (0.0033)
<i>HEO</i>	0.0222 * ** (0.0067)	-0.0001 (0.0079)			0.0161 * * (0.0076)	-0.0020 (0.0081)
<i>Multinationality×HFD</i>			-0.0009 * (0.0005)	0.0027 (0.0018)	-0.0010 * (0.0005)	0.0027 (0.0019)
<i>HFD</i>			0.0065 * ** (0.0012)	-0.0005 (0.0037)	0.0073 * ** (0.0013)	-0.0003 (0.0039)
<i>Multinationality</i>	0.0041 * ** (0.0019)	-0.0046 (0.0031)	0.0015 (0.0034)	-0.0119 * * (0.0059)	0.0053 (0.0039)	-0.0119 * ** (0.0060)
<i>Firm size</i>	-0.0165 * ** (0.0023)	-0.0198 * ** (0.0038)	-0.0172 * ** (0.0020)	-0.0192 * ** (0.0034)	-0.0159 * ** (0.0017)	-0.0196 * ** (0.0037)
<i>Leverage</i>	0.0236 (0.0171)	0.1262 * ** (0.0186)	0.0544 * ** (0.0166)	0.1319 * ** (0.0191)	0.0407 * * (0.0170)	0.1316 * ** (0.0191)
<i>Slack</i>	-0.0024 (0.0077)	0.0029 (0.0071)	-0.0037 (0.0080)	0.0016 (0.0069)	-0.0029 (0.0084)	0.0010 (0.0072)
<i>Tobinq</i>	-0.0205 * ** (0.0050)	-0.0166 * ** (0.0036)	-0.0151 * ** (0.0047)	-0.0154 * ** (0.0032)	-0.0159 * ** (0.0049)	-0.0155 * ** (0.0033)
<i>Firm growth</i>	-0.0017 (0.0178)	-0.0997 * ** (0.0202)	-0.0047 (0.0154)	-0.1018 * ** (0.0189)	-0.0089 (0.0145)	-0.1011 * ** (0.0198)
<i>Firm age</i>	-0.0215 * * (0.0085)	0.0091 (0.0066)	-0.0138 * * (0.0061)	0.0087 (0.0057)	-0.0128 * * (0.0062)	0.0094 (0.0066)
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
Constant	0.4706 * ** (0.0631)	0.4817 * ** (0.0855)	0.4375 * ** (0.0557)	0.4694 * ** (0.0778)	0.4012 * ** (0.0524)	0.4766 * ** (0.0834)
<i>N</i>	302	574	302	574	302	574

Note: Panel A is the subsample of state-owned firms, and Panel B is the subsample of private-owned firms. Values in parentheses are heteroscedastic robust standard errors, and * **, * * and * indicate statistically significant two-tailed t-test at 1%, 5% and 10% levels, respectively.

5. Further analysis

China is well-known as a socialist country. One of its critical institutional characteristics is that there are a large number of state-owned firms in China. It has been suggested that state-owned firms often have greater ability to access various resources in China compared to that of privately-owned firms (Cui and Jiang, 2012). Consequently, state-owned firms are likely to be largely affected by their home country environment, such as its economic openness and financial development. Thus, we further empirically study the different effects of the home country environment (i.e., economic openness and financial development) across state-owned and privately-owned firms. We argue that the moderating effects of home country economic openness and financial development on the DR reduction of multinationality are more pronounced in state-owned firms than in privately-owned firms.

Following previous studies (Delios et al., 2006; Zhou, 2019), state-owned firms are defined as firms that are ultimately controlled by a government agency, while privately-owned firms are defined as firms that are not ultimately controlled by a government agency. To test the different effects of the home country environment on multinationality's DR reduction in state-owned and privately-owned firms, two subsamples are constructed—one for state-owned firms (Panel A) and one for privately-owned firms (Panel B)—and a subsample analysis is performed. The subsample analysis results are presented in Table 11.

Columns 1 and 2 in Table 11 show that the estimated coefficient of $Multinationality \times HEO$ is significantly negative in Column 1 (Panel A); however, it is positive but not significant in Column 2 (Panel B). These results suggest that the significantly negative moderating effect of home country economic openness is more pronounced in state-owned firms than in privately-owned firms.

Columns 3 and 4 in Table 11 show that the estimated coefficient of $Multinationality \times HFD$ is significantly negative in Column 3 (Panel A); however, it is positive but insignificant in Column 4 (Panel B). These results suggest that the significantly negative moderating effect of home country financial development is more pronounced in state-owned firms than in privately-owned firms.

Finally, Columns 5 and 6 in Table 11 report the results of simultaneously including all variables in the Tobit regression model. The results in these two columns still support the argument that the home country environment, including economic openness and financial development, exert greater influence on state-owned firms than on privately-owned firms.

6. Conclusion

6.1. Discussion of results

Real options theory suggests that multinationality enables MNCs to build cross-country networks that could provide them with real options flexibility, allowing them to dynamically optimize production under an uncertain environment, reducing their DR. We argue that multinationality's real options flexibility is conditional on the MNCs' home country environment (i.e., economic openness and financial development). This argument tends to be particularly true for multinational SMEs because they are more vulnerable to their external environment.

Based on the multinational operating data of SMEs that are A-share listed firms in China from 2003 to 2021, this study finds that there is a significantly negative relationship between multinationality and DR in SMEs. The finding suggests that SMEs could achieve additional flexibility through multinational operations, which is in accord with real options theory's argument on multinationality. Regarding the moderating effects of the home country environment, the study's results show that the relationship between multinationality and DR in SMEs is significantly and negatively moderated by home country economic openness and financial development. The findings suggest that the home country environment is one of the important conditions necessary for SMEs to achieve real options flexibility from multinationality. High levels of home country economic openness and financial development could enhance the ability of SMEs to take advantage of the heterogeneous environments across foreign countries, thus helping them achieve greater operational flexibility.

Further analysis suggests that the moderating effects of home country economic openness and financial development on the DR reduction obtained from multinationality are more pronounced in state-owned firms than in privately-owned firms. This finding implies that the home country environment plays a more important role for state-owned firms' achievement of real options flexibility from multinationality. This supports the view that, in socialist countries like China, state-owned firms have an advantage over privately-owned firms in the benefits from developing their home country environment, such as increasing economic openness and financial development.

6.2. Implications for research and practice

Our findings have important research implications. Prior studies that have explored the conditions needed to form real options flexibility from multinationality have generally focused on macroeconomic conditions in the host countries and firm characteristics (Belderbos et al., 2014; Zhou, 2019; Zhou, 2023). However, the role of the home country environment in determining the real options flexibility created by multinationality is unexplored. Our study helps identify the home country conditions that are related to multinationality's real options flexibility and further highlights the role of the home country environment in exploiting the benefits of multinational operations. Our findings suggest that researchers who work in the area of international business should consider the effects of the home country environment in future research.

The findings of this study have important implications for policy makers. First, our findings suggest that SMEs could achieve great operational flexibility through multinational operation. Therefore, one policy implication of our findings is that China should provide policy support to help SMEs participate in international competition and global industrial division. This will aid them in making full

use of the differentiated global market environment and thus improve their operational flexibility and global resource allocation capability. Second, our findings indicate that home country economic openness could enhance the SMEs' ability to achieve greater real option flexibility from multinational operation. Therefore, one policy implication of our findings suggests that governments in countries such as China should develop policies, such as lowering barriers to investment and trade, to further increase their economic openness. These will facilitate both investment and trade and thus enhance SMEs' ability to participate in the international market competition. Third, this study shows that home country financial development could enhance the SMEs' ability to achieve greater real option flexibility from multinational operation. Therefore, one policy implication of our findings suggests that China should further deepen their financial system reform and accelerate establishment of a modern financial system to improve the allocation of financial resources. This will create a favorable home country financial market environment for SMEs in these countries, enabling them to achieve real options flexibility from multinational operations.

6.3. Limitation and future research

Our study has several limitations, which could be addressed in future research. First, due to data constraints, we use firms listed in the Small and Medium Enterprise Board and the Growth Enterprise Board as the SMEs for our empirical study. Although this approach is widely used in the study of SMEs in China (Huang et al., 2016; Liu et al., 2022), these firms are generally outstanding leaders among SMEs. Therefore, they may not be representative of all kinds of SMEs. Research in the future could extend our findings by building a sample of unlisted SMEs and test whether our findings also hold for unlisted SMEs. Second, this study considers two factors of home country environments: economic openness, and financial development. There may be other factors of home country environments that could affect the DR benefit of multinationality for SMEs. Future research could further study the role other home country environment characteristics play in achieving the DR reduction of multinationality. Third, our empirical analysis only considers SMEs from China; consequently, the findings might be conditional on the specific context in China. Therefore, future research that uses SMEs from other countries as the empirical sample may provide additional evidence and make our findings more generalizable.

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Declaration of Competing Interest

None.

Data availability

Data will be made available on request.

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CEO characteristics, multinationality and downside risk: evidence from Chinese multinational corporations

CEO
characteristics

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Abstract

Purpose – Real options theory posits that multinationality provides additional operating flexibility and helps firms reduce downside risk. This study aims to explore the effects of chief executive officer (CEO) characteristics on the downside risk implication of multinationality in Chinese multinational corporations (MNCs).

Design/methodology/approach – This study gathers a sample of Chinese MNCs from 2009 to 2020 and deploys a Tobit panel estimation model with fixed effects in the empirical analysis.

Findings – This study finds that multinationality has a significant negative effect on downside risk. The downside risk reduction effect of multinationality is stronger in firms led by older CEOs, women CEOs, CEOs with overseas experience or broader functional backgrounds or those with higher educational levels. Additionally, the above effects of CEO characteristics on the downside risk reduction effect of multinationality are more pronounced in firms with smaller top management team (TMT) sizes. Hence, the findings show that the multinational network constructed by Chinese MNCs could offer great operating flexibility, and CEO characteristics and the CEO–TMT interface play an important role in achieving real options flexibility from multinationality.

Originality/value – This study shows that multinationality could be an effective way for emerging market firms to reduce business risk. This study helps identify CEO characteristics that are associated with real option performance and emphasizes that CEO personal attitudes and abilities could influence the real options flexibility obtained from multinationality. This study also contributes to the understanding of micro foundations in international business by focusing on the role of CEO characteristics and the CEO–TMT interface in the downside risk implications of multinationality.

Keywords Multinationality, Downside risk, Real options, CEO characteristics, Chinese multinational corporations

Paper type Research paper

Introduction

Extant literature posits that multinational corporations (MNCs) may have relatively lower levels of risk than domestic companies, considering that multinationality enables MNCs to

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have the distinct advantage of shifting operational activities among their cross-country affiliates in response to changes in external conditions. Real options theory suggests that the global network constructed by multinationality provides MNCs with a portfolio of options for switching that offer various operational flexibilities, which can enhance their cooperation and resource reallocation abilities among affiliates located across countries (Kogut and Kulatilaka, 1994). Therefore, MNCs should benefit from upside opportunities in favorable environments and reduce downside risks in adverse ones (Andersen, 2012; Ioulianou *et al.*, 2021; Reuer and Leiblein, 2000; Yeo and Lee, 2020).

Scholars have conducted a series of pioneering empirical studies on the downside risk-reduction effect of multinationality based on real options theory. For example, some scholars find that multinationality helps MNCs achieve lower or higher returns by shifting their business activities among subsidiaries located in different countries (Allen and Pantzalis, 1996; Rangan, 1998; Tang and Tikoo, 1999), whereas others find that having business activities across countries does not necessarily enhance firms' operational flexibility (Reeb *et al.*, 1998; Reuer and Leiblein, 2000). Existing studies have explored several factors that affect the downside risk implications of multinationality. For instance, real option awareness (Driouchi and Bennett, 2011), correlations with labor costs among host countries (Belderbos *et al.*, 2014) and the degree of market uncertainty (Ioulianou *et al.*, 2021) have been investigated.

This study seeks to extend the existing literature in two ways. First, it incorporates decision-makers' characteristics into the determinants of the downside risk implications of multinationality. The literature on micro foundations in international business suggests that managerial behavior play a significant role in firms operating in multiple countries because these firms face heightened levels of bounded rationality and reliability (Maitland and Sammartino, 2015; Kano and Verbeke, 2015; Kano and Verbeke, 2019). Although the importance of managerial discretion is well-recognized in the real options literature (Kogut, 1985; Kogut and Kulatilaka, 1994), only few empirical studies have focused on the role of chief executive officers (CEOs) in shaping the switching option value of firms' multinationality. The upper echelons theory stresses that top managers play a critical role in a firm's strategic processes (Hambrick, 2007). CEOs, as the most powerful actors in a firm's top management team (TMT), are supposed to have considerable influence on a firm's strategic choices (Kim *et al.*, 2016; Lee and Lim, 2021; Powell and Lim, 2021). In emerging countries, such as China, where formal and informal institutional support is lacking or ineffective (Agnihotri and Bhattacharya, 2021; Estrin and Prevezer, 2010; Peng *et al.*, 2004), CEOs may have a greater influence on firms' strategic choices (Gao, 2011; Ting *et al.*, 2017). This study suggests that CEOs could influence the effectiveness of taking advantage of multinational switching options and, thus, affect downside risk reduction from multinationality.

Second, prior studies mainly investigate the downside risk implications of multinationality by focusing on firms in developed markets, such as those operating in the USA and Japan (Belderbos *et al.*, 2014; Tong and Reuer, 2007). However, it remains unclear whether these findings apply to firms in developing markets. As developing and developed countries have distinct institutional environments, our study, focusing on the impact of multinationality on downside risk in firms from developing countries, could provide new evidence.

Based on a sample containing Chinese A-share listed manufacturing MNCs over 2009–2020, this study shows that multinationality has a significantly negative effect on downside risk and CEO characteristics significantly influence this relationship. Specifically, the negative relationship between multinationality and downside risk is stronger in firms led by older CEOs,

women CEOs, CEOs with overseas experience or broader functional backgrounds or those with higher educational levels. Moreover, the effects of CEO characteristics on the downside risk reduction effect of multinationality are more pronounced when firms have smaller TMT. The findings show that the multinational network constructed by Chinese MNCs could offer great operating flexibility, and that CEOs play an important role in achieving real options flexibility from multinationality.

Our study contributes to the existing research in the following ways. First, by establishing the influence of decision-makers on the downside risk implications of multinationality, this study helps identify CEO characteristics associated with real option flexibility originating from multinationality. We emphasize that top executives' personal attitudes and abilities can influence the effectiveness of taking advantage of multinational networks and thus, affect the real options flexibility obtained from multinationality. Second, more recent studies have underscored the importance of the CEO-TMT interface, stressing that it is not the CEO alone, but the interaction and interfacing mechanisms between the CEO and TMT that affect firm performance (Georgakakis *et al.*, 2019; Georgakakis *et al.*, 2017). Our analysis of the different effects of CEO characteristics on the downside risk implications of multinationality across TMT sizes could provide new evidence for the importance of the CEO-TMT interface. Third, the investigation of the theoretical prediction of real options theory, focusing on Chinese firms, could contribute to the relatively scant literature on developing countries.

The remainder of this paper is organized as follows. Section 2 reviews related literature and develops the hypotheses. Section 3 outlines the data used, describes the variables and presents econometric models. Section 4 presents the empirical results. Section 5 presents a robustness check for the results. Section 6 reports the analysis of the different effects of CEO characteristics on the downside risk implications of multinationality across TMT sizes. Section 7 concludes the study and discusses its implications.

Literature review and theoretical development

Multinationality and downside risk

The application of real options theory in multinational business suggests that firms investing in a number of foreign countries have worldwide production and sales networks, which provides them with a set of options to switch operational activities within their international investment portfolio. For example, de Meza and van der Ploeg (1987) developed a one-period stochastic model to analyze the advantages of operating in multiple countries. Their analysis showed that multinationality provides MNCs with great operating flexibility, which lowers operational costs and creates value for these MNCs. Kogut and Kulatilaka (1994) constructed a multi-period stochastic dynamic programming model to analyze the value of multinationality when uncertainty exists in the exchange rate among host countries. They show that multinationality enhances an MNC's ability to shift operational activities to a favorable location with a lower input price, and then increases the operating flexibility for MNCs with uncertain exchange rates. Huchzermeier and Cohen (1996) developed a lattice model to analyze MNCs' operating flexibility, demonstrating that multinationality provides additional options for alternative product and supply chain network designs under exchange rate uncertainty. Considering the real option nature of multinationality, firms operating in multiple countries tend to have lower downside risk in a dynamic external environment (Reuer and Leiblein, 2000).

The role of chief executive officer characteristics

The literature on the micro foundation of international management stresses that it is important to understand managerial behavior in explaining MNCs' choices because bounded rationality and reliability increase when MNCs operate in complex international situations (Maitland and Sammartino, 2015; Kano and Verbeke, 2015; Kano and Verbeke, 2019). Real options theory suggests that managers' discretion plays a critical role in exploiting multinational switching opportunities (Driouchi and Bennett, 2011; Ipsmiller *et al.*, 2019; Kogut, 1985). The upper echelons theory emphasizes that top executives have a critical influence on a firm's operations (Hambrick, 2007). The CEO, as the most powerful actor in a firm's management team, may have even greater influence and may be particularly important for firms in emerging market countries, such as China, because of the lack of formal and informal institutional support (Estrin and Prevezer, 2010; Peng *et al.*, 2004). Thus, this study seeks to explore how CEO heterogeneity determines the heterogeneity of downside risk effects from multinationality. Particularly, this study explores the effect of CEO characteristics, such as age, gender, overseas experience, functional background and educational level, on the relationship between multinationality and downside risk, so as to clarify how CEO personal attitudes and ability influence the real options flexibility obtained from multinationality.

Chief executive officer age

Previous research suggests that the age of a CEO is a major factor influencing a firm's risk-taking activities (Serfling, 2014; Yim, 2013). Older CEOs are more interested in their financial and career security because their social circles, spending traits and retirement income expectations have been established (Li *et al.*, 2017; Prendergast and Stole, 1996). These CEOs pay more attention to maintaining their occupational safety and income stability by taking measures to ensure the stability of their operations (Hambrick and Mason, 1984). Therefore, they are more likely to choose conservative strategies to avoid operational risk in decision-making rather than taking any risky actions that might disrupt their pursuit of stability (Carlsson and Karlsson, 1970). Contrastingly, younger CEOs tend to show excellent managerial ability by taking decisions with high-risk characteristics (Prendergast and Stole, 1996). For example, Serfling (2014) showed that older CEOs are more likely to keep their firms at a lower level of operational risk because they prefer less risky investment policies. Croci *et al.* (2017) found that older CEOs are more likely to adopt a risk-hedging strategy for their firms. Yeoh and Hooy (2022) suggested that younger CEOs tend to engage in riskier activities because they are subject to reputational costs. Hence, younger CEOs are likely to take risks. They might heavily invest in countries characterized by high risk and high rewards and pay less attention to the potential downside risk-containing benefits of switching options across countries. By contrast, older CEOs may be less likely to take risks and they actively take advantage of multinational networks to reduce downside risk because multinationality provides MNCs with more operational flexibility to deal with operational risk.

Additionally, older CEOs generally have a longer tenure, which is associated with more experience and knowledge in understanding and running businesses (Cai and Sevilir, 2012; Wilbon, 2002). Therefore, it can be assumed that, compared to the younger CEOs who have less experience, older CEOs are more likely to have a greater ability to deal with multinational operations, which will facilitate MNCs to take advantage of favored environments among host countries and thus enhance operational flexibility.

This study therefore hypothesizes that:

- H1.* The negative relationship between multinationality and downside risk is stronger for firms managed by older CEOs.

Chief executive officer gender

Psychological research shows that women and men have different risk preferences. For example, through a meta-analysis of 150 psychology studies, [Byrnes et al. \(1999\)](#) found that, compared to men, women have greater risk aversion and are less likely to take risky actions. The different risk preferences of women and men are likely to result in differences in business behaviors ([Huang and Kisgen, 2013](#); [Powell and Ansic, 1997](#)). Particularly, researchers find that firms managed by women tend to actively take measures to avoid risky events to lower the risk level of firms ([Li and Zeng, 2019](#); [Fang et al., 2020](#)). In this regard, men may take risks and invest in risky countries with high rewards. They are likely to pay less attention to the downside risk-reduction benefits from switching options across multiple countries. In contrast, women CEOs might be less likely to take risks and they actively take advantage of switching opportunities embedded in multinational networks to reduce downside risk. Therefore, women CEOs are more likely to actively explore switching opportunities embedded in multinational networks when the external environment changes, thus enhancing the negative effect of multinationality on downside risk.

Additionally, compared to men, women are usually more sensitive to ethical issues and are more likely to act ethically ([Collins, 2000](#); [Croson and Gneezy, 2009](#)). Previous research finds that the ethical nature of women managers could help firms' actions become more ethical and reduce corporate agency problems ([Adams and Ferreira, 2009](#); [Gul et al., 2011](#)). MNCs usually face serious agency problems because it is difficult to supervise overseas business activities ([Fatemi, 1984](#)). [Kano and Verbeke \(2019\)](#) also suggested that MNCs operating in complex international situations tend to face heightened levels of bounded rationality and reliability, and an appropriate governance structure is needed to guarantee effective operations. Thus, a good corporate governance environment is important for MNCs. In such cases, women CEOs who behave more ethically are likely to enhance an MNC's ability to benefit from multinationality by building effective governance structures. Therefore, this study argues that women CEOs can help MNCs make better use of multinational switching opportunities, thus strengthening the negative relationship between multinationality and downside risk.

As discussed above, this study proposes the following hypothesis:

- H2.* The negative relationship between multinationality and downside risk is stronger in firms managed by women CEOs than it is in those managed by male CEOs.

Chief executive officer overseas experience

Previous studies suggest that managers' knowledge and experience in international markets play an important role in dealing with operational problems in uncertain overseas markets ([Azam et al., 2018](#); [Johanson and Vahlne, 2009](#)). For example, managers' overseas study and work experience provide rich market knowledge and communication skills and give them a strong ability to understand the production network and sales channels across countries ([Duan et al., 2020](#); [White, 2007](#)). In other words, CEOs with overseas experience possess rich knowledge of international markets and can better overcome the operational liabilities abroad. Thus, CEOs' overseas experience is conducive to helping MNCs reduce trade

barriers and shift operational activities among host countries in response to the changes in the external environment.

Furthermore, CEOs with overseas experience usually have broader overseas relationship networks (Reuber and Fischer, 1997; Conyon *et al.*, 2019). These networks are helpful for firms to quickly obtain international market information from multiple channels (Sharma and Blomstermo, 2003) and are conducive to evaluating the international market accurately, which helps firms make timely and effective multinational switching decisions. Therefore, CEOs with overseas experience can also help firms respond to external uncertain environments quickly and enhance the downside risk reduction effect of multinationality.

As discussed above, this study hypothesizes:

- H3. The negative relationship between multinationality and downside risk is stronger in firms managed by CEOs with overseas experience than in those managed by CEOs without overseas experience.

Chief executive officer functional background

A functional position often requires specific skills and knowledge. Experience in one functional position enables a person to have skills and knowledge connected to that function (Bermiss and Murmann, 2015; Waller *et al.*, 1995). In other words, CEOs with multiple functional backgrounds have diversified skills and a wider range of knowledge related to various functions. In this regard, CEOs with rich functional backgrounds will have the ability to understand the information processing methods, thinking patterns and communication habits of executives with different functional backgrounds and thus promote mutual understanding and communication efficiency among TMT members (Keller, 2001). Real options theory suggests that communication efficiency in the progress of information processing is particularly important for MNCs to obtain real options flexibility from multinationality, because these firms often face complex international environments and have wide information sources (Trigeorgis and Reuer, 2017). Thus, CEOs with more functional backgrounds will gain greater advantage in enhancing the negative relationship between multinationality and downside risk.

Additionally, CEOs who experience broad functional positions often understand the rules and practices of these diverse positions (Earley and Mosakowski, 2000). These CEOs tend to be more persuasive in dealing with conflicts among functionally diverse TMT members (Qian *et al.*, 2013). Broad functional backgrounds enable CEOs to effectively coordinate the relationship between TMT members in the process of exploring multinational switching opportunities, thus strengthening the negative relationship between multinationality and downside risk.

This study hypothesizes that:

- H4. The negative relationship between multinationality and downside risk is stronger in firms managed by CEOs with a broader functional background.

Chief executive officer educational level

Educational background is an important dimension that influences decision-makers' thinking mode, knowledge reserve and cognitive ability (Hambrick and Mason, 1984; Wally and Baum, 1994). Wiersema and Bantel (1992) suggested that highly educated decision-makers have a great knowledge base required for the rational and correct evaluation of a number of business decisions. Several studies have found that decision-makers with higher

educational levels have greater cognitive complexity because education enhances their ability to absorb new ideas and process complex information (Herrmann and Datta, 2002). Therefore, a higher educational level is closely related to a greater ability to process information and deal with complex conditions.

MNCs operating in multiple countries usually face complex environments because different countries have specific environments, such as cultures and institutions (Hsu *et al.*, 2013). In such conditions, CEOs with high educational levels will have a great ability to process international information and thus pay more attention to valuable decision-making information (Jiang and Murphy, 2007). Hence, in the process of exploring real options flexibility from multinational networks, CEO educational level is likely to play an important role in ensuring success. This study hypothesizes the following:

- H5.* The negative relationship between multinationality and downside risk is stronger in firms managed by CEOs with higher education levels.

Methodology

Data and sample

As the development of real options theory is based on MNCs engaged in manufacturing (Kogut and Kulatilaka, 1994), this study focuses on these kind of firms. Existing research suggests that owning overseas subsidiaries is a key feature of MNCs (Zhou, 2019). Information about foreign operating subsidiaries of A-share listed Chinese manufacturing firms from their annual financial reports is collected in this study. It includes only those firms with at least one overseas subsidiary in the research sample. The distribution of host countries in which Chinese overseas subsidiaries are located shows that Chinese manufacturing firms tend to operate in both developed and developing countries. These host countries typically have heterogeneous input markets and demand conditions. Hence, it seems to be true that there is room for Chinese manufacturing MNCs to exercise switching options across host countries.

This study further matches MNCs' multinationality data with CEO characteristics, as well as basic accounting information gathered from the China Stock Market and Accounting Research Database (CSMAR). Prior studies suggest that it is necessary to maintain reasonable within-industry sample sizes (Miller and Leiblein, 1996). This study only includes the two-digit industry in which it has at least 10 firms in each year (Belderbos *et al.*, 2014). The final sample consists of 1,875 observations, which contain Chinese publicly listed manufacturing MNCs that were active for at least five consecutive years from 2009 to 2020.

Dependent variable

Extant literature suggests that the real option's key contribution is that it offers the holder a right against downside risk (Bowman and Hurry, 1993). Thus, downside risk is taken as a dependent variable while investigating the implications of the real options theory on multinationality (Miller and Leiblein, 1996; Zhou, 2019). Particularly, this study specifies the *Downside Risk* using the following equation:

$$\text{Downside Risk}_{i,t} = \sqrt{\left(\frac{1}{5}\right) \sum_t^{t-4} (IROA_{i,t-1} - ROA_{i,t})^2 | IROA_{i,t-1} > ROA_{i,t}} \quad (1)$$

where $IROA_{i,t-1}$ represents firm i 's target performance level, measured as the average return on assets (ROA) for all firms in the same two-digit industry as firm i in the $t-1$ th year, and $ROA_{i,t}$

MBR
31,1

represents firm i 's ROA in year t . Over the five-year period, when the firm's ROA falls below $IROA_{i,t-1}$, the difference between $IROA_{i,t-1}$ and $ROA_{i,t}$ is calculated. Otherwise, the performance shortfall is zero. Then, *Downside Risk* is expected to be positive when a firm's performance is below the target performance level, and zero when the firm performs better than the target.

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Independent variables
MN. In line with prior studies (Tong and Reuer, 2007; Zhou, 2019), the independent variable of multinationality (*MN*) is measured by the number of foreign countries in which a firm has subsidiaries. Multinationality can be a good proxy for the idea that operating subsidiaries in foreign countries with heterogeneous environments offer MNCs a series of switching options to shift business activities to reduce the negative effects of external environmental uncertainty (Kogut and Kulatilaka, 1994).

Moderators
To test the moderating effects of CEO characteristics on the relationship between *MN* and *Downside Risk*, this study specifies the proxies for CEO characteristics as follows:

- *AGE*. *AGE* is measured as the natural logarithm of CEO age.
- *GENDER*. Gender is measured using dummy variables in this study. If the CEO is female, the value of *GENDER* is one and zero, otherwise.
- *OVERSEAS*. The existing literature suggests that overseas experience involves studying or working in foreign countries (Lee and Park, 2008). Therefore, this study measures CEO overseas experience by using a dummy variable (*OVERSEAS*). If a firm's CEO has overseas study or work experience, *OVERSEAS* has a value of one and zero, otherwise.
- *FUNCTION*. This study measures the broadness of the CEO's functional background (*FUNCTION*) using a numeric variable. The value of *FUNCTION* is the number of CEO's functional backgrounds. According to the previous classification of functional backgrounds, this study classifies functional backgrounds into the following eight categories: production, R&D, design, human resources, management, marketing, finance and law.
- *EDUCATION*. This study measures CEO's educational level (*EDUCATION*) by using an ordinal variable (Wei et al., 2018). *EDUCATION* takes values from 1 to 5, where 1 = technical secondary school and below, 2 = junior college, 3 = bachelor's degree, 4 = master's degree and 5 = doctorate. A higher *EDUCATION* value indicates a greater educational level of the CEO.

Control variables
This study controls for the following variables related to a firm's performance risk in the empirical models:

- *State*. If a government agency is the ultimate controller of a firm, then the *State* has a value of one and zero, otherwise.
- *Firm size*. This study controls for firm size because larger firms may have more resources to deploy internationally, and thus, have a greater buffer against downside risks (Zhou, 2019). *Firm size* was measured as the natural logarithm of total assets.

- *Slack*. Existing research suggests that organizational slack has a significant influence on a firm's risk. For example, [Miller and Leiblein \(1996\)](#) found that a firm's organizational slack is negatively related to its downside risk, whereas [Belderbos et al. \(2014\)](#) found that organizational slack is an indicator of a firm's low operating efficiency, resulting in a higher level of downside risk. Therefore, this study controls for organizational slack (*Slack*), measured as the sum of the ratios of receivables, inventory, selling and general and administrative expenses to total sales ([Belderbos et al., 2014](#)).
- *RD*. Firms with stronger innovation may have more investment opportunities in the future and thus have a greater ability to deal with external uncertainty. Therefore, this study controls for innovation ability (*RD*), measured as the natural logarithm of the number of a firm's patents plus one.
- *Tobin's Q*. Existing research suggests that a firm with a higher level of intangible assets will have distinct downside risk characteristics ([Tong and Reuer, 2007](#)). As a firm's general intangible assets are usually proxied by its Tobin's Q ([Morck and Yeung, 1992](#)), this study controls for *Tobin's Q*.
- *Growth*. High growth for a firm usually indicates that it has better future growth opportunities and enhances its ability to reduce downside risk. This study captures a firm's growth by using its sales revenue growth rate.
- *Firm age*. Older firms are likely to possess fewer investment opportunities and thus, have less ability to reduce their downside risk. We measured *Firm age* using the natural logarithm of years since establishment.

Additionally, this study constructs a set of industry and year dummy variables to control for industry- and period-fixed effects.

Analyses and results

Descriptive analysis results

[Table 1](#) presents the descriptive statistics of the main variables for the entire sample. As shown in [Table 1](#), on average, a firm establishes subsidiaries in approximately 2.236 foreign

Variable	N	Mean	SD	Min	Max
1. <i>Downside risk</i>	1875	0.022	0.028	0.000	0.158
2. <i>MN</i>	1875	2.236	1.962	1.000	13.400
3. <i>AGE</i>	1875	3.887	0.118	3.459	4.190
4. <i>GENDER</i>	1875	0.053	0.200	0.000	1.000
5. <i>OVERSEAS</i>	1875	0.083	0.248	0.000	1.000
6. <i>FUNCTION</i>	1875	1.734	0.633	1.000	4.000
7. <i>EDUCATION</i>	1875	3.795	1.281	1.400	5.000
8. <i>State</i>	1875	0.334	0.472	0.000	1.000
9. <i>Firm size</i>	1875	22.540	1.239	20.408	26.148
10. <i>Slack</i>	1875	0.503	0.276	0.116	1.570
11. <i>RD</i>	1875	2.886	1.741	0.000	8.443
12. <i>Tobin's Q</i>	1875	1.504	0.911	0.116	6.272
13. <i>Growth</i>	1875	0.127	0.136	-0.246	0.774
14. <i>Firm age</i>	1875	2.602	0.383	1.386	3.526

Notes: To keep in line with the dependent variable, the values of the independent and control variables are averaged for the same five years as *downside risk*

Table 1.
Descriptive statistics

countries, 5.3% of CEOs in the sample are women, the average age of CEOs is about 49 years, 8.3% of CEOs in the sample have overseas backgrounds, the average number of functional backgrounds for CEOs in the sample is 1.734 and the average degree of education for CEOs in the sample is higher than that of a bachelors.

Table 2 presents a correlation matrix for the main variables. The correlations between *MN* and other explanatory/control variables are all within acceptable ranges, which suggests that there is no significant multicollinearity problem in the study

Regression analysis results

In this study, we use a panel data set to investigate how CEO characteristics affect the relationship between multinationality and downside risks. Using a panel data set, fixed-effect models can be applied to better control for unobserved firm heterogeneity. As the dependent variable of downside risk is censored at zero and Tobit regressions are commonly applied to censored/truncated sets of data, this study adopts a Tobit panel estimation model with fixed effects, which is consistent with previous studies (Belderbos *et al.*, 2014).

Model 1 in Table 3 is a baseline model, which includes *MN*, *AGE*, *GENDER*, *OVERSEAS*, *FUNCTION*, *EDUCATION* and the main control variables. The regression results of the main control variables show that the coefficient of *State* is significantly positive ($\beta = 0.011, p < 0.05$), suggesting that state-owned firms have a higher downside risk. The coefficient of *Firm size* is significantly negative ($\beta = -0.016, p < 0.01$), indicating that a firm's downside risk decreases with size. The coefficient of *RD* is significantly negative ($\beta = -0.006, p < 0.01$), suggesting that a firm's downside risk decreases with its innovation ability. The coefficient of *Tobin's Q* is significantly negative ($\beta = -0.020, p < 0.01$), indicating that a firm's downside risk decreases with its intangible assets. The coefficient of *Growth* is significantly negative ($\beta = -0.050, p < 0.01$), suggesting that a firm's downside risk decreases with its growth. The coefficient of *MN* is significantly negative ($\beta = -0.001, p < 0.1$), suggesting that firms operating in more countries tend to have a lower downside risk. This result supports the key prediction of the real options theory on the downside risk reduction effect of multinationality.

The regression results of Model 2 in Table 3 were used to test *H1* by incorporating the interaction term between *MN* and *AGE* in the baseline model. *H1* argues that *MN*×*AGE* has a significantly negative effect on downside risk. The results show that the coefficient of *MN*×*AGE* is significantly negative ($\beta = -0.031, p < 0.01$), which supports *H1*.

The regression results of Model 3 in Table 3 were used to test *H2* by introducing the interaction term between *MN* and *GENDER* in the model. *H2* argues that *MN*×*GENDER* has a negative effect on downside risk. The coefficient of *MN*×*GENDER* is significantly negative ($\beta = -0.020, p < 0.01$). These results support *H2*.

The regression results of Model 4 in Table 3 were used to test *H3* by incorporating the interaction term between *MN* and *OVERSEAS* in the model. *H3* proposes that *MN*×*OVERSEAS* has a negative effect on downside risk. The coefficient of *MN*×*OVERSEAS* is significantly negative ($\beta = -0.036, p < 0.05$). These results support *H3*.

The regression results of Model 5 in Table 3 were used to test *H4* by incorporating the interaction term between *MN* and *FUNCTION* in the model. *H4* proposes that *MN*×*FUNCTION* has a negative effect on downside risk. The coefficient of *MN*×*FUNCTION* is significantly negative ($\beta = -0.002, p < 0.05$). These results support *H4*.

The regression results of Model 6 in Table 3 were used to test *H5* by incorporating the interaction term between *MN* and *EDUCATION* in the model. *H5* proposes that

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. <i>Downdside risk</i>	1												
2. <i>MN</i>	-0.161***	1											
3. <i>AGE</i>	0.091*	0.133***	1										
4. <i>GENDER</i>	-0.034	0.004	-0.085*	1									
5. <i>OVERSEAS</i>	-0.090*	0.102**	-0.074	-0.084*	1								
6. <i>FUNCTION</i>	-0.083	0.135***	-0.089*	0.177***	-0.049	1							
7. <i>EDUCATION</i>	0.05	-0.017	-0.139**	0.103*	0.015	0.136**	1						
8. <i>State</i>	0.303***	0.072	0.133***	-0.154***	-0.125**	-0.093*	0.148***	1					
9. <i>Firm size</i>	-0.122**	0.439***	0.199***	-0.065	0.015	0.038	0.06	0.348***	1				
10. <i>Slack</i>	0.063	-0.073	-0.015	0.077	0.024	-0.003	0.096*	-0.01	-0.310***	1			
11. <i>RD</i>	-0.098*	0.114**	0.215***	-0.164***	0.069	0.145***	0.105*	-0.007	0.160***	-0.001	1		
12. <i>Tobin's Q</i>	-0.164***	-0.225***	-0.165***	0.085*	0.137***	0.022	0.046	-0.268***	-0.598***	0.261***	0.054	1	
13. <i>Growth</i>	-0.233***	0.109**	-0.067	0.111**	0.022	0.100*	0.104*	-0.032	0.017	0.065	-0.001	0.176***	1
14. <i>Firm age</i>	0.113**	0.093*	0.169***	-0.073	0.031	-0.07	-0.124**	0.206***	0.256***	-0.149***	-0.08	-0.271***	-0.190***

Notes: $N = 1875$. Significance level * $p < 0.1$, ** $p < 0.05$ and *** $p < 0.01$

Table 2.
Correlation matrix

Table 3.
Results of Tobit
regression analyses
for the effects of CEO
characteristics

Variable	Downside risk						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<i>Constant</i>	0.420*** (0.097)	0.387*** (0.100)	0.428*** (0.097)	0.399*** (0.089)	0.420*** (0.098)	0.354*** (0.093)	0.185* (0.104)
<i>State</i>	0.011** (0.005)	0.012*** (0.005)	0.010** (0.005)	0.012** (0.005)	0.011** (0.005)	0.009* (0.005)	0.007 (0.005)
<i>Firm size</i>	-0.016*** (0.002)	-0.017*** (0.002)	-0.017*** (0.002)	-0.015*** (0.002)	-0.016*** (0.002)	-0.014*** (0.002)	-0.017*** (0.003)
<i>Slack</i>	0.009 (0.006)	0.008 (0.006)	0.010* (0.006)	0.008 (0.006)	0.009 (0.006)	0.008 (0.005)	0.006 (0.006)
<i>RD</i>	-0.006*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)
<i>Tobin's Q</i>	-0.020*** (0.003)	-0.020*** (0.003)	-0.020*** (0.003)	-0.020*** (0.003)	-0.020*** (0.003)	-0.019*** (0.003)	-0.022*** (0.003)
<i>Growth</i>	-0.050*** (0.017)	-0.050*** (0.017)	-0.052*** (0.018)	-0.053*** (0.017)	-0.050*** (0.017)	-0.059*** (0.017)	-0.064*** (0.016)
<i>Firm age</i>	0.004 (0.005)	0.005 (0.005)	0.004 (0.005)	0.004 (0.005)	0.004 (0.005)	0.003 (0.005)	0.006 (0.004)
<i>AGE</i>	0.000 (0.006)	-0.001 (0.006)	0.032*** (0.012)	0.000 (0.007)	0.000 (0.007)	0.002 (0.006)	0.035*** (0.013)
<i>GENDER</i>	-0.005 (0.017)	0.008 (0.022)	-0.005 (0.017)	-0.007 (0.016)	-0.005 (0.017)	-0.005 (0.015)	0.054*** (0.020)
<i>OVERSEAS</i>	0.000 (0.009)	-0.001 (0.009)	-0.001 (0.009)	0.083** (0.033)	0.000 (0.010)	0.007 (0.010)	0.094*** (0.029)
<i>FUNCTION</i>	-0.002 (0.002)	-0.002 (0.002)	-0.001 (0.002)	-0.000 (0.002)	-0.002 (0.004)	0.000 (0.002)	-0.002 (0.003)
<i>EDUCATION</i>	0.001 (0.002)	0.001 (0.002)	0.002 (0.002)	0.001 (0.001)	0.001 (0.002)	0.006** (0.002)	0.008*** (0.003)
<i>MN</i>	-0.001* (0.001)	0.025 (0.028)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.002)	0.010** (0.004)	0.145*** (0.036)
<i>MN × AGE</i>		-0.031*** (0.007)					-0.033*** (0.008)
<i>MN × GENDER</i>			-0.020*** (0.007)				-0.023*** (0.008)
<i>MN × OVERSEAS</i>				-0.036** (0.015)			-0.043*** (0.014)
<i>MN × FUNCTION</i>					-0.002** (0.001)		-0.003* (0.002)
<i>MN × EDUCATION</i>						-0.003*** (0.001)	-0.004** (0.002)
<i>N</i>	1,875	1,875	1,875	1,875	1,875	1,875	1,875

Notes: Significance level * <0.1; ** <0.05; *** <0.01. Values in parentheses are standard errors

$MN \times EDUCATION$ has a negative effect on downside risk. The coefficient of $MN \times EDUCATION$ is significantly negative ($\beta = -0.003, p < 0.01$). These results support $H5$.

Finally, this study provides regression results of Model 7 by incorporating all variables simultaneously in Table 3. The results in this column are consistent with those in previous columns.

Robustness check

Heckman two-stage method. In this study, we focus only on MNCs. As some unobservable factors that determine a firm's international entry may also affect the relationship between multinationality and downside risk, a sample selection bias may exist. This study applies the Heckman two-stage method to correct potential sample selection bias (Heckman, 1979). In the first stage, this study uses the following selection equations to predict the probability that a firm would enter the international market and calculate an inverse Mills ratio term:

$$\Pr(D_{i,t} = 1) = \omega_0 + \omega_1 Labor\ productivity_{i,t} + \vec{\lambda} X_{i,t} + \varepsilon_{i,t} \quad (2)$$

where $D_{i,t}$ indicates whether firm i has at least one foreign subsidiary. *Labor productivity* is a firm's labor productivity, measured by the natural logarithm of sales divided by the number of employees. *Labor productivity* is included in the selection equation because prior studies in the field of international business show that productivity plays a critical role in a firms' international entry (Helpman et al., 2004). $X_{i,t}$ includes a set of control variables, as mentioned in the previous section.

In the second stage, the inverse Mills ratio (*IMR*) generated in the first stage is included in the Tobit regression model as an additional explanatory variable. Table 4 reports the regression results by incorporating *IMR* into the Tobit model. The results show that the estimated coefficients of *IMR* in Table 4 are not statistically significant, suggesting that self-selection bias is not a serious concern in this study. Additionally, the results in Table 4 support the conclusions in Table 3, suggesting that the results of this study are robust.

Two-stage least squares regression. Firms with lower downside risks may expand to more countries than their counterparts will. In other words, non-sample-induced endogeneity may exist in this study. Two-stage least squares (2SLS) regression is an appropriate approach for addressing non-sample-induced endogeneity. In the first stage, this study regresses *MN* on a set of lagged instrumental variables (including domestic regional economic openness and labor productivity) and lagged covariates (including *MN*, firm size and firm growth). Industry-year effects are also included to reduce identification concerns. We then replace the actual value of the endogenous variable (*MN*) with its predicted scores (*MN_IV*) from the first stage. The F statistic in the first stage is 1316.52, which is higher than 10, and the Sargan statistic is 7.582 ($p > 0.1$), which suggests the validity of our instruments.

Table 5 presents the empirical results obtained by replacing *MN* with *MN_IV*. The results support the conclusions in Table 3, which suggest that the results of this study are robust when non-sample-induced endogeneity is controlled.

Alternative dependent variable

In the existing literature, in addition to using ROA as a performance indicator to calculate downside risk, some studies also use return on equity (ROE) as a performance indicator to calculate the downside risk (Tong and Reuer, 2007). To verify whether the above research conclusions hold when different indicators are used, this study calculates the downside risk

Table 4.
Results of robustness
check from using
Heckman two-stage
method

Variable	Downside risk						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<i>Constant</i>	1.426*** (0.367)	1.285*** (0.369)	1.483*** (0.367)	1.301*** (0.324)	1.406*** (0.370)	1.137*** (0.349)	0.612 (0.433)
<i>State</i>	0.015** (0.007)	0.015** (0.007)	0.013** (0.007)	0.016*** (0.006)	0.015** (0.007)	0.011* (0.006)	0.012* (0.007)
<i>Firm size</i>	-0.021*** (0.006)	-0.022*** (0.007)	-0.021*** (0.006)	-0.022*** (0.006)	-0.021*** (0.007)	-0.017*** (0.006)	-0.024*** (0.008)
<i>Slack</i>	0.007 (0.006)	0.007 (0.006)	0.009 (0.006)	0.007 (0.006)	0.008 (0.006)	0.007 (0.005)	0.005 (0.006)
<i>RD</i>	-0.007*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)	-0.006*** (0.002)	-0.008*** (0.002)
<i>Tobin's Q</i>	-0.020*** (0.003)	-0.020*** (0.003)	-0.020*** (0.003)	-0.021*** (0.003)	-0.020*** (0.003)	-0.020*** (0.003)	-0.022*** (0.003)
<i>Growth</i>	-0.041** (0.021)	-0.041** (0.021)	-0.044** (0.021)	-0.045** (0.019)	-0.042* (0.021)	-0.052*** (0.020)	-0.051** (0.020)
<i>Firm age</i>	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.006 (0.005)	0.005 (0.005)	0.007 (0.005)
<i>IMR</i>	-0.014 (0.018)	-0.014 (0.018)	-0.012 (0.018)	-0.019 (0.016)	-0.013 (0.019)	-0.009 (0.015)	-0.021 (0.020)
<i>AGE</i>	0.001 (0.006)	0.000 (0.006)	0.032*** (0.012)	0.001 (0.006)	0.001 (0.007)	0.003 (0.006)	0.035*** (0.013)
<i>GENDER</i>	-0.012 (0.017)	-0.005 (0.021)	-0.013 (0.017)	-0.014 (0.016)	-0.013 (0.017)	-0.011 (0.016)	0.041* (0.022)
<i>OVERSEAS</i>	-0.000 (0.009)	-0.001 (0.009)	-0.002 (0.009)	0.082** (0.034)	-0.000 (0.010)	0.007 (0.010)	0.094*** (0.031)
<i>FUNCTION</i>	-0.001 (0.002)	-0.001 (0.002)	0.000 (0.002)	0.001 (0.002)	-0.000 (0.004)	0.001 (0.002)	-0.002 (0.004)
<i>EDUCATION</i>	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)	-0.000 (0.002)	0.000 (0.002)	0.005** (0.003)	0.006** (0.003)
<i>MN</i>	-0.001* (0.001)	0.014 (0.027)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.002)	0.009** (0.004)	0.122*** (0.040)
<i>MN × AGE</i>		-0.023*** (0.007)					-0.028*** (0.009)
<i>MN × GENDER</i>			-0.020*** (0.007)				-0.023*** (0.008)
<i>MN × OVERSEAS</i>				-0.036** (0.015)			-0.042*** (0.014)
<i>MN × FUNCTION</i>					-0.002** (0.001)		-0.003* (0.002)
<i>MN × EDUCATION</i>						-0.003*** (0.001)	-0.003** (0.002)
<i>N</i>	1,875	1,875	1,875	1,875	1,875	1,875	1,875

Notes: Significance level * <0.1; ** <0.05; *** <0.01. Values in parentheses are standard errors

Variable	Downside risk						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<i>Constant</i>	0.458*** (0.001)	0.535*** (0.001)	0.445*** (0.001)	0.444*** (0.001)	0.436*** (0.001)	0.392*** (0.001)	0.355*** (0.001)
<i>State</i>	0.013*** (0.001)	0.013*** (0.001)	0.011*** (0.001)	0.013*** (0.001)	0.013*** (0.001)	0.010*** (0.001)	0.007*** (0.001)
<i>Firm size</i>	-0.015*** (0.000)	-0.013*** (0.000)	-0.015*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)	-0.013*** (0.000)	-0.013*** (0.000)
<i>Slack</i>	0.006*** (0.002)	0.008*** (0.002)	0.007*** (0.001)	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.007*** (0.001)
<i>RD</i>	-0.007*** (0.000)	-0.007*** (0.000)	-0.008*** (0.000)	-0.007*** (0.000)	-0.007*** (0.000)	-0.008*** (0.000)	-0.008*** (0.000)
<i>Tobin's Q</i>	-0.025*** (0.001)	-0.025*** (0.001)	-0.025*** (0.001)	-0.026*** (0.001)	-0.025*** (0.001)	-0.025*** (0.001)	-0.025*** (0.001)
<i>Growth</i>	-0.054*** (0.005)	-0.054*** (0.005)	-0.054*** (0.005)	-0.060*** (0.005)	-0.059*** (0.005)	-0.061*** (0.005)	-0.067*** (0.005)
<i>Firm age</i>	-0.001* (0.000)	-0.002*** (0.000)	-0.001 (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
<i>AGE</i>	-0.008*** (0.002)	-0.008*** (0.002)	0.024*** (0.002)	-0.009*** (0.002)	-0.008*** (0.002)	-0.008*** (0.002)	0.028*** (0.002)
<i>GENER</i>	-0.027*** (0.000)	-0.058*** (0.000)	-0.025*** (0.000)	-0.026*** (0.000)	-0.027*** (0.000)	-0.025*** (0.000)	-0.015*** (0.000)
<i>OVERSEAS</i>	-0.018*** (0.001)	-0.017*** (0.001)	-0.020*** (0.002)	0.034*** (0.002)	-0.016*** (0.002)	-0.013*** (0.002)	0.040*** (0.002)
<i>FUNCTION</i>	-0.002*** (0.001)	-0.001* (0.001)	-0.001*** (0.001)	-0.001* (0.001)	0.001 (0.001)	0.002*** (0.001)	0.000 (0.001)
<i>EDUCATION</i>	-0.002*** (0.000)	-0.003*** (0.000)	-0.001*** (0.000)	-0.003*** (0.000)	-0.003*** (0.000)	0.002*** (0.000)	0.004*** (0.000)
<i>MN_IV</i>	-0.001*** (0.000)	-0.005*** (0.000)	-0.000* (0.000)	-0.001*** (0.000)	0.001** (0.000)	0.009*** (0.000)	0.026*** (0.000)
<i>MN_IV × AGE</i>		-0.016*** (0.000)					-0.004*** (0.000)
<i>MN_IV × GENDER</i>			-0.019*** (0.001)				-0.023*** (0.001)
<i>MN_IV × OVERSEAS</i>				-0.022*** (0.001)			-0.024*** (0.001)
<i>MN_IV × FUNCTION</i>					-0.001*** (0.000)		-0.001*** (0.000)
<i>MN_IV × EDUCATION</i>						-0.003*** (0.000)	-0.003*** (0.000)
<i>N</i>	1,875	1,875	1,875	1,875	1,875	1,875	1,875

Notes: Significance level * <0.1; ** <0.05; *** <0.01. Values in parentheses are standard errors

Table 5.
Results of robustness
check by deploying
2SLS regression

of ROE performance and uses the new downside risk indicator as an alternative dependent variable.

Table 6 provides the regression results using the alternative dependent variable. The results support the conclusions in Table 3, which suggest that the research conclusions of this study can still hold when different indicators are used.

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Further analysis: the effects of chief executive officer across top management team size

Previous studies suggest that we should consider not only the CEO alone but also the CEO–TMT interface when investigating the effects of the CEO on firm performance (Georgakakis *et al.*, 2019, 2017). This study further investigates how the impact of CEO attributes is influenced by TMT characteristics. Specifically, this study empirically examines the different effects of CEO attributes across TMT sizes.

Prior studies suggest that firms with large TMT sizes will have complex formal systems and are likely to have difficulty communicating among TMT members (Shaw and Harkey, 1976; Wiersema and Bantel, 1992). In this regard, CEOs in firms with smaller TMT sizes will have more effective communication with other TMT members, and thus, these CEOs could exert greater influence on other TMT members. Therefore, the moderating effects of CEO characteristics on the relationship between multinationality and downside risk are expected to be more pronounced in firms with smaller TMT size.

Following Wiersema and Bantel (1992), this study defines TMT size as the total number of TMT members. To test the different effects of CEO characteristics on the relationship between multinationality and downside risk across TMT sizes, this study constructs two subsamples based on the median TMT size in the full sample and performs a subsample analysis. The two subsamples are Panel A, in which the firms' TMT size is smaller than or equal to the median TMT size of the full sample, and Panel B, in which the firms' TMT size is larger than the median TMT size of the full sample. Table 7 reports the empirical results of the subsample analysis.

The results in Models 1 and 2 show that the negative moderating effect of CEO age can be observed only in Panel A ($p < 0.01$) and not in Panel B. We further test whether the coefficients of $MN \times AGE$ in the two panels are different and find that the difference between the two coefficients is significant ($F = 5.16, p < 0.05$). The results indicate that the negative moderating effect of CEO age is more pronounced in firms with a smaller TMT size.

The results in Models 3 and 4 show that the negative moderating effect of CEO gender can be observed in both Panel A ($p < 0.01$) and Panel B ($p < 0.05$). We further test whether the coefficients of $MN \times GENDER$ in the two panels are different and find that the difference between the two coefficients is significant ($F = 9.48, p < 0.01$). The results indicate that the negative moderating effect of CEO gender is more pronounced in firms with a smaller TMT size.

The results in Models 5 and 6 show that the negative moderating effect of CEO overseas experience can be observed only in Panel A ($p < 0.01$) and not in Panel B. We further test whether the coefficients of $MN \times OVERSEAS$ in the two panels are different and find that the difference between the two coefficients is significant ($F = 7.11, p < 0.01$). The results indicate that the negative moderating effect of CEO overseas experience is more pronounced in firms with smaller TMT sizes.

The results in Models 7 and 8 show that the negative moderating effect of CEO functional background diversity can be observed only in Panel A ($p < 0.01$) and not in Panel B. We further test whether the coefficients of $MN \times FUNCTION$ in the two panels are different and find that the difference between the two coefficients is significant ($F = 8.13, p < 0.01$). The results indicate that the negative moderating effect of CEO functional background diversity is more pronounced in firms with a smaller TMT size.

Variable	Downside risk						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<i>Constant</i>	1.426*** (0.367)	1.285*** (0.369)	1.483*** (0.367)	1.301*** (0.324)	1.406*** (0.370)	1.137*** (0.349)	0.612 (0.433)
<i>State</i>	0.021 (0.018)	0.022 (0.018)	0.014 (0.017)	0.022 (0.018)	0.021 (0.018)	0.012 (0.019)	0.005 (0.018)
<i>Firm size</i>	-0.044*** (0.008)	-0.046*** (0.009)	-0.046*** (0.008)	-0.039*** (0.007)	-0.043*** (0.009)	-0.035*** (0.008)	-0.045*** (0.009)
<i>Slack</i>	0.026 (0.019)	0.024 (0.019)	0.033* (0.019)	0.024 (0.020)	0.026 (0.019)	0.018 (0.020)	0.018 (0.019)
<i>RD</i>	-0.014*** (0.004)	-0.015*** (0.004)	-0.015*** (0.005)	-0.011** (0.005)	-0.013*** (0.005)	-0.011** (0.004)	-0.013*** (0.005)
<i>Tobin's Q</i>	-0.050*** (0.012)	-0.051*** (0.012)	-0.050*** (0.012)	-0.050*** (0.009)	-0.050*** (0.012)	-0.048*** (0.010)	-0.055*** (0.009)
<i>Growth</i>	-0.185*** (0.059)	-0.185*** (0.058)	-0.192*** (0.060)	-0.205*** (0.056)	-0.192*** (0.057)	-0.220*** (0.058)	-0.229*** (0.052)
<i>Firm age</i>	0.014 (0.017)	0.015 (0.017)	0.014 (0.017)	0.013 (0.016)	0.012 (0.017)	0.007 (0.016)	0.016 (0.015)
<i>AGE</i>	-0.003 (0.046)	-0.006 (0.046)	0.135 (0.108)	0.003 (0.047)	0.001 (0.047)	0.009 (0.046)	0.165 (0.110)
<i>GENDER</i>	-0.076 (0.056)	-0.027 (0.073)	-0.081 (0.056)	-0.086 (0.053)	-0.080 (0.056)	-0.072 (0.051)	0.114 (0.078)
<i>OVERSEAS</i>	-0.038 (0.035)	-0.043 (0.036)	-0.047 (0.035)	0.251** (0.122)	-0.036 (0.036)	-0.003 (0.037)	0.279*** (0.106)
<i>FUNCTION</i>	-0.018** (0.008)	-0.020** (0.008)	-0.015* (0.008)	-0.012 (0.008)	-0.011 (0.013)	-0.010 (0.008)	-0.015 (0.012)
<i>EDUCATION</i>	-0.002 (0.006)	-0.001 (0.006)	0.000 (0.006)	-0.004 (0.005)	-0.002 (0.005)	0.014* (0.007)	0.016* (0.010)
<i>MN</i>	-0.010*** (0.004)	0.094 (0.110)	-0.009** (0.004)	-0.006* (0.003)	-0.005 (0.008)	0.032*** (0.012)	0.474*** (0.152)
<i>MN × AGE</i>		-0.097*** (0.028)					-0.111*** (0.035)
<i>MN × GENDER</i>			-0.086* (0.049)				-0.107** (0.051)
<i>MN × OVERSEAS</i>				-0.125** (0.063)			-0.145** (0.057)
<i>MN × FUNCTION</i>					-0.004*** (0.001)		-0.003** (0.002)
<i>MN × EDUCATION</i>						-0.012*** (0.004)	-0.011* (0.006)
<i>N</i>	1,875	1,875	1,875	1,875	1,875	1,875	1,875

Notes: Significance level * <0.1; ** <0.05; *** <0.01. Values in parentheses are standard errors

Table 6.
Results of robustness
check by using
alternative
dependent variables

Table 7.
Results on the effects
of CEO across TMT
size

Variable	Downside risk					
	Panel A Model 1	Panel B Model 2	Panel A Model 3	Panel B Model 4	Panel A Model 5	Panel B Model 6
<i>Constant</i>	0.257*** (0.001)	0.097 (0.105)	0.492*** (0.001)	0.158 (0.109)	0.478*** (0.001)	0.104 (0.107)
<i>State</i>	0.025*** (0.001)	0.016*** (0.006)	0.027*** (0.001)	0.014** (0.006)	0.033*** (0.001)	0.017*** (0.006)
<i>Firm size</i>	-0.016*** (0.000)	-0.013*** (0.003)	-0.014*** (0.000)	-0.011*** (0.003)	-0.015*** (0.000)	-0.009*** (0.002)
<i>Stack</i>	0.019*** (0.002)	0.002 (0.007)	0.033*** (0.002)	0.012** (0.006)	0.011*** (0.002)	0.015** (0.006)
<i>RD</i>	-0.009*** (0.000)	0.000 (0.002)	-0.006*** (0.000)	-0.000 (0.002)	-0.007*** (0.000)	0.001 (0.002)
<i>Tobin's Q</i>	-0.018*** (0.001)	-0.009*** (0.003)	-0.018*** (0.001)	-0.009*** (0.003)	-0.019*** (0.001)	-0.009*** (0.003)
<i>Growth</i>	-0.037*** (0.004)	-0.036*** (0.012)	-0.056*** (0.004)	-0.037*** (0.011)	-0.035*** (0.004)	-0.041*** (0.011)
<i>Firm age</i>	0.004*** (0.000)	0.003 (0.006)	0.002*** (0.000)	0.001 (0.006)	0.001*** (0.000)	-0.002 (0.006)
<i>AGE</i>	-0.004*** (0.001)	0.004 (0.007)	0.064*** (0.001)	0.020* (0.011)	0.010*** (0.001)	0.001 (0.008)
<i>GENDER</i>	0.025*** (0.000)	0.054*** (0.025)	-0.054*** (0.000)	0.026 (0.017)	-0.041*** (0.000)	0.028 (0.017)
<i>OVERSEAS</i>	0.025*** (0.003)	-0.035* (0.018)	0.022*** (0.003)	-0.028* (0.016)	0.167*** (0.004)	0.061 (0.039)
<i>FUNCTION</i>	-0.006*** (0.001)	-0.004 (0.003)	-0.000 (0.001)	-0.001 (0.003)	0.000 (0.001)	-0.003 (0.003)
<i>EDUCATION</i>	0.001* (0.000)	0.001 (0.001)	-0.001*** (0.000)	0.002* (0.001)	-0.002*** (0.000)	0.003*** (0.001)
<i>MN</i>	0.147*** (0.000)	0.063 (0.038)	-0.003*** (0.000)	0.001 (0.001)	-0.002*** (0.000)	0.001 (0.001)
<i>MN × AGE</i>	-0.038*** (0.000)	-0.016 (0.010)	-0.033*** (0.001)	-0.013** (0.006)		
<i>MN × GENDER</i>						
<i>MN × OVERSEAS</i>					-0.068*** (0.002)	-0.015 (0.036)
<i>MN × FUNCTION</i>						
<i>MN × EDUCATION</i>						
<i>F test of coefficient equality</i>						
<i>MN × AGE</i>	5.16**		9.48***			
<i>MN × GENDER</i>						
<i>MN × OVERSEAS</i>						
<i>MN × FUNCTION</i>						
<i>MN × EDUCATION</i>						
<i>N</i>	937	938	937	938	937	938

Notes: Panel A is the subsample in which the firms' TMT size is smaller than or equal to the median TMT size in the full sample. Panel B is the subsample in which the firm's TMT size is larger than the median TMT size in the full sample. Significance level * <0.1, ** <0.05, *** <0.01. Values in parentheses are standard errors

(continued)

Variable	Downside risk					
	Panel A Model 7	Panel B Model 8	Panel A Model 9	Panel B Model 10	Panel A Model 11	Panel B Model 12
<i>Constant</i>	0.426*** (0.001)	0.174 (0.115)	0.347*** (0.001)	0.210 (0.142)	0.202*** (0.001)	0.179 (0.188)
<i>State</i>	0.026*** (0.001)	0.016*** (0.006)	0.025*** (0.001)	0.017** (0.007)	0.024*** (0.001)	0.018** (0.007)
<i>Firm size</i>	-0.014*** (0.000)	-0.011*** (0.003)	-0.011*** (0.000)	-0.012*** (0.004)	-0.015*** (0.000)	-0.013*** (0.003)
<i>Slack</i>	0.022*** (0.002)	0.009 (0.006)	0.020*** (0.002)	0.009 (0.006)	0.027*** (0.002)	0.007 (0.008)
<i>RD</i>	-0.008*** (0.000)	-0.000 (0.002)	-0.007*** (0.000)	-0.000 (0.002)	-0.009*** (0.000)	0.000 (0.002)
<i>Tobin's Q</i>	-0.018*** (0.001)	-0.008** (0.003)	-0.020*** (0.001)	-0.008** (0.003)	-0.022*** (0.001)	-0.009*** (0.003)
<i>Growth</i>	-0.035*** (0.004)	-0.036*** (0.011)	-0.050*** (0.004)	-0.035*** (0.011)	-0.065*** (0.003)	-0.030*** (0.011)
<i>Firm age</i>	0.005*** (0.000)	0.001 (0.006)	0.006*** (0.000)	0.001 (0.006)	0.007*** (0.000)	-0.002 (0.007)
<i>AGE</i>	0.000 (0.001)	0.001 (0.007)	0.010*** (0.001)	0.000 (0.007)	0.067*** (0.002)	0.035** (0.016)
<i>GENDER</i>	-0.035*** (0.000)	0.024 (0.017)	-0.042*** (0.000)	0.021 (0.018)	0.029*** (0.000)	0.038 (0.033)
<i>OVERSEAS</i>	0.028*** (0.003)	-0.031* (0.017)	0.033*** (0.003)	-0.034 (0.021)	0.147*** (0.004)	0.055 (0.033)
<i>FUNCTION</i>	-0.010*** (0.001)	-0.004 (0.005)	0.003*** (0.001)	-0.003 (0.004)	-0.004*** (0.001)	-0.010 (0.006)
<i>EDUCATION</i>	-0.000 (0.000)	0.001 (0.001)	0.011*** (0.000)	-0.000 (0.003)	0.009*** (0.000)	-0.002 (0.004)
<i>MN</i>	-0.009*** (0.000)	-0.000 (0.002)	0.022*** (0.000)	-0.003 (0.005)	0.194*** (0.000)	0.006 (0.064)
<i>MN × AGE</i>					-0.045*** (0.001)	-0.021** (0.009)
<i>MN × GENDER</i>					-0.045*** (0.000)	-0.005 (0.014)
<i>MN × OVERSEAS</i>					-0.061*** (0.002)	-0.019 (0.029)
<i>MN × FUNCTION</i>	-0.003*** (0.000)	0.001 (0.001)	-0.008*** (0.000)	0.001 (0.001)	-0.004*** (0.000)	0.001 (0.002)
<i>MN × EDUCATION</i>					-0.007*** (0.000)	0.004 (0.003)
<i>F test of coefficient equality</i>						
<i>MN × AGE</i>						8.26***
<i>MN × GENDER</i>						7.19***
<i>MN × OVERSEAS</i>						6.52***
<i>MN × FUNCTION</i>	8.13***					9.27***
<i>MN × EDUCATION</i>				45.37***		12.68***
<i>N</i>	937	938	937	938	937	938

CEO
characteristics

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Table 7.

The results in Models 9 and 10 show that the negative moderating effect of CEO education level can be observed only in Panel A ($p < 0.01$) and not in Panel B. We further test whether the coefficients of $MN \times EDUCATION$ in the two panels are different and find that the difference between the two coefficients is significant ($F = 45.37$, $p < 0.01$). The results indicate that the negative moderating effect of CEO education level is more pronounced in firms with smaller TMT sizes.

Finally, Models 11 and 12 provide regression results by incorporating all variables simultaneously. The results in these columns are consistent with those reported in previous columns. These results support the argument that CEOs in firms with smaller TMT sizes exert greater influence on other TMT members.

Conclusion

According to real options theory, multinationality offers MNCs a set of switching options to adjust operating activities among their international networks in response to changing macroeconomic conditions and enhance MNCs' ability to select favorable outcomes in a dynamic environment (Kogut and Kulatilaka, 1994; McGrath, 1997). In other words, operating in multiple countries allows MNCs to maintain the flexibility to avoid downside risks arising from unexpected changes in macroeconomic conditions (Belderbos *et al.*, 2014; Ioulianou *et al.*, 2021). However, previous studies provide mixed evidence on the relationship between multinationality and downside risk (Allen and Pantzalis, 1996; Rangan, 1998; Reeb *et al.*, 1998; Reuer and Leiblein, 2000; Tang and Tikoo, 1999; Zhou, 2019). Studies on the microfoundation of MNCs suggest that the understanding of decision-makers' heterogeneity is the key to deeper understanding of MNCs' performance heterogeneity (Maitland and Sammartino, 2015; Kano and Verbeke, 2015; Kano and Verbeke, 2019). Hence, this study aims to analyze the relationship between multinationality and downside risk by investigating the effects of CEO characteristics in emerging markets. More specifically, this study examines the impact of multinationality on downside risk in Chinese firms and the moderating effect of CEO characteristics, such as age, gender, overseas experience, functional background and educational level, on the relationship between multinationality and downside risk.

Based on a sample of Chinese manufacturing MNCs from 2009 to 2020, the analyses found that multinationality exerts a strong negative effect on the downside risk of Chinese firms. This result is in line with the core theoretical prediction of real options theory and suggests that there exists a valuable switching opportunity in the multinational network constructed by Chinese firms. The analysis of the moderating effect of CEO characteristics on the relationship between multinationality and downside risk shows that older CEOs, women CEOs, CEOs with overseas experience or broader functional backgrounds or those with higher educational levels strengthen the negative effect of multinationality on downside risk. The findings suggest that CEOs' age, gender, overseas experience, functional background and educational level could affect their attitude and ability to take advantage of the global network in dealing with changes in the external environment and significantly influence the relationship between multinationality and downside risk.

Further analysis shows that the moderating effect of CEO characteristics on the relationship between multinationality and downside risk is more pronounced in firms with a smaller TMT size. The findings suggest that a small TMT size could facilitate communication between CEO and other TMT members, and CEOs in firms with smaller TMT sizes could exert greater influence on other TMT members. The results further indicate that we should consider not only the CEO alone but also the CEO-TMT interface when investigating the effect of CEO on firm performance.

The findings of this study have valuable implications for future researchers. First, although scholars have emphasized that the external environment and decision-makers' capabilities can be important factors in determining real options performance in MNCs, they usually pay attention to how macroeconomic conditions (e.g. exchange rate, market demand, labor cost) affect the real options performance of multinationality, whereas the effects of decision-makers remain poorly investigated. Our study suggests that researchers working in this area should consider the effects of decision makers in future research. Second, our findings also indicate that TMT could affect CEOs' influence on firm performance. Therefore, this study suggests that researchers should consider not only the CEO alone but also the CEO-TMT interface when investigating the effects of CEO attributes on firm performance. Third, the findings of this study emphasize the importance of micro foundations in international management and suggest that the understanding of decision-makers is important for understanding MNCs' performance heterogeneity (Maitland and Sammartino, 2015; Kano and Verbeke, 2015; Kano and Verbeke, 2019). Finally, our findings may have important implications for MNCs in emerging countries. For these MNCs, formal and informal institutional support in the external environment is generally lacking or ineffective (Agnihotri and Bhattacharya, 2021; Estrin and Prevezer, 2010; Peng *et al.*, 2004), and decision makers, such as CEOs, generally have a great influence on firms' strategic choices (Gao, 2011; Ting *et al.*, 2017). Thus, it may be particularly important to understand the role of decision-makers in MNCs' performance heterogeneity.

This study has several important practical implications. First, the findings suggest that multinationality offers valuable switching opportunities for firms in emerging countries to deal with external uncertainty and reduces their downside risk. This finding implies that multinationality could be an effective way for emerging market firms to reduce business risk. Second, the findings show that CEO characteristics and the CEO-TMT interface within a firm can affect a firm's attitudes and ability to obtain real options flexibility from a multinational network. Thus, a firm's top executive choices are highly important for effectively taking advantage of multinational switching options. Without a solid internal organizational base, real options flexibility does not necessarily benefit MNCs.

This study has several limitations that may offer some directions for future research. First, the empirical analysis in this study only considers MNCs in China. These findings may be subject to China's unique context. Future research based on firms in other countries with vastly varying economic environments may provide new evidence and further generalize the findings. Second, real options research suggests that there may exist subadditivity in an MNC's switching options portfolio, and subadditivity can potentially nullify the contribution of multinationality to downside risk mitigation (Belderbos *et al.*, 2014; McGrath, 1997). Due to data constraints, this study does not accurately assess the subadditivity associated with input markets or demand conditions across multinational investment portfolios. Future research can test our findings by considering accurate subadditivity in an MNC's switching options portfolio. Third, due to data constraints, this study captures CEO overseas experience using a dummy variable, which is widely used in the existing literature. However, a dummy variable cannot capture the exact magnitude of experience and the nuanced differences between study and work experience. Future research could extend this line of research by constructing more fine-grained variables. Fourth, in addition to the moderating effects of CEO characteristics on the relationship between multinationality and downside risk, there may be direct effects on an MNCs' foreign expansion and multinationality, thus affecting downside risk. Future research can extend the existing literature in this direction. Fifth, based on real options theory, this study suggests that multinationality grants MNCs switching options. However, this study cannot

directly identify whether MNCs actually use switching options provided by multinationality. Future research could examine the actual use of switching options for a particular MNC by using a case study.

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How Does Capital Intensity Affect the Relationship between Outward FDI and Productivity? Micro-evidence from Chinese Manufacturing Firms

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ABSTRACT

Based on outward foreign direct investment (OFDI) data of Chinese manufacturing companies in the period of 2001–2016, this paper examines the impact of capital intensity on the casual relationship between OFDI and productivity. Results show that, first, the pre-entry productivity of OFDI firms is higher than that of non-OFDI firms only for labor-intensive firms but not for capital-intensive firms, which suggests the self-selection effect only holds for labor-intensive firms. Second, the post-entry productivity improvement of OFDI firms only gained by capital-intensive firms but not by labor-intensive OFDI firms, which suggests the learning-by-doing effect only holds for capital-intensive firms. One possible explanation for these results is that the OFDI purpose of capital-intensive firms is to achieve technical progress while the OFDI purpose of labor-intensive firms is to gain profits.

KEYWORDS

Outward foreign direct investment; productivity; capital intensity; self-selection effect; learning-by-doing effect

JEL CLASSIFICATION

D2; F2; L6

Since China's entry into WTO, the Chinese government proposed a series of policies (e.g. "Go Out" policy and "One Belt One Road" policy) to strongly encourage domestic firms to invest in overseas to enhance their international competitiveness. The data from the Chinese National Bureau of Statistics show that China's outward FDI (OFDI) is growing fast after entering into WTO. In 2018, China's domestic investors have made investments in 188 countries/regions. The OFDI flow has achieved a total of 143 billion dollars, which accounts for 14.1% of the global OFDI flow and ranks second in the world. At the same time, China's OFDI stock has achieved a total of 1980 billion dollars, which accounts for 6.4% of the global OFDI stock and ranks third in the world. As OFDI from China plays an increasingly important role in global investment, the issues about what determines the OFDI decision of Chinese firms and what the benefits Chinese firms can get from OFDI become common concerns of academia and business community. Although a sizable literature has gone to the issues of Chinese OFDI (Buckley et al. 2007; Li et al. 2017; Ramasamy, Yeung, and Laforet 2012; Yang, Chen, and Huang 2013), there are

relatively few studies focusing on the relationship between OFDI and productivity with Chinese firm-level data (Chen, Lin, and Yabe 2019; Huang and Yang 2020; Li et al. 2017). As the relationship between OFDI and firm productivity is one of the important themes in the field of international trade, this paper seeks to address issues of Chinese OFDI by studying the casual relationship between OFDI and firm productivity.

Prior studies in international trade propose two hypotheses to address the relationship between OFDI and firm productivity. One is the self-selection hypothesis. This hypothesis has both theoretical basis and empirical support. Melitz (2003) and Helpman, Melitz, and Yeaple (2004) have done pioneering works for the theoretical basis of self-selection hypothesis. Melitz (2003) theoretically clarifies the relationship between exports and firm heterogeneity, represented as productivity, in a general equilibrium framework. Melitz (2003) concludes that the higher productivity of the firm, the more it is likely to be an exporter. Extending the model of Melitz (2003), Helpman, Melitz, and Yeaple (2004) further clarify the relationship among export, outward FDI, and firm heterogeneity, represented as productivity. In Helpman, Melitz, and Yeaple (2004), firms choosing to serve a foreign market via OFDI face the highest fixed costs, and they need to be more productive to make up for these costs and get monopolistic profits. Therefore, the implication of Helpman, Melitz, and Yeaple (2004) suggests that there is self-selection for firms entering into international markets via OFDI and OFDI firms are generally more productive than non-OFDI ones. The self-selection hypothesis has been confirmed in many empirical studies utilizing firm plant-level data from many countries (e.g. Kimura and Kiyota (2006) in Japan; Damijan, Polanec, and Prašnikar (2007) in Slovenia and Engel, Procher, and Schmidt (2013) in France).

Learning-by-doing hypothesis is another one to address the relationship between OFDI and firm productivity. This hypothesis suggests that the operation in foreign markets allows OFDI firms to gain potential productivity growth through additional ways, such as profit from economies of scale, increased competition in international markets that forces firms to behave more productive, knowledge flows from international market (that provides information about process and product innovations, reducing costs and improving quality), and staff with different culture and knowledge backgrounds from different countries may also contribute to the innovation and technological progress in OFDI firms. There are several studies providing evidences for this hypothesis. For example, Branstetter (2006) provides evidences with Japanese firms. Yang, Chen, and Huang (2013) provide evidence with firms in Chinese Taiwan.

In this paper, we argue that the capital intensity is important for the relationship between OFDI and productivity in firms from emerging markets because firms with different level of capital intensity may have different OFDI purposes, which will result in different relationship between OFDI and

productivity. In particular, capital-intensive firms are often highly technology intensive and they rely heavily on technology to compete. However, the technological level of firms in developing countries is relatively lower than that of firms in developed countries. In order to enhance their competitiveness, the OFDI purposes of capital-intensive firms from developing countries are mainly to access advanced foreign technology and enhance their efficiency rather than to gain profit in international market (Makino, Lau, and Yeh 2002). Therefore, we expect that, for capital-intensive firms, the self-selection hypothesis may not be supported while the learning-by-doing hypothesis may be supported.

Compared with capital-intensive firms, labor-intensive firms rely more heavily on low-cost labor rather than technology, and one important competitiveness for firms from developing countries is the low-cost labor. In order to expand their competitive advantage and achieve more profits in international market, OFDI is an important option for labor-intensive firms from developing countries. According to the theory of Helpman, Melitz, and Yeaple (2004), one condition for firms who want to gain profits in the international market is to be more productive before entering international market. Thus, we expect that, for labor-intensive firms, the self-selection hypothesis may be supported while the learning-by-doing hypothesis may not be supported.

In spite of a large number of empirical studies have studied the relationship between OFDI and firm productivity, there are few papers explicitly and thoroughly analyzing how capital intensity may have influence on the causal relationship between OFDI and productivity. To fill this gap, we aim to investigate two predictions of the relationship between OFDI and firm productivity across firms with different capital intensities in this paper. First, we test the self-selection prediction that productivity promotes firms into OFDI by using propensity score matching (PSM). Second, we test the learning-by-doing prediction that OFDI boosts a firm's productivity growth by using PSM and difference-in-differences (DID) analysis.

In order to test these predictions, we use a unique hand-collected data set comprising Chinese publicly traded manufacturing firms and their international operation activities in the period of 2001–2016. Our results provide several important insights. First, we find the productivity distribution for OFDI firms stochastically dominates that of non-OFDI firms, which holds for both capital-intensive firms and labor-intensive firms. Second, the pre-entry productivity of OFDI starters is higher than that of the matched non-OFDI firms in labor-intensive firms while the pre-entry productivity difference between OFDI starters and the matched non-OFDI firms is not statistically significant in capital-intensive firms. This result indicates the self-selection prediction only holds for labor-intensive firms. Third, we find capital-intensive firms can gain post-entry extra productivity growth but labor-intensive firms cannot, which suggests that learning-by-doing effects of OFDI

only happen for capital-intensive firms. The results above suggest that higher productivity of capital-intensive OFDI firms originates from learning-by-doing effects of OFDI while higher productivity of labor-intensive OFDI firms originates from self-selection of OFDI.

The rest of this paper is organized as follows: Section 2 presents the data source and descriptive statistics. Section 3 is devoted to the analysis of whether productivity promotes firms into OFDI and the influence of capital intensity. Section 4 analyzes whether OFDI contributes to productivity growth of OFDI firms and the difference between capital-intensive firms and labor-intensive firms. Section 5 concludes.

1. Data and Overview

The OFDI data set used in this paper is unique because the detail OFDI data of Chinese listed firms is not available from any open database. We hand-collect OFDI information for all Chinese manufacturing firms publicly traded on the A-share market during 2001–2016 from their annual financial reports. The annual financial reports are gotten from <http://www.cninfo.com.cn/cninfo-new/index>, which is an official designated website for Chinese listed firms to disclose information. In our sample, we exclude the following types of OFDI: (i) OFDI in tax havens (e.g. Cayman Islands, Virgin Islands, and Bermuda), (ii) OFDI for investment management, (iii) OFDI for natural resources. Since we need financial data to support our research (e.g. the calculation of productivity and the matching progress), we only consider firms for which we can access basic accounting and market information from the China Stock Market & Accounting Research Database (CSMAR), developed by GTA Information Technology, one of the major providers of Chinese data. As the analysis of learning-by-doing effect requires financial data of 3 years before and after the year of a firm's OFDI occurrence, our financial data covers the period of 1998–2019.

Given our interest in studying the capital intensity on the casual relationship between OFDI and productivity, we divide the sample into two categories, one is capital-intensive firms, and the other is labor-intensive firms. In line with prior studies (Kucera and Sarna 2006), we define labor-intensive and capital-intensive firms according to their industry characteristics. In this paper, we follow the definition of labor-intensive and capital-intensive industries provided by Kucera and Sarna (2006). Table 1 shows the detailed categorization of labor-intensive and capital-intensive industries. The industries categorized as labor-intensive in this paper are similar to those characterized as such by other studies (Kucera and Sarna 2006) which include the light manufacturing industries for which their product can be readily conveyed by hand and for which there do not appear to be large technological barriers preventing firms in these industries to compete in international markets. The capital-intensive industries are those whose products

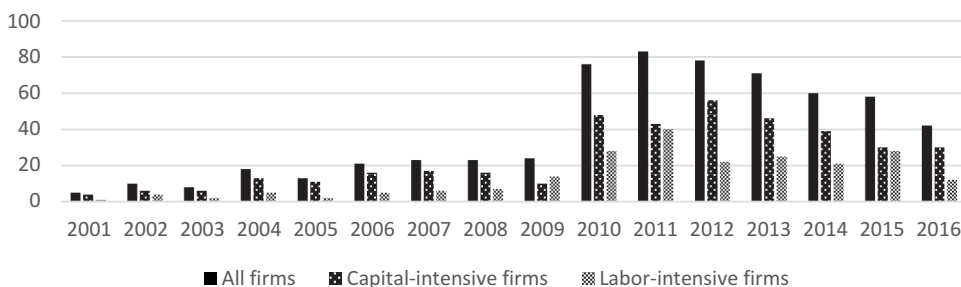
Table 1. The categorization of labor-intensive and capital-intensive industries.

Industry code	Labor-intensive industries
C17	Manufacture of textiles
C18	Textile clothing and apparel industry
C19	Leather, fur, feather and related products, and footwear Industry
C20	Wood processing and wood, bamboo, rattan, brown and grass products industry
C21	Furniture manufacturing industry
C22	Paper and paper products industry
C23	Printing, publishing, and allied industries
C24	Manufacturing of cultural, educational, art and craft, sports and entertainment goods
C29	Rubber and plastic products industry
C30	Nonmetallic mineral products industry
C33	Manufacture of fabricated metal products
C34	General equipment manufacturing industry
C35	Manufacturing of special equipment
Industry code	Capital-intensive industries
C14	Food manufacturing industry
C15	Wine, beverage, and refined tea manufacturing industry
C25	Petroleum processing, coking, and nuclear fuel processing industry
C26	Manufacturing of chemical materials and chemicals
C27	Pharmaceutical manufacturing industry
C28	Chemical fiber manufacturing industry
C31	Ferrous metal smelting and calendering industry
C32	Nonferrous metal smelting and calendering industry
C36	Automobile manufacturing industry
C37	Manufacturing of railway, ship, aerospace, and other transportation equipment
C38	Electrical machinery and equipment manufacturing industry
C39	Manufacturing of computers, communications, and other electronic equipment

Industry code and name are from China Securities Regulatory Commission Industry Classification of Listed Companies (2012 version).

are produced by highly automated “continuous-process” technologies (Kucera and Sarna 2006).

Figure 1 demonstrates the number of new OFDI firms in our samples for the period of 2001 to 2016. As a firm’s information before its initial public offerings (IPO) is not available, the new OFDI firms above are those having made OFDI in the sample period. In the “capital intensity and self-selection effect” part and “capital intensity and learning-by-doing effect” part, only 391 new OFDI firms are kept due to the missing value of other financial variables used in this paper. Figure 1 shows that the number of new OFDI firms shows a boost after the crisis of 2008, and the new OFDI firms in capital-intensive firms increase more quickly than that in labor-intensive firms after the crisis of 2008.

**Figure 1.** The distribution of new OFDI firms during 2001–2016.

Productivity is a central variable in this paper. We measure the productivity by using a firm's total factor productivity (TFP), which is widely used in the study of productivity. Since traditional ordinary least squares estimation of the production function given may lead to simultaneity bias and selection bias, we use a semi-parametric estimation procedure proposed by Levinsohn and Petrin (2003) to deal with the endogeneity problem.

Before testing for self-selection and learning, we present some analysis of the relationship between OFDI status and productivity in this part, which will get a first picture of the productivity difference between OFDI firms and non-OFDI firms. As both the self-selection hypothesis and the learning-by-OFDI hypothesis suggest that OFDI firms have higher TFP levels, we expect the productivity of OFDI firms will dominate non-OFDI firms. We follow Delgado, Farinas, and Ruano (2002) to test the rank ordering of the productivity distribution of firms that differ in their involvement in the international markets. In Table 2, we report the results using KS test on the cumulative productivity distributions of TFP levels for various types of firms (i.e. All firms, capital-intensive firms, and labor-intensive firms). The two-sided KS test suggests the cumulative productivity distribution of OFDI firms is not equal to that of non-OFDI firms in all types of firms. Further, the one-sided KS test suggests the cumulative productivity distribution of OFDI firms dominates that of non-OFDI firms. From the evidences above we can conclude that the productivity distribution of OFDI firms stochastically dominates non-OFDI firms.

2. Capital Intensity and Self-selection Effect

Self-selection hypotheses supposes that productivity promotes firms into OFDI. Past studies testing the hypotheses often simply compare the TFP between OFDI firms and non-OFDI firms. However, a firm's specific characteristics may also have influence on its OFDI decision. Thus, if we want to understand the influence of productivity on firms' OFDI decisions, to properly control for firms' specific characteristics is needed. Matching technique is widely used by a large number of studies to select a control group whose distribution of observed characteristics in the pre-entry period is as similar as possible to the distribution in the OFDI starters group.

Table 2. TFP differences between OFDI firms and non-OFDI firms.

Group	Number of observations		Equality of distributions	Favorable difference to	
	OFDI firms	Non-OFDI firms		OFDI firms	Non-OFDI firms
All firms	3276	10373	0.35*** (0.00)	-0.00 (1.00)	0.35*** (0.00)
Capital-intensive firms	2188	6714	0.35*** (0.00)	-0.00 (1.00)	0.35*** (0.000)
Labor-intensive firms	1088	3659	0.38*** (0.00)	-0.00 (1.00)	0.38*** (0.00)

P-value in parentheses. *** indicate significance at 1% level.

More specifically in this paper, let Y denote TFP and $D_{i,t} \in \{0, 1\}$ be an indicator of whether firm i is an OFDI starter in period t (as opposed to a non-OFDI firms). Thus, we can use $Y_{i,t-1}(1)$ define the TFP of an OFDI firm in $t-1$, for firm i classified as OFDI starter in t , and $Y_{j,t-1}(0)$ as the TFP for a non-OFDI firm j if it has the same characteristics (expect TFP) with OFDI firm i . The self-selection effect of OFDI for firm i at time $t-1$ can be defined as:

$$Y_{i,t-1}(1) - Y_{j,t-1}(0) \quad (1)$$

The main problem is how to find the non-OFDI firm j which has the same characteristics (expect TFP) with OFDI firm i . We overcome this problem by employing the PSM technique, which is proposed by Rosenbaum and Rubin (1983). The PSM technique allows us to select, from a pool of non-OFDI firms in t , a control group with a set of observable variables (X in $t-1$) affecting the probability of OFDI, as similar as possible to that of OFDI starters. It is then assumed that conditional on X (expect TFP), firms with the same characteristics will make decision to involve in international investment only based on TFP. Thus, expression (1) can be rewritten as:

$$E\{Y_{i,t-1}(1)|X_{i,t-1}\} - E\{Y_{j,t-1}(0)|X_{i,t-1}\} \quad (2)$$

As the matching technique relies on the probability of OFDI, we obtain the probability of a firm to start its first OFDI (propensity score) before performing the matching by using the following Probit model:

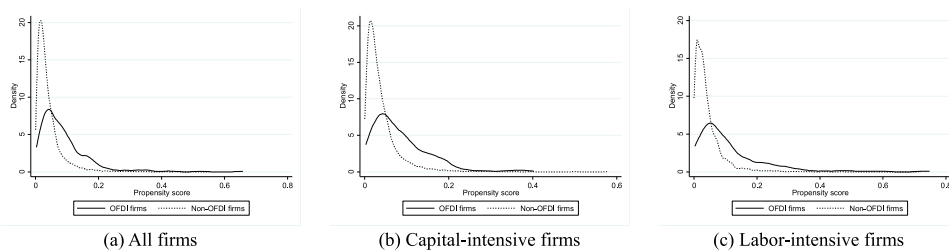
$$P(D_{i,t} = 1) = F(X_{i,t-1}) \quad (3)$$

In particular, $X_{i,t-1}$ includes the following factors: State ownership, firm size, capital intensity, firm growth, innovation ability, firm age, the exporting intensity, debt level, a vector of time, and industry dummy variables.

In the matching analysis, we compare the productivity of OFDI starters and matched non-OFDI firms for the times $t-1$. Figure 2 maps the kernel density functions of propensity score for OFDI starters and non-OFDI firms in all firms, capital-intensive firms, and labor-intensive firms, respectively. From this figure, we can derive the following evidences: (i) Before matching, the kernel density functions of propensity score for OFDI firms and non-OFDI firms are significantly different from each other. (ii) After matching, the kernel density functions of propensity score for the two groups almost overlap, suggesting that the two groups have almost similar characteristics. The results suggest that our matching process is able to find appropriate matches for OFDI firms in all firm group, capital-intensive firm group, and labor-intensive firm group.

Table 3 shows TFP of OFDI firms is not significantly higher than that of the matched non-OFDI firms in all firms as well as capital-intensive firms, but TFP of OFDI firms is significantly different from that of the matched non-OFDI

(1) Pre-matching



(2) After matching

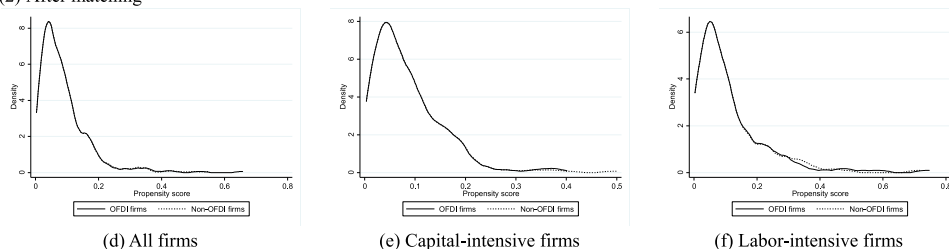


Figure 2. Propensity score of pre-matching and after-matching for self-selection effects. Only firms have made OFDI decision during the sample period are kept in the treated group (OFDI firms).

Table 3. TFP difference in t-1.

Group	Time	TFP		TFP difference	N
		OFDI firms	Non-OFDI firms		
All firms	t-1	12.45	12.22	0.23***	391 (391)
Capital-intensive firms	t-1	12.51	12.43	0.08	260 (260)
Labor-intensive firms	t-1	12.34	12.06	0.28***	131 (131)

Only firms have made OFDI decision during the sample period are kept in the treated group (OFDI firms). N stands for observations: number of OFDI firms and number of control observations in parentheses. *** indicate significance at 1% level.

firms in labor-intensive firms. The results imply that the self-selection effect is great for labor-intensive firms involving in international operation via OFDI, but the self-selection effect is not bound for capital-intensive firms. This may due to the high extra cost of international involvement for labor-intensive firms and thus productivity is more critical for labor-intensive firms to survive in international operation. Existing studies have provided some evidences. For example, Bernard, Jensen, and Schott (2006) reveal that the extra cost (e.g. tax) of involving in international business is the highest in labor-intensive firms and lowest in capital-intensive firms.

3. Capital Intensity and Learning-by-doing Effect

In this section, we examine whether or not OFDI contributes to productivity growth of OFDI firms and the difference between capital-intensive firms and labor-intensive firms. To test the effects of OFDI on productivity growth, we should construct an appropriate comparison group of firms without OFDI,

which is called control group hereafter. Since OFDI and non-OFDI firms usually differ considerably in many characteristics, such as size, technology, and productivity. These factors have been found to influence a firm's competitive advantages, with considerable bearing on the decision of the firm to undertake OFDI. At the same time, these factors are also important in determining the firms' productivity. If all non-OFDI firms are used as a control group, this might lead to self-selection bias when evaluating the impact of OFDI activity. The method of propensity score matching is used in this section to deal with the selection problem by constructing a comparison group of firms from non-OFDI firms with observable characteristics similar to those of OFDI firms. The method of propensity score matching is proposed by Rosenbaum and Rubin (1983), which is widely used to deal with the selection problem (Heckman, Ichimura, and Todd 1997; Yang, Chen, and Huang 2013). In this section, we first construct comparison group of firms by using propensity score matching and then we employ DID analysis to compare the productivity growth between OFDI firms and the matched control group to test whether OFDI firms benefit from OFDI.

More specifically in this paper, let ΔY denote the TFP difference and $D_{i,t} \in \{0, 1\}$ be an indicator of whether firm i is an OFDI starter in period t (as opposed to a non-OFDI firms). Thus, we can use $\Delta Y_{i,(t-1)+s}(1)$ define the TFP difference of an OFDI firm between $t-1$ and $(t-1)+s$, $s > 0$, for firm i classified as OFDI starter in t , and $\Delta Y_{i,(t-1)+s}(0)$ as the TFP difference for firm i if it did not become an OFDI firm. The learning effect of OFDI for firm i at time $(t-1)+s$ can be defined as:

$$\Delta Y_{i,(t-1)+s}(1) - \Delta Y_{i,(t-1)+s}(0) \quad (4)$$

Following the policy/treatment evaluation literature (e.g. Heckman, Ichimura, and Todd 1997), we define the average effect of OFDI on firms who start to OFDI as:

$$\begin{aligned} \text{ATT} &= E[\Delta Y_{i,(t-1)+s}(1) - \Delta Y_{i,(t-1)+s}(0) | D_{i,t} = 1] \\ &= E[\Delta Y_{i,(t-1)+s}(1) | D_{i,t} = 1] - E[\Delta Y_{i,(t-1)+s}(0) | D_{i,t} = 1] \end{aligned} \quad (5)$$

The ideal context is that we can get both $\Delta Y_{i,t}(1)$ and $\Delta Y_{i,t}(0)$ at the same time, but in reality, the counterfactual $\Delta Y_{i,t}(0)$ is not observed. Therefore, we have to construct a group of non-OFDI firms that have the same characteristics with OFDI firms, generating $\Delta Y_{i,t}(0)$.

By using matching techniques, we select the matched non-OFDI firms for OFDI firms from a pool of non-OFDI firms based on a set of observable variables (X) affecting productivity growth. Those matched non-OFDI firms have similar probability to start OFDI with OFDI starters in $t-1$. It is then assumed that, conditional on X , firms with the same characteristics randomly involve in international investment. Thus, expression (5) can be rewritten as:

$$ATT = E[\Delta Y_{i,(t-1)+s}(1)|X_{i,t-1}, D_{i,t} = 1] - E[\Delta Y_{i,(t-1)+s}(0)|X_{i,t-1}, D_{i,t} = 0] \quad (6)$$

Since the probability of becoming an OFDI starter (propensity score) is the basis to perform the matching, we employ the following Probit model to obtain the predicted probability.

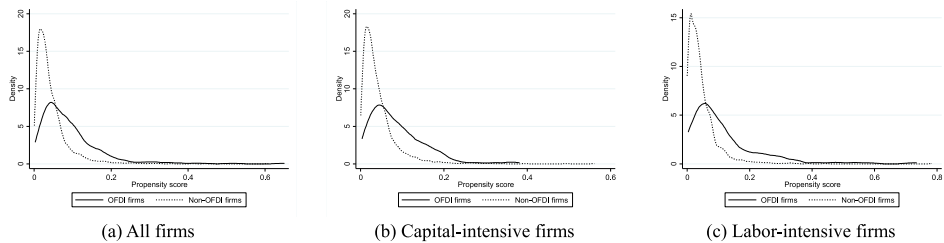
$$P(D_{i,t} = 1) = F(X_{i,t-1}) \quad (7)$$

As TFP is an important factor affecting firms' probability of OFDI and their productivity growth, we also include firms' TFP into X in addition to variables in Model (3).

Figure 3 shows the kernel density functions of propensity score, based on the OFDI firms and the non-OFDI firms in the pre- and post-matching. Figure 3 clearly shows that, before matching, the kernel density functions of propensity score for OFDI firms and that for non-OFDI firms are significantly different from each other, but after matching, the kernel density functions of propensity score for the two groups almost overlap, suggesting that the two groups have almost similar characteristics after matching. The results suggest that our matching process is able to find appropriate matches for OFDI firms in all firm group, capital-intensive firm group, and labor-intensive firm group.

In addition, the using of DID method should satisfy the parallel trend hypothesis, that is, TFP of the treatment group and control group should

(1) Pre-matching



(2) After matching

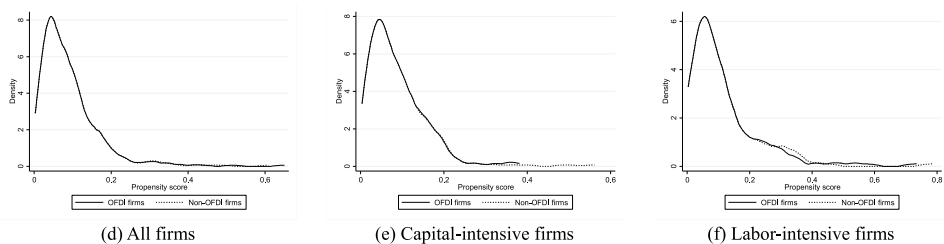


Figure 3. Propensity score of pre-matching and after-matching for learning-by-doing effects. Only firms have made OFDI decision during the sample period are kept in the treated group (OFDI firms).

have the same change trend before the OFDI occurs. Thus, we further test parallel trend hypothesis by using the following model.

$$TFP_{i,t} = \beta_0 + \beta_1 Pre1year_{i,t} \times FDI_i + \beta_2 Pre2year_{i,t} \times FDI_i + \beta_3 Pre3year_{i,t} \times FDI_i + \vec{\tau}Z_{i,t} + \vec{\gamma}W_{i,t} + \varepsilon_{i,t} \quad (8)$$

Where *Pre1year*, *Pre2year*, *Pre3year_{i,t}* and *FDI* are dummy variables, *Pre1year* takes the value 1 if the year is the first year before OFDI year and 0 otherwise. *Pre2year* takes the value 1 if the year is the second year before OFDI year and 0 otherwise. *Pre3year* takes the value 1 if the year is the third year before OFDI year and 0 otherwise. *FDI* takes the value 1 if the firm is OFDI firms and 0 otherwise. *Z* represents a vector of control variables including state ownership, firm size, capital intensity, growth, innovation ability, firm age, exporting intensity, debt level. These control variables are measured as previous section.

Table 4 shows the coefficients of *Pre1 year*×*FDI*, *Pre2 year*×*FDI*, and *Pre3 year*×*FDI* are all not statistically significant, suggesting the TFP change trends of the treatment group and control group are almost the same in the 3 years before OFDI decision. Therefore, the results support the parallel trend hypothesis.

In this part, we start to analyze whether firms' OFDI contributes their TFP growth and the difference between capital-intensive firms and labor-intensive firms by using the DID analysis based on the sample constructed by PSM technique. We set the following model to achieve our goal.

$$\Delta TFP_{i,t_0-1+s} = TFP_{i,t_0-1+s} - TFP_{i,t_0-1} = \theta_0 + \theta_1 FDI + \vec{\tau}Z_{i,t} + \vec{\gamma}W_{i,t} + \varepsilon_{i,t} \quad (9)$$

where *t₀* is the year of the firm starts to initiate an OFDI, *s* = 1, 2, 3,4. Since the TFP is a natural logarithmic form, $\Delta TFP_{i,t_0-1+s}$ is a firm's TFP growth after *s* years of OFDI. *FDI* is a dummy variable. If a firm is an OFDI firm, *FDI* takes value 1, and 0 otherwise. *Z* and *W* represent vectors of control variables as

Table 4. Testing the parallel trend hypothesis.

Variables	All firms	Capital-intensive firms	Labor-intensive firms
<i>Pre1 year</i> × <i>FDI</i>	0.05 (0.03)	0.06 (0.04)	−0.01 (0.05)
<i>Pre2 year</i> × <i>FDI</i>	0.04 (0.03)	0.06 (0.04)	−0.01 (0.05)
<i>Pre3 year</i> × <i>FDI</i>	0.03 (0.04)	0.05 (0.05)	−0.03 (0.05)
<i>Controls</i>	YES	YES	YES
<i>Intercept</i>	0.77* (0.43)	1.18** (0.51)	0.95 (0.63)
<i>N</i>	2346	1560	786
<i>R</i> ²	0.58	0.57	0.63

The sample includes firms have made OFDI decision during the sample period and the matched control group. Values in the parentheses are standard errors. *N* stands for observations. * and ** indicate significance at 10% and 5% level, respectively.

mentioned in previous section, which aims to control a firm's other characteristics, time trend, and industry effects in TFP growth. In Model (9), we use the TFP difference as dependent variable directly, so the coefficient of *FDI* capture the DID effects. More specifically, θ_1 is the extra productivity growth difference between OFDI firms and the control groups.

In the analysis, we compare the productivity growth difference of OFDI starters and the matched non-OFDI firms for four periods after OFDI. Table 5 reports the results of these comparisons. Table 5 clearly shows that, for all firms, the coefficients of *FDI* are positive and statistically significant (i.e. $p < .05$) for the three periods, suggesting that the productivity growth of OFDI starters is significantly higher than that of matched non-OFDI firms and this productivity growth difference increasingly larger after the year of OFDI. Specifically, on average, the productivity growth for OFDI starters is 9% higher than that of non-OFDI firms in the second year of OFDI, and this differential growth quickly increases to 16% for firms with 4 years of OFDI experience. Therefore, on average, learning-by-doing effects do exist for the OFDI firms in all firm group.

For capital-intensive firms, we find the coefficients of *FDI* are positive and statistically significant (i.e. $p < .05$) for the three periods, suggesting that OFDI starters gain significantly higher productivity growth than the matched non-OFDI firms, and the extra productivity growth increasingly larger after the year of OFDI. More specifically, compared with the matched capital-intensive non-OFDI firms, the capital-intensive OFDI starters gain 9% extra productivity growth in the second year of OFDI, and the extra productivity growth gains increase to 20% for firms with 4 years of OFDI experience. In other words, learning-by-doing effects do exist for the capital-intensive OFDI firms.

For labor-intensive firms, we find the coefficients of *FDI* are positive but not statistically significant for the four periods, suggesting that the productivity growth of labor-intensive OFDI firms is not statistically significant different from that of non-OFDI firms, which suggests that labor-intensive OFDI firms cannot gain extra productivity growth over non-OFDI firms. Therefore, learning-by-doing effects do not exist for the labor-intensive OFDI firms.

The results above reveal different post-entry productivity performance for capital-intensive starters and labor-intensive starters, which can be summarized as follows: (i) capital-intensive firms can gain extra productivity growth through OFDI but labor-intensive firms cannot gain extra productivity growth through OFDI, (ii) the productivity gains can be achieved for capital-intensive firms with at least 2 years of OFDI experience; (iii) the trend of extra productivity growth gain shows an upward tendency during the 4 years after OFDI for capital-intensive firms, suggesting the increasing learning intensity these years.

4. Conclusion

Theoretical models (e.g. Helpman, Melitz, and Yeaple 2004; Melitz 2003) link the productivity level of firms with their involvement in international trade. But existing literature shows that studies on the relationship between OFDI and productivity with Chinese firm-level data are relative few (Li et al. 2017) and there are fewer papers focusing on the impact of capital intensity on the causal relationship between OFDI and productivity. In order to fill this gap, we examine the casual relationship between OFDI and productivity and the influence of the firm's capital intensity by using OFDI data of Chinese A-share listed manufacturing firms in the period of 2001–2016. We gain several interesting conclusions. First, by using KS test, we find OFDI firms are more productive than non-OFDI firms both for capital-intensive firms and labor-intensive firms while the productivity difference between OFDI firms and non-OFDI firms in labor-intensive firms is larger than that in capital-intensive firms. The result is consistent with findings of prior studies (Kimura and Kiyota 2006).

Second, we find the pre-entry productivity of OFDI firms is higher than that of matched non-OFDI firms in labor-intensive firms, but the pre-entry productivity of OFDI firms is not different from matched non-OFDI firms in capital-intensive firms. The result provides evidence that the OFDI threshold put forward by Helpman, Melitz, and Yeaple (2004) is binding for labor-intensive firms but not for capital-intensive firms. The implication of this result is that productivity is critical for labor-intensive firms but not for capital-intensive firms. This finding has a similar implication with the study of Damijan, Polanec, and Prašnikar (2007), who find both productivity and capital intensity have important influence on firms' OFDI entry.

Third, by conducting PSM techniques and DID analysis, we find evidence of post-entry productivity improvement for capital-intensive OFDI firms but not for labor-intensive OFDI firms. The result suggests that the learning-by-doing effect only holds for capital-intensive firms, which implies that the extra productivity growth is capital intensity dependent. In addition, the extra productivity growth for capital-intensive firms shows increasing learning intensity during the 4 years after OFDI. Our finding suggests capital-intensive firms are more likely to gain productivity benefits from international operations than labor-intensive firms. Our finding is in line with the argument that capital-intensive firms are more likely to carry out R&D or introduce new technologies (Guan and Pang 2017).

We provide some possible explanations for the different relationship between OFDI and productivity in capital-intensive firms and labor-intensive firms. First, for capital-intensive firms, their purpose of international operation is to achieve technical progress rather than gain profits in international markets. Therefore, productivity is not a determinant in OFDI decision for capital-intensive firms, and OFDI can contribute to productivity growth for them. This is especially true for capital-intensive firms from developing countries because their products are

usually also technology-intensive and they have strong motivation of introducing new technology to increase the competition of their products in international markets (Makino, Lau, and Yeh 2002). Second, for labor-intensive firms, they rely more heavily on low-cost labor rather than technology, and one important competitiveness for firms from developing countries is the low-cost labor. In order to expand their competitive advantage and achieve more profits in the international market, OFDI is an important option for labor-intensive firms from developing countries. According to the theory of Helpman, Melitz, and Yeaple (2004), one condition for firms who want to gain profits in the international market is to be more productive before entering international market. Thus, productivity is a determinant in OFDI decision for labor-intensive firms, but OFDI cannot enhance their productivity growth.

The joint consideration of evidences provided by our study suggests that high productivity of capital-intensive OFDI firms mainly comes from the learning-by-doing effect while high productivity of labor-intensive OFDI firms mainly comes from self-selection effect. As theoretical model proposed by Helpman, Melitz, and Yeaple (2004) argues that high productivity required for OFDI firms in the pre-entry period is to cover the cost of international operation and gain large profits in international markets, evidences above imply that the extra cost of international operation is high for labor-intensive firms and productivity seems a barrier for labor-intensive firms to enter into international markets via OFDI. Therefore, our study suggests possible measures to increase international participation of domestic labor-intensive firms should include policies aimed to raise firm productivity such as easing the access to new production technologies.

Funding

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- 市场准入管制放松与产业结构升级
- 多因素联动下企业研发国际化的创新路径研究
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工业机器人进口、企业雇佣结构升级 与出口产品质量提升

林 峰 周 超

摘要 中国是全球最大的工业机器人进口国，工业机器人应用快速扩张趋势下，如何结合企业雇佣结构，发挥工业机器人在外贸高质量发展过程中的作用成为亟待探讨的重要问题。采用 2000—2013 年中国工业企业数据和中国海关数据，实证考察工业机器人进口对制造业企业出口产品质量的影响以及企业雇佣结构在其中的调节作用。结果显示：工业机器人进口显著提升了中国企业出口产品质量；工业机器人进口对加工贸易企业、私营企业、劳动密集型企业 and 东部地区企业出口产品的“提质”作用更为明显。结合全国经济普查数据分析发现，工业机器人进口与企业雇佣结构具有互补性，企业雇佣结构越高级，工业机器人进口对企业出口产品质量的提升作用就越强。因此，应以智能制造为引领，发挥工业机器人对企业出口产品质量的赋能作用，并重视企业雇佣结构升级的互补效应，推动“人机协作”的生产模式，从而推进制造业企业智能制造与出口产品质量“双升级”。

关键词 工业机器人进口；出口产品质量；企业雇佣结构；智能制造

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一 引 言

随着人工智能技术的蓬勃发展，全球机器人产业正迎来创新发展、升级换代的重要机遇期。根据国际机器人联合会（IFR）的数据，1993 年全球工业机器人存量仅为 56 万台，2023 年已突破 420 万台，年均增幅达到 21%。从工业机器人的市场分布来看，尽管美国、日本、德国等工业化国家引领了智能化浪潮，但中国、印度等新兴市场国家在工业机器人市场显示出巨大的发展空间和潜力。自 2016 年开始，中国超越日本成为全球最大的工业机器人市场，2023 年新安装工业机器人在全球市场占比达到 51%。伴随着人口老龄化加速和劳动力成本提升，中国制造业的智能化升级需求日益凸显，工业机器人的下游应用领域快速扩张。依托大数据、人工智能、云计算、物联网等新一代互联网技术，越来越多的制造业企业通过引进和使用工业机器人实现了智能化改造和数字化转型，这也显著提

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升了中国制造业的全球价值链分工地位（黄亮雄等，2023^[1]；何茜茜等，2024^[2]）。

工业机器人的高速增长充分体现了从中国“制造”到中国“智造”的战略思路。国家政策支持是引领机器人产业走向智能化和网络化的基础，有利于破除中国机器人缺乏核心产品和技术的发展桎梏（Cheng et al.，2019）^[3]。国务院发布的《中国制造2025》计划中，将机器人产业列入实现智能制造的十大战略支柱产业之一。党的二十大报告明确提出，要建设现代化产业体系，构建以新一代信息技术、人工智能等为代表的新增长引擎。在智能制造的大背景下，企业对产品质量的要求不断提升，中国制造业也朝着集约化和智能化的方向升级（祝树金等，2022）^[4]。但需要正视的是，中国制造业企业出口产品质量总体不高的困局依然存在，甚至还陷入出口产品质量持续下降的“低品质陷阱”（刘啟仁和铁瑛，2020）^[5]，成为掣肘中国外贸高质量发展的瓶颈问题。因此，如何将“质量优先”理念落实到微观企业主体，并利用人工智能技术推动企业出口产品质量升级，这是值得学术界关注的重要课题。

现有研究表明，工业机器人的大规模使用主要源于人口老龄化加剧和劳动力成本上升。一方面，在资本相对充足的情况下，人口老龄化会导致中年劳动力相对稀缺，进而促进工业机器人的使用（Acemoglu 和 Restrepo，2022）^[6]；另一方面，劳动力成本上涨迫使企业加大工业机器人的使用比例，以技术红利替代人口红利，进而加速“机器换人”趋势（Fan et al.，2021）^[7]。虽然“机器换人”会降低劳动报酬占比和产出价格，但工业机器人从根本上克服了产品成本和产品差异化间的矛盾，显著提高了劳动生产率（Graetz 和 Michaels，2018^[8]；Koch et al.，2021^[9]）。随着工业机器人在制造业领域的应用，国内研究主要聚焦于工业机器人对制造业企业的劳动力替代效应和生产率提升效应（王林辉等，2022^[10]；诸竹君等，2022^[11]），但值得关注的是，中国是全球最大的工业机器人进口国，进口工业机器人在赋能企业绿色转型（林熙等，2023）^[12]、提升企业供应链韧性（何茜茜等，2024）^[2]和对冲人口红利消融（金碚，2024）^[13]等方面具有重要作用。从图1可以看出，在2013年以前，中国的工业机器人完全依赖进口；而在2013年后，中国仍有70%以上的工业机器人来自进口。尽管国内企业已经基本掌握了机器人生产技术，但主要集中在机器人产业的中低端领域，高端工业机器人仍依赖国外进口^①。因此，无论是数量上还是质量上，进口工业机器人的作用都不容忽视。

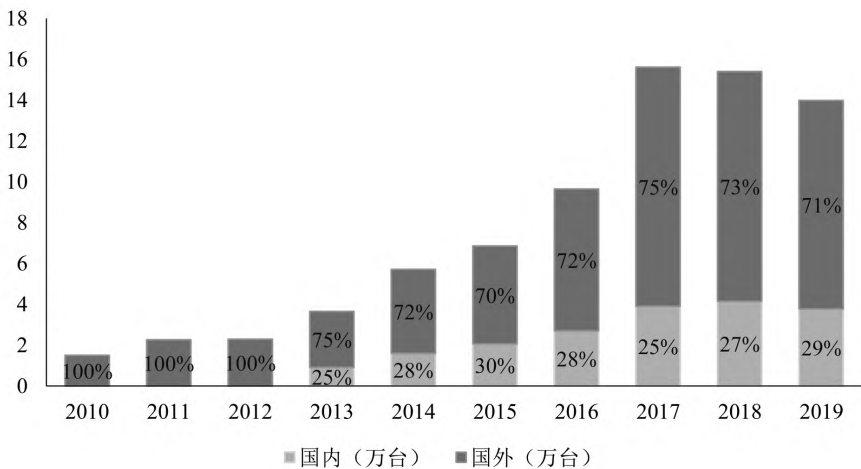


图1 中国工业机器人的国内和国外供应商分布

数据来源：国际机器人联合会（IFR）。

① 根据《中国机器人产业发展白皮书（2016版）》，中国自主品牌工业机器人以中低端的三轴、四轴为主，而高端的六轴或以上工业机器人主要依赖进口。2014年国产工业机器人的市场占有率不足30%，其中国产六轴工业机器人的市场份额不到10%。

与现有研究相比,本文可能的边际贡献有:(1)在因果识别方面,尽管现有文献检验了工业机器人使用对企业出口产品质量的影响(蔡震坤和綦建红,2021^[4];方齐云等,2023^[5]),但未能系统解决工业机器人使用与出口产品质量之间的内生性问题。本文不仅引入美国的工业机器人使用量 and 中国的工业机器人适应度作为工业机器人进口的工具变量,而且采用双重差分倾向得分匹配法(PSM-DID)进行因果推断,验证了工业机器人进口对企业高质量出口的积极影响。(2)在研究内容方面,企业雇佣结构升级会显著影响工业机器人的赋能效应,而现有文献普遍忽视了工业机器人应用与企业雇佣结构的互补性。本文结合企业层面的经济普查数据,检验工业机器人进口与企业雇佣结构的互补性,验证两者对企业高质量出口的协同作用,为推动企业出口产品质量升级提供了参考。

二 文献综述与理论假说

从历史的视角来看,全球每一次经济重大转型都伴随着突破性技术创新。第一次重大转型将人们从农场转移到工厂,是由机械化驱动;第二次重大转型将人们从工厂转移到办公室,是由计算机驱动;第三次重大转型正在发生,将由智能化驱动。发达国家的工人将从服务工作转向“庇护服务工作(Sheltered Service Jobs)”,而发展中国家的工人将从农业和制造业部门转移至面向出口的服务业部门。在第三次重大转型过程中,以工业机器人为代表的人工智能加快了资本替代部分工人的进程,导致原有的生产流通环节减少或消失。在国内尚未完全实现产业智能化的情况下,工业机器人进口是满足企业智能化改造需求的重要渠道。企业利用进口工业机器人的高效性、精准性和智能化,能够全方位地推动出口产品质量提升。

首先,进口工业机器人的使用改进了传统生产工艺。在流程优化方面,工业机器人通过编程控制,能够自动完成焊接、组装、搬运等重复性和程序化任务,相较常规人工操作会更加精确和稳定,从而减少因人为失误而导致的质量问题(Baldwin, 2019)^[6]。由于出口产品需符合严格的国际质量标准,而工业机器人可以长期连续运行,且操作标准保持一致,所以同一批次或不同批次的出口产品质量会更加稳定和可靠(程虹和袁璐雯,2020)^[7]。例如在喷涂、焊接等对操作要求极高的环节,工业机器人可以根据设定好的路径精准完成工艺流程,确保产品质量的高度一致性。此外,工业机器人还可以通过精密的传感器与控制系统进行自我调节,以适应多变的生产环境和工艺要求,从而优化传统生产流程(Eder et al., 2024)^[8]。在柔性生产方面,工业机器人通过与自动化生产线、输送系统和其他智能设备的协作,实现柔性制造生产线(蒋为等,2024)^[9]。例如借助工业物联网与数字化技术,工业机器人能够根据出口订单调整生产工艺,驱动制造业企业生产方式向定制化方向转变。

其次,进口工业机器人的使用优化了生产运作效率。与传统自动化设备相比,工业机器人通常具有更快的处理速度,能够显著缩短生产周期,提高生产线的整体运作效率(Acemoglu 和 Restrepo, 2022)^[10]。一方面,工业机器人的高效性帮助企业提高了单位时间内的有效产量,使得出口订单能够更快速地完成并交付客户,减少延迟交付带来的商业风险。通过工业机器人的高效生产,出口企业能为客户提供定制化、高品质的产品,同时保持合理的成本结构。这种灵活性使得企业快速适应不同国家和地区的市场需求,并满足国际质量认证标准的要求(黄亮雄等,2023)^[11];另一方面,工业机器人的使用优化了资源配置效率,降低了单位产品的生产成本。这种“高质量与低成本”组合为出口企业在价格竞争激烈的国际市场中提供了比较优势,使其能够满足海外客户对成本控制和产品性能的双重要求(DeStefano 和 Timmis, 2024)^[12]。特别是在需求价格弹性较大的中低端市场中,企业能以较低的生产成本维持高质量出口,这不仅提高了出口产品的可信度和附加值,也提升了出口产品在国际市场上的质量形象(Artuc et al., 2023)^[13]。

最后,进口工业机器人的使用强化了产品质量监控。工业机器人通常配备了先进的传感器和数据采集系统,可以在生产环节实时监测产品质量。例如在焊接环节,工业机器人通过视觉系统实时检测焊接的完整性或表面瑕疵,能够精准发现质量问题并进行调整。机器人采集的生产数据能为出口企业

提供信息反馈,企业可以及时发现潜在的工艺瓶颈,制定精准的改进计划,从而提升出口产品质量(唐宜红和顾丽华,2022)^[22]。通过工业机器人实现的自动化生产流程,出口企业可以更加便捷地建立生产过程的追溯系统(Koch et al., 2021)^[23]。一旦出口产品出现质量问题,企业可以迅速找到问题源头并进行修正。而在工业机器人接管重复性、高强度的生产任务后,企业可以将人力资源集中于产品研发管理,从而制造出更具创新性和附加值的出口产品(祝树金等,2022)^[24]。综上所述,本文提出第一个可供检验的假说。

假说1:工业机器人进口对企业出口产品质量具有促进作用。

现有研究表明,工业机器人的使用会增加对机器人检测与维护、工程设计、软件编程等高技能工人的需求,创造出更多新业态、新模式的“人机协作”岗位(Acemoglu 和 Restrepo, 2018)^[25]。Tang et al. (2021)^[26]基于中国制造业企业的研究发现,在机器人大量投入生产流程后,企业会雇佣更多受过高等教育的工人,以满足人工智能环境下的技能要求。林峰和李宏兵(2023)^[25]的跨国经验证据表明,工业机器人使用会提高各国对本科及以上学历的劳动力需求。因此,工业机器人进口与企业雇佣结构的互补性可能会进一步影响出口产品质量。

第一,随着劳动力知识层次和技能水平的提升,企业引进工业机器人后会持续优化和创新出口产品。技能型员工对工业机器人编程、控制和监控等进行技术革新,使得工业机器人能够快速匹配制造环境,这提高了生产线的灵活性和自适应性,有利于出口产品质量升级(方齐云等,2023)^[23]。知识型员工利用知识背景和管理经验,将工业机器人用于高精度和重复性的生产环节,而将复杂决策和创新任务交给高技能员工,这有效提升了“人机协作”的生产效率(Ballestar et al., 2022)^[24]。知识技能型员工则使企业更有能力制定长期战略,持续投资于工业机器人技术的升级和创新,并结合出口市场需求改进生产流程,从而促进出口产品质量提升。

第二,企业能够利用知识溢出效应调整和优化出口产品质量。高技能劳动力可以快速掌握工业机器人引进过程中的新技术和新工艺,并将其延伸至质量检测、供应链管理等其他生产环节,这种知识溢出效应有利于企业进一步提升出口产品质量(刘啟仁和铁瑛,2020)^[23]。高技能劳动力还能利用知识溢出效应中的隐性知识(如操作技巧、工艺诀窍等),诊断和改进出口产品质量问题,将知识溢出效应转化为企业出口竞争优势。Brambilla et al. (2019)^[27]的研究指出,高技能劳动力通过与跨国合作伙伴的技术交流,可以获取先进的质量管理经验,并结合企业出口情况制定更高效的质控策略,从而改进设计、优化材料或调整生产工艺,使出口产品质量更符合市场预期。

第三,雇佣结构升级有助于企业对出口市场需求作出精确响应。知识技能型员工能更准确地识别国际市场对出口产品质量的具体要求,如认证标准、环保要求和消费者定制化需求等(Zhou 和 Zhang, 2021)^[28],并且结合机器人技术进行产品设计、生产工艺或销售策略的调整,从而快速完成从设计到生产的迭代过程。同时,具有国际视野和专业知识的技能型员工能更快速地分析出口市场的变化趋势和技术性贸易壁垒(喻美辞和蔡宏波,2019)^[29],使出口企业更灵活地应对全球市场环境变化。综上所述,本文提出第二个可供检验的假说。

假说2:企业雇佣结构升级会增强工业机器人进口对企业出口产品质量的促进作用。

三 研究设计

(一) 模型设定与变量选择

本文设定如下计量模型来识别工业机器人进口对企业出口产品质量的影响:

$$\ln qua_{it} = \beta_1 + \beta_2 \ln robot_{it} + \theta Z'_{it} + \lambda_i + \eta_t + \varepsilon_{it} \quad (1)$$

其中, i 表示企业, t 为年份。 qua_{it} 表示企业出口产品质量, $robot_{it}$ 表示企业进口的工业机器人数量。 Z'_{it} 表示企业和行业层面的控制变量集。 λ_i 和 η_t 分别代表企业固定效应和年份固定效应, ε_{it} 代表随机误差项。主要变量的选取依据和度量方法如下:

1. 工业机器人进口。根据中国海关数据库的 HS6 编码,工业机器人主要包括以下七类:喷涂机器人、搬运机器人、IC 工厂专用自动搬运机器人、电阻焊接机器人、电弧焊接机器人、激光焊接机器人以及多功能工业机器人。借鉴 Fan et al. (2021)^[7]、林熙等 (2023)^[12] 的做法,本文采用工业机器人进口数量加 1 后取对数作为解释变量 (lnrobot)。

2. 出口产品质量。参照 Khandelwal et al. (2013)^[6] 的思路,本文采用“企业 (i) - 产品 (h) - 目的国 (m) - 年份 (t)”四个维度的海关数据来构造出口产品质量指标。具体地,利用效用函数求取某一产品 h 的出口产品数量:

$$q_{ihmt} = p_{ihmt}^{-\sigma} \lambda_{ihmt}^{\sigma-1} (E_{mt}/P_{mt}) \quad (2)$$

其中, q_{ihmt} 、 p_{ihmt} 和 λ_{ihmt} 分别表示企业 i 向目的国 m 出口产品 h 的数量、价格和质量。 σ 表示不同产品间的替代弹性。 E_{mt} 和 P_{mt} 分别表示 m 国的消费者支出水平和价格总指数。对式 (2) 取自然对数,可以得到如下方程式:

$$\ln q_{ihmt} = \chi_{mt} - \sigma \ln p_{ihmt} + \varepsilon_{ihmt} \quad (3)$$

其中, $\chi_{mt} = \ln E_{mt} - \ln P_{mt}$, 表示“目的国 - 年份”的固定效应。 $\varepsilon_{ihmt} = (\sigma - 1) \ln \lambda_{ihmt}$ 代表包含质量信息的残差项。对式 (3) 进行估计,可以得到产品层面的出口产品质量:

$$qua_{ihmt} = \ln \hat{\lambda}_{ihmt} = \hat{\varepsilon}_{ihmt} / (\sigma - 1) = (\ln q_{ihmt} - \ln \hat{q}_{ihmt}) / (\sigma - 1) \quad (4)$$

其中, qua_{ihmt} 表示产品 h 的质量。考虑到行业间产品替代弹性的差异性,本文根据 Broda 和 Weinstein (2006)^[11] 提供的 HS3 位码的产品替代弹性,对 σ 进行赋值。借鉴刘啟仁和铁瑛 (2020)^[8] 的研究,对产品层面的出口产品质量进行标准化,以出口额占比为权重加总到企业层面,并将企业出口产品质量的对数作为被解释变量 (lnqua)。

3. 控制变量。参考吕越等 (2020)^[12] 的做法,选取如下控制变量:企业规模 (lnsize),以企业资产总额的对数衡量;企业年龄 (lnage),以企业存续年限的对数表示;企业资本密集度 (lnkl),以企业固定资产净值与员工人数的比值取对数度量;企业杠杆率 (lev),以企业总负债占总资产的比例表示;行业竞争程度 (HHI),以赫芬达尔指数,即所有企业在所属行业的市场占有率的平方和衡量,赫芬达尔指数越低,表示行业竞争程度越高。

(二) 样本说明与统计特征

本文借鉴 Brandt et al. (2012)^[13] 的方法,剔除企业名称、职工人数、开业年份等关键指标缺失的企业,剔除了职工人数少于 8 人以及财务指标明显异常的企业,并保留行业代码为 C 的制造业企业样本。为保证 HS 编码的一致性,本文根据联合国统计司 (UNSD) 提供的编码对照表,将产品 HS8 位码调整为 HS6 位码,并剔除 HS 编码前两位数字在 01—21、25—27 的初级品和资源品样本。对 2000—2013 年中国工业企业数据和中国海关数据进行匹配,并对主要变量进行上下 1% 分位的 Winsor 处理,最终得到 2000—2013 年企业 - 年份层面的观测值 580416 个。表 1 为主要变量的统计特征。

表 1 主要变量的描述性统计

变量	观测值	均值	标准差	最小值	最大值
lnqua	580416	-0.5156	0.2933	-1.7601	-0.0886
lnrobot	580416	0.0190	0.1351	0.0000	1.0986
lnsize	580416	10.7063	1.4558	7.8442	14.8653
lnage	580416	2.1086	0.6582	0.0000	3.8712
lnkl	580416	3.8033	1.3848	0.3054	7.3651
lev	580416	1.5497	0.2613	1.0224	2.2311
HHI	580416	0.0087	0.0147	0.0013	0.2148

四 实证结果分析

(一) 基准回归结果

表 2 的估计结果显示,列(1)中工业机器人进口的系数在 1% 的水平上显著为正,印证了工业机器人进口对企业出口产品质量的促进作用。加入企业层面控制变量后,列(2)中工业机器人进口的系数数值有所下降,但仍然在 1% 的水平上显著为正,这与假说 1 的理论预期相一致,说明工业机器人进口可以显著提升企业出口产品质量。列(3)进一步引入行业层面的控制变量,工业机器人进口的系数仍然显著为正,再次验证了假说 1。

表 2 基准回归结果

变量	(1)	(2)	(3)
<i>lnrobot</i>	0.0626*** (0.0044)	0.0417*** (0.0043)	0.0416*** (0.0043)
<i>lnsize</i>		0.0189*** (0.0006)	0.0189*** (0.0006)
<i>lnage</i>		0.0033*** (0.0010)	0.0034*** (0.0010)
<i>lnkl</i>		0.0088*** (0.0006)	0.0088*** (0.0006)
<i>lev</i>		0.0052** (0.0022)	0.0053** (0.0022)
<i>HHI</i>			-0.3653*** (0.0438)
常数项	-0.5168*** (0.0007)	-0.6997*** (0.0062)	-0.6977*** (0.0062)
年份固定效应	是	是	是
企业固定效应	是	是	是
样本量	580416	580416	580416
R ²	0.7705	0.7716	0.7717

注:小括号内为企业层面的聚类标准误;*、**和***分别代表 10%、5% 和 1% 的显著性水平。

在控制变量方面,企业规模、企业年龄、企业资本密集度、企业杠杆率的系数显著为正,这与苏丹妮等(2018)^[34]的研究结论一致。规模较大的企业可能拥有更多的资源和更高的生产效率,能够更好地满足市场需求,因而出口产品质量的提升空间更大;存续年限较长的企业积累了更多经验和技
术,同时也具有一定市场信誉度和品牌认知度,这对出口产品质量具有促进作用;资本密集度和杠杆率较高的企业往往能吸引更多投资,有利于企业进行研发、生产和品质控制,增强企业创新能力,进而提升出口产品质量。行业竞争程度的系数在 1% 的水平上显著为负,表明在竞争激烈的行业中,企业为了获取更多的市场份额和更高的市场地位,往往会提升自身的出口产品质量。

(二) 稳健性检验

1. 工具变量回归。出口产品质量较高的企业为了保持产品的独特性和领先性，可能会在生产环节投入更多的工业机器人，因而存在反向因果关系所引致的内生性问题。为此，本文选取如下工具变量进行处理：(1) 美国同行业的工业机器人使用量 (*robot_US*)。借鉴 Kugler et al. (2020)^[63] 的思路，中国和美国均是工业机器人使用的大国，在市场规模、政策支持及下游应用等方面具有相似表现，因而两国的机器人使用量具有一定相关性。美国行业层面的工业机器人使用不会直接影响中国企业层面的出口产品质量，满足外生性要求。因此，本文以美国同行业工业机器人使用量的对数作为中国工业机器人进口的工具变量，数据来自 IFR 数据库。需要注意的是，IFR 行业分类与中国的国民经济行业分类标准并不一致，为此本文参考闫雪凌等 (2020)^[64] 的做法，将 IFR 涉及的 14 个制造业行业与国民经济行业进行整合。(2) 企业所在行业的工业机器人适应度 (*suitsbility*)。借鉴 Bonfiglioli et al. (2020)^[67] 的方法，工业机器人适应度以行业内机器人资本存量总额占行业资产总额的比例的对数衡量。工业机器人适应度越大，表示行业越适合应用人工智能技术，这为行业内的企业进口工业机器人提供了适宜环境，满足相关性要求。此外，该工具变量是行业层面的，满足外生性要求。

表 3 工具变量回归结果

变量	(1) IV: <i>robot_US</i>	(2) IV: <i>suitsbility</i>
<i>lnrobot</i>	1.7874*** (0.3357)	0.6793*** (0.1868)
Kleibergen – Paapr	67.286	267.886
LM 统计量	[0.0000]	[0.0000]
Kleibergen – Paapr	67.274	221.995
Wald F 统计量	{16.380}	{16.380}
控制变量	是	是
年份固定效应	是	是
企业固定效应	是	是
样本量	580377	580416

注：小括号内为企业层面的聚类标准误，中括号内为 P 值，大括号内为 Stock – Yogo 弱识别检验的 10% 临界值；*、**和***分别代表 10%、5% 和 1% 的显著性水平。

表 3 是两阶段最小二乘法 (2SLS) 的回归结果。列(1) 以美国同行业的工业机器人使用量作为工具变量，模型同时拒绝了 Kleibergen – Paapr LM 检验和 Kleibergen – Paapr Wald F 检验的原假设，说明工具变量满足相关性和外生性的要求。核心解释变量的系数在 1% 的水平上显著为正，表明工业机器人进口能够显著提升企业出口产品质量。列(2) 以企业所在行业的工业机器人适应度作为工具变量，同样满足了相关性和外生性的要求。核心解释变量的系数在 1% 的水平上显著为正，表明工业机器人进口有助于企业高质量出口。工具变量回归结果验证了基准模型设定的合理性。

2. 采用双重差分倾向得分匹配法 (PSM – DID)。企业进口工业机器人可能是自发的、有选择的行为，例如生产率越高的企业越倾向于引进工业机器人 (李磊等，2021)^[68]。考虑到样本自选择偏差引致的内生性干扰，本文采用 PSM – DID 方法进行检验。首先，将进口工业机器人的企业设定为处理组 (*inrobot_i* = 1)，并利用 PSM 方法匹配未进口工业机器人的对照组企业 (*inrobot_i* = 0)。借鉴诸竹君等 (2022)^[11] 的做法，选取的协变量包括：企业年龄、企业规模、企业平均工资、企业资本密集度、企业生产率和企业杠杆率。其次，采用近邻匹配、半径匹配和核匹配进行逐期匹配，发现各协变量在

匹配后的标准偏差绝对值均未超过 10%。最后，基于 PSM 获取的样本数据，引入企业进口工业机器人的年度虚拟变量 ($time$)，若企业在 t 年进口工业机器人，则 $time_t = 1$ ，否则为 0。进而构建如下多时点 DID 模型：

$$\ln qua_{it} = \alpha_1 + \alpha_2 imrobot_i \times time_t + \theta Z'_{it} + \lambda_i + \eta_t + \varepsilon_{it} \tag{5}$$

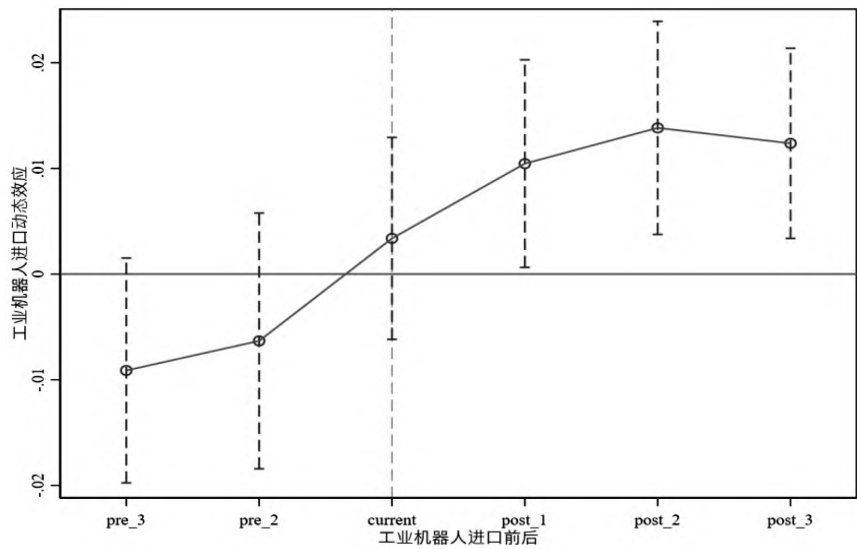


图 2 平行趋势检验结果

运用双重差分法的前提条件是满足平行趋势假设。本文对处理组和对照组企业进行 1：3 近邻匹配，平行趋势检验结果见图 2^①。可以发现，在进口工业机器人之前，处理组与对照组的出口产品质量并不存在明显差异；而在进口工业机器人之后，处理组与对照组的出口产品质量存在显著差异，这表明平行趋势假设得到满足。表 4 列(1) — 列(4) 是分别采用 1：1 近邻匹配、1：3 近邻匹配、半径匹配和核匹配的 DID 回归结果， $imrobot \times time$ 的系数均在 1% 的水平上显著为正，表明工业机器人进口能提升企业出口产品质量，这进一步支持了基准模型的经验判断。

表 4 采用 PSM - DID 方法

变量	(1) 1：1 近邻匹配	(2) 1：3 近邻匹配	(3) 半径匹配	(4) 核匹配
$imrobot \times time$	0.0538 *** (0.0021)	0.0547 *** (0.0018)	0.0443 *** (0.0038)	0.0528 *** (0.0034)
控制变量	是	是	是	是
年份固定效应	是	是	是	是
企业固定效应	是	是	是	是
样本量	204159	580416	578298	580416
R ²	0.8241	0.7657	0.7718	0.7717

注：小括号内为企业层面的聚类标准误；*、**和*** 分别代表 10%、5% 和 1% 的显著性水平。

① 其余匹配方式得出的检验结果并无明显差异。

3. 排除其他事件干扰。首先，本文排除自由化因素对回归结果产生的干扰。一方面，中国在样本期内加入了世界贸易组织，关税减免带来的贸易自由化可能会对企业出口产品质量产生显著影响；另一方面，在外资准入自由化趋势下，外资企业进入门槛的降低会对企业出口产品质量产生影响。本文引入行业关税税率（*tariff*）和行业外资企业产出占比（*foreign*）。其次，随着信息通信技术（ICT）的蓬勃发展，数字经济不仅能提高工业机器人的市场渗透率，也有利于企业高质量出口。为此，本文引入省级层面的长途光缆密度（*cable*）、互联网普及率（*internet*）和移动基站数（*station*）。最后，为了排除潜在遗漏变量的干扰，本文进一步控制了行业固定效应以及省份和年份固定效应的交互项。表 5 的估计结果显示，核心解释变量 *lnrobot* 的系数仍然在 1% 的水平上显著为正。

表 5 排除其他事件干扰

变量	(1) 排除自由化干扰	(2) 排除 ICT 干扰	(3) 排除遗漏变量干扰
<i>lnrobot</i>	0.0200 *** (0.0047)	0.0379 *** (0.0044)	0.0055 *** (0.0009)
<i>tariff</i>	0.0028 *** (0.0002)		
<i>foreign</i>	-0.4243 *** (0.0062)		
<i>cable</i>		0.0080 *** (0.0010)	
<i>internet</i>		0.0005 *** (0.0001)	
<i>station</i>		0.0261 *** (0.0022)	
控制变量	是	是	是
年份固定效应	是	是	否
企业固定效应	是	是	是
行业固定效应	否	否	是
省份 - 年份固定效应	否	否	是
样本量	532778	564193	580407
R ²	0.7728	0.7914	0.7768

注：小括号内为企业层面的聚类标准误；*、**和***分别代表 10%、5% 和 1% 的显著性水平。

4. 调整样本范围。由于本文样本包含未进口工业机器人的企业，所以核心解释变量存在大量零值，这可能会导致基准回归结果产生偏差。为了减少零值对回归结果的影响，本文以进口工业机器人数量大于 0 的企业为样本进行回归。从表 6 列(1) 可以看出，核心解释变量的系数显著为正，进而验证了基准模型设定的合理性和回归结果的有效性。此外，机器人制造商可能是将进口的工业机器人作为中间投入品，并非用于最终产品的生产。本文参考 Fan et al. (2021)^[7] 的做法，将企业名称中包含“机器人”的企业识别为机器人制造商，并将这类企业剔除后重新进行回归。从表 6 列(2) 可以看出，核心解释变量的系数仍然显著为正，表明工业机器人进口对企业出口产品质量起到促进作用，再次验

证了研究结论的稳健性。

表 6 调整样本范围

变量	(1) 剔除未进口工业机器人的企业	(2) 剔除机器人制造商
<i>lnrobot</i>	0.0187*** (0.0011)	0.0421*** (0.0043)
控制变量	是	是
年份固定效应	是	是
企业固定效应	是	是
样本量	18801	580381
R ²	0.8324	0.7721

注：小括号内为企业层面的聚类标准误；*、**和***分别代表 10%、5% 和 1% 的显著性水平。

(三) 异质性检验

1. 基于企业贸易类型的异质性检验。考虑到企业贸易类型的差异性，本文将样本分为一般贸易企业和加工贸易企业进行分组回归。从表 7 列(1) 和列(2) 可以看出，尽管工业机器人进口的系数均显著为正，但工业机器人进口对加工贸易企业出口产品质量具有更强的促进作用。可能的解释是，加工贸易企业通常从事来料加工、进料加工等业务，需要严格按照海外客户的质量标准进行生产，而工业机器人的高精度和高重复性能够帮助加工贸易企业提高加工精度和一致性，减少人为操作导致的误差，从而满足国际市场的质量要求。一般贸易企业的生产流程更加多样化，产品的个性化需求也较高 (DeStefano 和 Timmis, 2024)^[2]，因此工业机器人进口提升企业出口产品质量的边际效果相对较低。

表 7 基于企业贸易类型及所在地区的异质性检验

变量	(1) 一般贸易企业	(2) 加工贸易企业	(3) 东部地区企业	(4) 中部地区企业	(5) 西部地区企业
<i>lnrobot</i>	0.0154*** (0.0049)	0.0385*** (0.0063)	0.0393*** (0.0044)	0.0259 (0.0251)	0.0421 (0.0430)
控制变量	是	是	是	是	是
年度固定效应	是	是	是	是	是
企业固定效应	是	是	是	是	是
样本量	425336	152111	526777	34856	18783
R ²	0.7981	0.7771	0.7643	0.8154	0.8223

注：小括号内为企业层面的聚类标准误；*、**和***分别代表 10%、5% 和 1% 的显著性水平。

2. 基于企业所在地区的异质性检验。从表 7 列(3) 一列(5) 可以看出，工业机器人进口有利于东部地区企业的高质量出口，但对中西部地区企业的出口产品质量并未产生显著影响。可能的原因是，东部地区推进制造业智能化转型的步伐要明显快于中西部地区。例如 2015 年浙江省率先启动了“机器换人”分行业试点，积极引导企业进行智能化升级。此外，东部地区在吸引高技能人才，尤其是人工智能领域人才方面，出台了一系列鼓励和支持政策，这为“人机协作”提供了有利条件。根据《中国人工智能发展报告 2020》，东部地区人工智能人才投入量占全国的比重高达 63%。而中西部地

区的企业在技术研发、知识技能型人才储备和数字化匹配等方面较薄弱，难以充分利用工业机器人的协作优势（赵春明等，2020）^{〔9〕}，这可能导致工业机器人使用缺乏效率，使工业机器人进口对企业出口产品质量的促进作用相对有限。

3. 基于企业所有制的异质性检验。表8列（1）—列（3）显示，工业机器人进口能够提升私营企业和外资企业出口产品质量，其中对私营企业出口产品的“提质”效果更加明显。而对于国有企业的出口产品质量，工业机器人进口并未产生显著的正向影响。可能的解释是，国有企业具有稳定的市场和融资环境，并不主要依赖人工智能来谋求革新升级，因此利用工业机器人提质增效的动力相对不足。而私营企业和外资企业普遍具有较高的市场灵活性和创新驱动导向，能够迅速引进和适应工业机器人技术，以满足国际市场对高质量出口产品的需求。此外，这类企业通常提供绩效驱动的激励机制，鼓励高技能员工学习和应用工业机器人，从而发挥“人机协作”的潜能（方齐云等，2023）^{〔13〕}。尤其是在出口导向型产业中，私营企业由于竞争压力较大，更倾向于主动引入机器人技术来提升出口产品质量，从而满足国际市场的高标准要求。

4. 基于企业要素密集型的异质性检验。本文根据资本劳动比的1/3分位点和2/3分位点，将样本划分为劳动密集型企业、中间企业和资本密集型企业。表8列（4）—列（6）显示，工业机器人进口对劳动密集型企业出口产品质量的促进作用要明显强于对中间企业和资本密集型企业。可能的原因是，一方面，劳动密集型企业的生产流程更依赖人工操作，但这些工人可能存在技能分化、操作不稳定或效率低下等问题（蒋殿春和卢霄，2023）^{〔14〕}。工业机器人的使用能够替代人工完成精确的生产任务，避免人工操作中的不稳定因素，确保出口产品质量的一致性。另一方面，相对于资本密集型企业所采用的高科技设备和自动化生产线，劳动密集型企业的生产过程往往相对简单，技术含量也较低。因此，为了适应市场对出口产品的生产进度要求和技术标准，劳动密集型企业会通过进口工业机器人来提高生产效率和出口产品质量。

表8 基于企业所有制及要素密集型的异质性检验

变量	(1) 国有企业	(2) 私营企业	(3) 外资企业	(4) 劳动密集型企业	(5) 中间企业	(6) 资本密集型企业
lnrobot	0.0211 (0.0237)	0.0803*** (0.0205)	0.0196*** (0.0063)	0.0532*** (0.0109)	0.0490*** (0.0065)	0.0350*** (0.0056)
控制变量	是	是	是	是	是	是
年份固定效应	是	是	是	是	是	是
企业固定效应	是	是	是	是	是	是
样本量	23516	196229	104782	204475	196962	178979
R ²	0.7944	0.8381	0.7664	0.8229	0.8267	0.7931

注：小括号内为企业层面的聚类标准误；*、**和***分别代表10%、5%和1%的显著性水平。

五 进一步分析

本文借鉴刘啟仁和铁瑛（2020）^{〔5〕}的做法，通过合并2004年和2008年的全国经济普查数据验证工业机器人进口与企业雇佣结构的互补性。关于经济普查数据的处理，本文剔除了具有研究生及以上、本科、大专、高中和初中及以下这5类学历的雇员总数不等于年末从业人员的样本，并将其与中国工业企业数据和中国海关数据进行匹配。用企业雇佣本科及以上学历的员工数占雇员总数的比例衡

量企业雇佣结构 (*emp*)，企业雇佣高学历员工的比重越大，表明企业雇佣结构越高级。为考察企业雇佣结构的调节效应，本文构造工业机器人进口和企业雇佣结构的交互项 ($\lnrobot \times emp$) 进行回归。为避免多重共线性的影响，对变量 *lnrobot* 和 *emp* 进行中心化处理，回归结果如表 9 所示。

表 9 企业雇佣结构与工业机器人进口的互补性验证

变量	(1)	(2)	(3)
<i>lnrobot</i>	0.0369*** (0.0136)	0.0364*** (0.0124)	0.0341*** (0.0090)
<i>emp</i>		0.5396*** (0.0334)	1.2814*** (0.1251)
$\lnrobot \times emp$		0.3066*** (0.0751)	1.3566*** (0.3336)
控制变量	是	是	是
年份固定效应	是	是	是
企业固定效应	是	是	是
样本量	58769	58769	58769
R ²	0.8634	0.9271	0.7279

注：小括号内为企业层面的聚类标准误；*、**和***分别代表 10%、5% 和 1% 的显著性水平。

表 9 列(1) 呈现了 2004 年和 2008 年样本期的回归结果。可以发现，核心解释变量 *lnrobot* 的系数仍然显著为正，表明工业机器人进口显著提升了企业出口产品质量。引入交互项后，列(2) 中企业雇佣结构 *emp* 的系数在 1% 的水平上显著为正，表明企业雇佣结构越高级，出口产品质量就越高。工业机器人进口和企业雇佣结构交互项 $\lnrobot \times emp$ 的系数在 1% 的水平上显著为正，说明企业雇佣结构越高级，工业机器人进口对企业出口产品质量的促进作用越强，即证实了工业机器人进口与企业雇佣结构之间的互补性。列(3) 中，用企业雇佣高级技术职称员工数占企业雇员总数的比例衡量企业雇佣结构，以观察结果是否稳健。可以看出， $\lnrobot \times emp$ 的系数仍然在 1% 的水平上显著为正，进而验证了假说 2，即工业机器人进口对企业出口产品的“提质”作用受企业雇佣结构的影响，企业雇佣结构升级会增强工业机器人进口对企业出口产品质量的正向影响。

考虑到样本自选择偏差问题，本文在 PSM - DID 模型中引入企业雇佣结构变量及其与 $\lnrobot \times time$ 的交互项。表 10 列(1) 呈现了 1 : 3 近邻匹配后的 DID 回归结果。可以发现， $\lnrobot \times time$ 的系数显著为正，表明工业机器人进口有利于企业高质量出口。交互项 $\lnrobot \times time \times emp$ 的系数在 1% 的水平上显著为正，表明工业机器人进口与企业雇佣结构具有互补性，两者对企业高质量出口发挥协同作用。此外，本文根据企业雇佣结构的中位数，以高雇佣结构和低雇佣结构的哑变量表征企业雇佣结构，并采用三重差分法 (DDD) 进行检验。从列(2) 可以看出，交互项 $\lnrobot \times time \times emp$ 的系数仍然显著为正，表明随着企业雇佣结构的升级，工业机器人进口会对企业出口产品质量产生更强的促进作用，再次验证了假说 2。

表 10 企业雇佣结构调节效应的 DID 检验

变量	(1)	(2)
$imrobot \times time$	0.0231 *** (0.0063)	0.0394 *** (0.0081)
emp	0.3040 *** (0.0968)	
$imrobot \times time \times emp$	0.4065 *** (0.1544)	0.0752 *** (0.0177)
控制变量	是	是
年份固定效应	是	是
企业固定效应	是	是
样本量	58769	58769
R^2	0.9271	0.4340

注：小括号内为企业层面的聚类标准误；*、**和***分别代表 10%、5% 和 1% 的显著性水平。

六 结论与政策启示

本文基于 2000—2013 年中国工业企业数据和中国海关数据，实证检验了工业机器人进口对制造业企业出口产品质量的影响。研究结果显示：工业机器人进口能够显著提升企业出口产品质量，且对加工贸易企业、私营企业、劳动密集型企业 and 东部地区企业出口产品的“提质”作用更为明显。结合全国经济普查数据分析发现，工业机器人进口与企业雇佣结构具有互补性。随着企业雇佣结构的升级，工业机器人进口对企业出口产品质量的促进作用进一步增强。本文研究结论对于推广智能制造技术、推进外贸高质量发展具有重要政策启示。

首先，要以智能制造为引领，充分发挥工业机器人的出口“提质”效能。企业应积极对标国际先进机器人技术，提升生产过程的智能化与精细化水平，同时通过搭建产学研合作平台，推动技术成果转化与产业落地，提升国内工业机器人的技术水平，形成自主可控的核心竞争力。政府可通过提供研发资金、设立专项补贴等方式，鼓励企业采购国产工业机器人，加大对国产工业机器人研发与创新的支持力度，缩小与国际先进水平的差距。政府还可通过设立智能制造示范基地、机器人产业创新中心等举措，为企业提供工业机器人使用的培训、技术指导和设备试验场景，助力企业实现智能制造升级与出口产品质量提升。

其次，要构建差异化转型路径，全面激发企业高质量出口潜力。加工贸易及劳动密集型企业应加快推进工业机器人的场景化应用，实现生产成本集约化与产品质量标准化的双重突破。私营企业可依托治理结构的灵活性优势，构建“智能化人才梯队+动态岗位适配”的转型路径，提升智能制造的适配能力。东部地区企业应强化产学研协同创新机制，充分利用高校资源与数字基础设施优势，推动人工智能深度集成应用，为制造业企业提供智能化改造范式。政府可通过人工智能应用示范工程等举措，强化政策引导作用，提升国有企业与中西部地区企业的出口产品质量。

最后，要注重高技术人才培养，积极构建“人机协作”生产新模式。企业可打造“机器人运维+数据分析+智能管理”的复合型人才团队，加速智能制造转型，助力出口产品质量提升。政府可

通过设立人才引进专项资金、人才服务中心等形式,为企业提供资金与服务支持,优化企业雇佣结构。同时,在科教兴国战略背景下,应构建以市场为导向的人才培养体系,通过提供与行业需求精准对接的培训项目,全面提升劳动力知识技能水平,从而强化工业机器人对企业出口的提质增效作用。

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Industrial Robot Imports, Employment Structure Upgrade, and Export Quality Improvement

LIN Feng ZHOU Chao

Abstract: China is the world's largest importer of industrial robots. With the rapid expansion trend of industrial robot applications, how to combine the employment structure of enterprises and play the role of industrial robots in the high-quality development of foreign trade has become an important issue that urgently needs to be explored. Using the matching data from Chinese industrial enterprise database and Chinese customs database from 2000 to 2013, this paper empirically examines the impact of industrial robot imports on the quality of manufacturing enterprises' export product and the moderating role of employment structure. It is found that the import of industrial robots has significantly improved the quality of China's export products. The heterogeneity test shows that the import of industrial robots has a more obvious effect on improving the quality of export products of processing trade enterprises, private enterprises, labor-intensive enterprises, and enterprises in the eastern region. Combining with the analysis of China's economic census data, it is found that industrial robot imports and enterprises' employment structure are complementary. The higher the employment structure, the stronger the role of industrial robots in improving the quality of export products. Therefore, we should take intelligent manufacturing as the lead, leverage the enabling effect of industrial robots on the quality of enterprises' export products, and pay attention to the complementary effect of the upgrading of the employment structure of enterprises, promoting the "human-machine collaboration" production mode, so as to advance the "dual upgrade" of intelligent manufacturing and export product quality of manufacturing enterprises.

Key words: industrial robot imports; export quality; enterprises' employment structure; intelligent manufacturing

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检索证明

根据委托人提供的论文材料，委托人华南农业大学经济管理学院 周超(学科类型:人文社科) 1 篇论文收录情况如下表。

序号	论文名称	发表刊物及发表的年月卷期/页码等	作者排名	论文等级	作者文中单位	收录情况	影响因子	中科院大类分区	引用
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