

申 报	系列：教师系列
	教学科研并重
	专业：会计学
	职称：副教授

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）

单 位（二级单位） 经济管理学院

姓 名 喻子秦

材料核对人：

单位盖章：

核对时间：

华南农业大学制

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2025年度校级本科教学改革项目立项名单						
序号	项目编号	项目名称	级别	所在单位	项目负责人	项目组成员
84	JG2025084	新文科背景下本科生《财务管理》课程数智化建设与教学体系改革研究	自筹	经济管理学院	喻子秦	陈艳艳、陈晓敏、周小春、龙思颖

华南农业大学教育教学研究和改革项目

申 报 书

项目类别 自筹项目

项目名称 新文科背景下本科生《财务管理》课程
数智化建设与教学体系改革研究

项目负责人 喻子秦

职 称 讲师

手机号码

所在单位

申报日期 2025.6.1

华南农业大学 本科生院 制

二 〇 二 五 年 五 月

广东省哲学社会科学规划专项小组

粤社科规专通〔2024〕38号

广东省哲学社会科学规划 2024 年度 学科共建项目立项通知书

喻子秦同志：

经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 2024 年度学科共建项目《创新信息夸大披露对资本市场效率的影响及机制研究——基于文本特征分析视角》获准立项，批准号：**GD24XGL038**。学科共建项目资助经费为 2 万元，由项目负责人所在单位自筹并分期划拨给项目负责人，第一次拨款 1.4 万元，预留经费 0.6 万元在项目鉴定

- 1 -

结项后拨付。请尽快登录广东省哲学社会科学规划项目管理平台上传签字盖章版申请书 PDF 扫描件并认真填报预算，预算个人填报截止时间为 7 月 26 日 12 点，单位审核截止时间为 7 月 26 日 17 点。逾时未填报立项预算视为放弃立项。

项目负责人填写预算后，本通知即成为具有约束效力的立项协议。项目负责人所在单位须承担保证责任。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，省哲学社会科学规划专项小组依据《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.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，课题组须按项目申请书所列计划开展研究。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、终止项目或撤消项目、延期等重要事项，项目负责人或所在单位必须及时填写《广东省哲学社会科学规划项目重要事项变更审批表》

（可在广东社科规划网“下载专区”下载），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，规划专项小组不接受项目结项申请，予以撤项处理。

5.项目成果的鉴定结项由省哲学社会科学规划专项小组组织，实行匿名鉴定制度。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，其预留经费不予拨付，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。

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

地址：广州市天河北路 618 号广东社科中心 B 座 928 室

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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）

2024 年 7 月 11 日

广州市社会科学规划领导小组办公室文件

穗社规办〔2025〕6号

关于广州市哲学社会科学发展“十四五”规划 2025年度常规课题（共建）立项的通知

各有关单位科研管理部门：

经专家评审、报广州市委宣传部审定，广州市哲学社会科学发展“十四五”规划2025年度常规课题（共建）立项390项。现将有关事项通知如下：

1.课题立项时间为2025年8月15日，结项时间为2027年5月30日前。须按照要求的时间向市社科规划办提交结项材料。

2.课题研究应按照《广州市哲学社会科学规划课题申报书》的设计进行。未经市社科规划办同意不得更改研究方向、内容、成果形式及变更管理单位。

3.请各单位科研管理部门及时将本通知有关事项告知课题负责人，并组织课题负责人签订《广州市哲学社会科学发展“十

四五”规划 2025 年度课题立项协议》一式 3 份（模板下载请联系市社科规划办），于 2025 年 9 月 3 日前送达我办审定盖章。

附件：广州市哲学社会科学发展“十四五”规划 2025 年度
常规课题（共建）立项名单



广州市社科规划领导小组办公室

2025 年 8 月 15 日

序号	负责人	单位名称	课题名称	课题编号
12	黄东平	华南理工大学	数字孪生技术驱动下的红色文化沉浸式体验空间构建研究——以华南理工大学图书馆研习书院为例	2025GZGJ12
13	陈洁	暨南大学	“人工智能+”驱动下广州强化全过程创新链人才支撑路径与策略研究	2025GZGJ13
14	陈义龙	暨南大学	数字赋能广州市体医融合的运行机制及路径研究	2025GZGJ14
15	闫立	暨南大学	广州加快推动汽车产业出海的机遇与风险研究：以广汽集团进军墨西哥市场为例	2025GZGJ15
16	董佺	华南师范大学	大湾区跨行政区产业合作中的多利益主体博弈模式及其机制优化研究	2025GZGJ16
17	汪惟宝	华南师范大学	数字人文视角下岭南设计史研究：方法论创新与知识图谱构建	2025GZGJ17
18	喻子秦	华南农业大学	“类沙盒”模式下金融科技监管对广州市企业新质生产力的影响及机制研究	2025GZGJ18
19	苏琳琳	华南农业大学	新质生产力赋能背景下零售服务对消费者行为的影响与优化策略研究	2025GZGJ19
20	范海峰	华南农业大学	广州市国有企业新质生产力对创新质量影响研究	2025GZGJ20
21	刘昌余	华南农业大学	基于人工智能视频监测的广州市智慧交通建设研究	2025GZGJ21
22	林敏慧	华南农业大学	嵌入性视角下艺术乡建与乡村旅游的互馈机制及实现路径研究	2025GZGJ22
23	李美群	华南农业大学	非遗+视域下岭南客家山歌在高校活态传承的路径探究	2025GZGJ23
24	栾志弘	华南农业大学	文化基因视域下广府音乐剧的叙事重构与现代性转化研究	2025GZGJ24

课题编号	2025GZGJ18
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广州市哲学社会科学发展“十四五”规划

2025 年度课题协议

二〇二五年八月

一、经专家组评审，报广州市委宣传部审定，同意将乙方申报的课题 “‘类沙盒’模式下金融科技监管对广州市企业新质生产力的影响及机制研究” 立项为广州市社科规划 2025 年度共建课题。课题编号：2025GZGJ18，课题负责人喻子秦，课题组成员陈艳艳、于建南、张京心、宋冰洁、肖翔。

二、课题经费管理

共建课题研究经费由丙方保障或乙方自筹。

三、课题结项要求

- 1.结项时间。2027 年 5 月 30 日前完成并向甲方提交结项材料。
- 2.结项条件。完成课题申报书研究任务，并满足以下条件之一即可申请结项：

(1) 成果形式为研究报告的：须提交 1 篇反映课题涉及领域基本情况、基础数据的深度调研报告，且课题成果（最终成果或阶段性成果）获各级党委政府或者各级党政职能部门吸收借鉴，有相关证明。

(2) 成果形式为论文的：至少 1 篇普刊论文。

(3) 成果形式为专著的：已正式出版。



3.结项材料。需提交结项材料电子版扫描件：①结题报告书；②课题申报书、课题立项协议；③研究成果；④佐证材料。发送以上电子材料至广州市社科规划办邮箱 gzsgbh@163.com。具体整理要求参见结项当年广州社科网公布的结项要求。

四、乙方必须遵守《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，恪守学术规范，不弄虚作假，保证取得预期研究成果。如乙方无故终止课题研究，按相关规定进行处理。

五、乙方研究成果对外发表或出版，以及报送相关部门，应标注“广州市哲学社科‘十四五’规划课题”字样和课题编号。

六、乙方研究成果应确保无涉密及涉意识形态问题。乙方研究成果对外发表或出版，以及报送相关部门前，应报丙方审查。

七、课题完成后，由丙方组织专家鉴定结项，结项评审结果通报甲方。

八、《课题立项协议》一式三份，一份由甲方保存，一份由

乙方保存，一份由丙方科研管理部门保存。

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）

法定代表人或委托人（签字）：

陈璐

日期：2025 年 8 月 14 日

乙方：喻子秦（课题负责人）

课题负责人（签字）：喻子秦

日期：2025 年 8 月 14 日

丙方：（单位盖章）

法定代表人或委托人（签字）：

陈红

日期：2025 年 8 月 14 日

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 喻子豪(学科类型:人文社科) 3 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
1	影子银行监管优化与企业创新——基于《资管新规》的准自然实验	会计研究 出版年：2023 出版日期：2023-04-15 卷期： 04 页码： - 文献号： 文献类型： 期刊论文	第一作者	A 类	华南农业大学 经济管理学院	北大核心		
2	Shadow banking regulation and firm investment efficiency: Evidence from China's new regulation of capital management	RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE 出版年：2025 出版日期： MAY 卷期： 77 页码： - 文献号： 102940 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)
3	Shadow banking Regulation and the stock price synchronicity —A quasi-natural experiment based on China's new asset management regulation	BORSA ISTANBUL REVIEW 出版年：2024 出版日期： JAN 卷期： 24 1 页码： 118-136	第一作者	A 类	华南农业大学 经济管理学院	SSCI	IF2-year=7.1 IF5-year=6.3 (2024)	经济学 2 区 Top 期刊： 否 OA 期刊： 是 (2025)

第 1 页/共 2 页

		文献类型： Article						
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说明：论文等级和中科院大类分区按《华南农业大学学位论文评价方案（试行）》划分。

报告免责声明:如未盖章,报告无效





总第426期

第 4 期
2023

会计研究

ACCOUNTING RESEARCH

再论财务报告的目标

会计准则内容呈现形式对会计师行为决策的影响研究

利润项目重分类与薪酬业绩指标权重调整

智慧司库管理会计体系研究



■ 主办单位：中国会计学会

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影子银行监管优化与企业创新

——基于《资管新规》的准自然实验^{*}

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【摘要】影子银行在一定程度上弥补了中国正规金融发展不足,但也可能放大系统性金融风险,有悖于宏观审慎原则。本文以《资管新规》政策为准自然实验,选择2015-2021年中国沪深A股上市企业为研究样本,检验影子银行监管优化对企业创新的影响及作用机制。研究发现,影子银行监管优化能够提升企业创新;机制检验发现,影子银行监管优化通过抑制企业金融化、降低投资风险,进而促进企业创新,支持了“影子银行风险观”假说;异质性检验发现,促进效应在国有企业、创新密集度和治理水平低的企业,以及产品市场竞争、影子银行发展和市场化程度较低的地区更为显著。本文不仅证实《资管新规》政策监管有效,还揭开了降低影子银行风险在微观企业创新层面的价值,为国家贯彻落实宏观审慎目标、引导金融有效服务实体经济提供政策启示。

【关键词】影子银行监管优化;资管新规;企业创新;金融化;投资风险

一、引言

党的二十大报告提出,加强和完善现代金融监管,守住不发生系统性风险的底线,增强金融服务实体经济能力。2021年末,央行发布《宏观审慎政策指引(试行)》文件,明确将防范系统性金融风险视为宏观审慎目标,进一步强调金融要有效支持实体经济。中国一直是以银行为主导的金融体系,影子银行是在资本市场信贷冲动受限、资产证券化程度较低情况下,对国内资产进行资产负债表外剥离的产物(周上尧和王胜,2021;Allen等,2019)。在长期金融压抑、信贷歧视的环境下,中小企业抗风险能力弱、缺乏抵押物,很难进行正规渠道融资,只能通过影子银行等非正规渠道来获取资金(蒋敏等,2020;程小可等,2015)。近年来,实体经济动力不足,金融资产具有更高收益,拥有闲置资金的大型企业更愿意进行影子银行投资(李建军和韩珩,2019;张成思和张步昙,2016)。在高需求和高收益的推动下,影子银行规模急剧扩张(项后军和周雄,2022)。虽然影子银行在一定程度上补充了正规信贷功能,为企业提供了额外投融资渠道,促进市场资金流动(Irani等,2021;An等,2018;钱雪松等,2018)。然而,影子银行由于隐蔽性较强,长期以来中国一直对其监管不足(李鹏,2019)。2008年,在“四万亿”刺激计划和宽松货币政策配合下,影子银行规模每年以20%以上的速度

增长。基于高杠杆、多嵌套、弱监管的特性,影子银行的无序扩张很可能会放大系统性金融风险,严重影响金融服务实体经济的能力,有悖于宏观审慎原则(李青原等,2022;侯成琪和黄彤彤,2020)。

为应对影子银行扩张乱象,2017年11月,央行会同各部委发布了《关于规范金融机构资产管理业务的指导意见》(简称《资管新规》征求意见稿),将影子银行纳入宏观审慎政策框架,奠定基本政策导向。2018年4月27日,《资管新规》正式颁布实施,核心内容为“破刚兑、防风险、去杠杆、去嵌套、减通道”,主打“全面监管、统一标准”,优化监管影子银行,践行宏观审慎管理。自《资管新规》发布以来,影子银行规模呈现大幅度下降。依据本文统计数据,截止2021年12月,影子银行规模从最高点27亿左右一直下降到18亿左右,下降幅度大约为33.33%。说明在宏观层面上,政策监管效果显著。在微观层面,企业是创新驱动发展的重要主体,其创新水平的提高至关重要。党的十九大报告和“十四五”国家发展规划均强调,创新在中国现代化建设全局中具有重要地位。而企业创新需要持久、大量的外部资金支持(彭龙等,2022;段军山和庄旭东,2021),由于影子银行直接通过信贷市场作用于企业资金配置(韩珩等,2022;彭俞超和何山,2020),那么影子银行监管优化是否会影响企业创新?

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学术上,鲜有文献直接研究影子银行监管,大多数集中探讨影子银行作为正规银行规避强监管的套利工具(Irani等,2021;侯成琪和黄彤彤,2020;刘莉亚等,2019)。在微观企业层面,有关文献分化出两个对立观点。“影子银行促进观”认为,影子银行能够充当企业资金“蓄水池”,提升企业资金流动性,缓解资金短缺风险,帮助企业持续经营(Chernenko和Sunderam,2014;黄贤环等,2021;蒋敏等,2020)。而“影子银行风险观”认为,影子银行游离于监管体系之外,多以杠杆进行监管套利,容易诱发系统性风险,严重影响国家金融安全(李青原等,2022;李建军和韩珣,2019)。因此,本文尝试从这两个对立观点来分析影子银行监管优化对企业创新的影响:根据“影子银行促进观”,企业可通过影子银行“蓄水池”效应满足“预防性储蓄”动机,提升流动性状况,平滑资金短缺,而影子银行监管优化限制了这一功能,削弱企业盈利能力,降低现金流水平,不利于企业创新。再根据“影子银行风险观”,在“利润追逐”动机下,企业更会因为高收益而依赖影子银行投资,形成金融化,提升投资风险,而影子银行监管优化能够控制投资风险,进而释放被侵占的资源,促进企业创新。

基于此分析,本文选择中国2015-2021年沪深A股上市企业为研究样本,以2018年发布的《资管新规》为准自然实验,实证探究影子银行监管优化对企业创新的影响及作用机制。研究发现,《资管新规》下,影子银行监管优化能够提升企业创新,抑制企业金融化和降低投资风险是两者之间重要的机制路径。此结果支持了“影子银行风险观”假说。同时,提升效应在国有企业、创新密集度和治理水平低的企业,以及产品市场竞争、影子银行发展和市场化程度较低的地区更为显著。

本文从以下几个方面做出了边际贡献。首先,扩展了影子银行监管的相关研究。现有文献较少直接研究影子银行监管,在当前防范系统性金融风险,金融服务实体经济的导向下,影子银行监管值得引起关注与重视。本文以《资管新规》优化监管影子银行为出发点,深入分析政策的实施效果,为宏观审慎政策框架的未来发展提供经验证据。其次,补充了影子银行在微观层面的经济后果。现有文献多从宏观层面探讨影子银行的经济后果,比如金融系

统脆弱性、货币政策有效性、信贷资源配置等(Chen等,2021;彭俞超和何山,2020;高蓓等,2020;Allen等,2019;Chen等,2018),较少涉及影子银行对微观企业的影响,并且针对影子银行的作用分化出对立的观点。本文研究影子银行监管优化对企业创新的影响,基于监管新视角,提供影子银行在微观层面作用的新证据。再次,丰富了企业创新的宏观影响因素。近年来,从宏观层面分析企业创新影响因素的文献非常多,比如税收激励(刘诗源等,2020)、产业政策(诸竹君等,2021)、金融发展(庄毓敏等,2020)等等。虽然有学者研究了非金融企业影子银行化^①与创新的关系(韩珣等,2022),但大多是从企业内部微观视角出发,而影子银行监管作为宏观市场因素一直以来都被忽略。本文以此为出发点,扩展了当前企业创新影响因素研究。最后,提供了辩证看待影子银行监管优化政策的证据。在新冠肺炎疫情影响下,企业经营备受打击,《资管新规》这种强监管方式可能给金融机构带去较大整改压力,造成一定的经济成本(彭俞超和何山,2020)。但本文结果证实了影子银行监管优化能够提高企业创新,说明政策能够有效控制影子银行带来的风险,有利于贯彻落实宏观审慎目标,支持实体经济发展。

二、制度背景

2008年全球金融危机之后,中国资管业务随着“四万亿”刺激计划和宽松货币政策迅速扩大^②,信贷规模急剧上升,“大资管”时代拉开序幕。虽然影子银行在一定程度上补充了非正规金融的功能,但容易因监管不足、多重套利,引发系统性风险等诸多危机(李鹏,2019)。自2010年以来,中国政府发布一系列监管政策,试图控制影子银行带来的风险。由于前期资管行业还处于起步阶段,对影子银行界定较为模糊,相关政策主要收紧的是信托业务,这会驱使影子银行逃避监管快速发展其他业务,整体上相关风险尚未得到控制(Yang等,2019)。2014年1月,银监会首次明确影子银行业务范围,一些同业业务和表外业务的监管政策也随之实施(见表1),初步确立影子银行的监管方向。2018年4月27日,《资管新规》^③落地,作为目前最为有力的“强监管”政策,将影子银行纳入宏观审慎管理体系,主打“破刚兑、防风险、去杠杆、去嵌套、减通道”,建立起覆盖全部参与主体的综合监管制度,

① 企业影子银行化表现为影子信贷资产占总资产比重逐渐提高。

② 依据央行发布《中国金融稳定报告(2017)》,截至2016年末,各行业金融机构资管业务总规模约60多万亿元,该体量大致接近2017年前三季度GDP总量(59.3万亿元)。

③ 2017年11月,央行联合各部委发布《资管新规》征求意见稿。2018年4月27日,《资管新规》正式稿落地,在征求意见稿的基础上,更加明确资管业务表述,并在打破刚性兑付、投资限制、信息披露上有更为严格的监管要求。《资管新规》要求金融机构对资管产品实行净值化管理,实现“卖者尽责、买者自负”;禁止金融机构将产品资金投资于商业银行信贷资产;严格规范产品嵌套和通道业务,要求金融机构开展业务时不得承诺保本保收益,不得为其他金融机构提供通道服务,并对产品设定统一杠杆率;禁止金融机构开展或者参与“资金池”业务,以“三单”(单独管理、单独建账、单独核算)管理为基础,加强产品久期管理。同时,《资管新规》还明确界定了更为广泛的资管业务范围,建立起覆盖全部参与主体的综合监管制度,统一合格投资者的标准及门槛。

统一合格投资者的标准及门槛，从而限制影子银行虚高收益和投资主体投机套利。较于以往政策，《资管新规》更

加强调“全面、统一”的监管概念，是全方位的监管优化手段，以此贯彻落实宏观审慎目标。

表 1 中国影子银行部分监管政策（2014-2018）

发布时间	政策	监管对象	重点要求
2014 年 1 月	第 107 号通知 (银监会)	资管业务	首次界定中国影子银行体系范畴；银行要按照实质重于形式的原则计提资本和拨备，代客理财资金要与自有资金分开使用，不得购买本银行贷款
2014 年 5 月	第 127 号通知 (央行、外汇管理局、 银监会、保监会、 证监会联合)	同业业务	(1) 不得接收和提供第三方金融机构信用担保；(2) 为非标准化金融投资留出适当的风险权重和准备金；(3) 区分存款和结算存款；(4) 对银行间借贷施加最长期限的上限
2016 年 3 月	第 82 号通知 (银监会)	表外业务	严格监管表外资产，不得通过银行理财资金直接或间接投资信贷资产收益权，要求银行将贷款类资产视为资本贷款和准备金；鼓励银行在集中平台上登记转让的信贷资产
2018 年 4 月	第 106 号通知 (央行、银监会、证监会、 外汇管理局联合)	资管业务	建立所有资管产品的统一规则：资产管理公司发起人被禁止承诺有保证的回报，被要求留出 10% 的管理费用于拨备（最高为资产管理规模的 1%）；设定投资者门槛；应定期向投资者报告资产净值；杠杆限制；投资其他资管产品的限制；加强产品及流程的信息披露，禁止明确担保、多重嵌套和“资金池”业务

实践中，《资管新规》极大限制了影子银行规模。图 1 显示了 2014 年 12 月至 2021 年 12 月中国影子银行规模的变化^④。2017 年 11 月《资管新规》征求意见稿发布后，影子银行规模在当年 12 月达到历史高位，之后便开始下降。在 2018 年 4 月政策正式实施后，影子银行规模出现加速下降。整体来看，从 2017 年底到 2021 年底，影子银行规模

从最高点 27 亿左右一直下降到 18 亿左右，下降幅度大约为 33.33%，说明该政策在宏观层面实施有效。在微观层面，企业创新需要大量、持续的资金支持，而影子银行与企业投融资关系紧密。因此，《资管新规》下，影子银行监管优化是否会对企业创新产生影响？本文将对此展开深入分析。

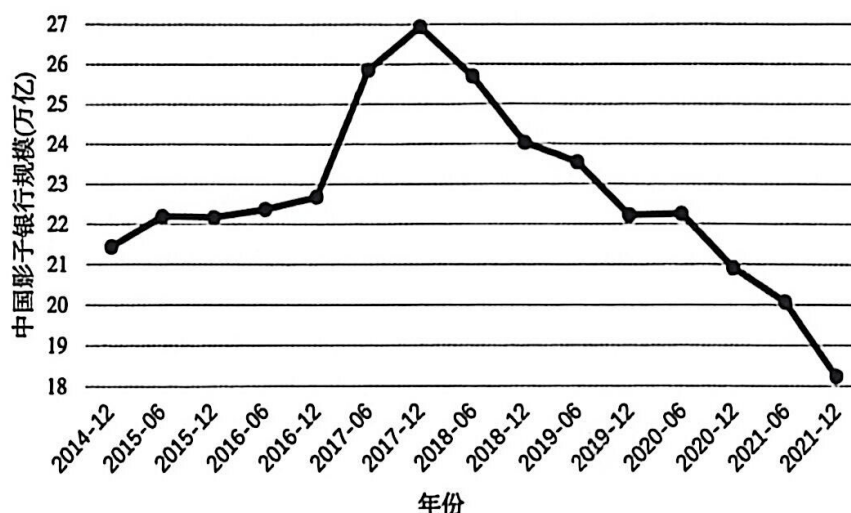


图 1 中国影子银行规模
数据来源：中国中经网统计数据库

^④ 影子银行规模的计算借鉴彭俞超和何山（2020）、李建军等（2015）的方法，使用社会融资规模存量中委托贷款、信托贷款以及未贴现银行票据的总和作为影子银行规模的代理变量。

三、文献回顾

宏观层面上,影子银行的经济后果研究较为丰富,但对于产生效果尚未达成一致意见。“影子银行促进观”认为,影子银行能够增加资本市场资金流动性与活跃度,推动经济增长(An等,2018;Hou等,2018;Lu等,2015;钱雪松等,2018;何平等,2017)。而“影子银行风险观”认为,影子银行以高杠杆运作,多为监管套利工具,更容易引发系统性风险,不利于金融稳定(Chen等,2021;Allen等,2019;Chen等,2018;高蓓等,2020;彭俞超和何山,2020;彭俞超和黄志刚,2018)。虽然目前较少研究涉及影子银行在微观企业层面的后果,但也有对立的观点:“影子银行促进观”认为,影子银行能够发挥“蓄水池”效应,帮助企业获得更多的流动资金,降低资金短缺风险,有助于企业持续经营。Chernenko和Sunderam(2014)提出,影子银行使货币政策传导渠道由传统的狭义传导变为广义传导,在一定程度上提高了企业外部融资水平。蒋敏等(2020)认为,影子银行能够缓解企业融资约束,降低融资成本。黄贤环等(2021)发现,影子银行通过提高企业现金流水平来抵御风险,进而提升未来业绩,实现“金融反哺实业”。而“影子银行风险观”认为,影子银行因高杠杆、弱监管给企业带来诸多风险,同时加剧企业金融化,势必挤出实业投资,不利于企业长期发展。Bleakley等(2010)发现,影子银行拓宽了企业短期融资,但更造成短期流动性与长期投资不匹配,降低企业价值。李建军和韩珣(2019)提出,企业投资影子银行会导致现金流波动,引发企业经营危机。杜勇等(2017)认为,在影子银行高额收益驱使下,企业最终会走向金融化道路,逐步脱离主业,造成经济“脱实向虚”,极大提高金融风险。因此,现有研究急需额外视角来进一步佐证影子银行在微观层面的作用,比如影子银行监管。

创新作为企业和国家发展的重要关键,鲜有文献关注影子银行监管对其影响。与本文较为相关的研究多以企业影子银行化为基础,比如韩珣等(2022)发现非金融企业影子银行化会抑制企业创新。但其为企业内部决策视角,尚未直接关注宏观政策下,影子银行监管与企业创新之间的关系。《资管新规》给本文提供了一个恰当的影子银行全面监管优化的背景,有助于从宏观视角给当前影子银行一个合理定位,为辩证看待影子银行监管政策提供经验证据。

四、研究假设

创新的高风险、长周期、不确定性等特征,使得企业需要高效、高质的资金支持(彭龙等,2022;段军山和庄旭东,2021)。实体企业投资影子银行业务主要出于两个动

机:“预防性储蓄”和“利润追逐”。前者认为,影子银行变现能力强,转换成本低,能充当资金“蓄水池”,平滑资金短缺风险(黄贤环等,2021),给创新提供了良好的基础,支持了“影子银行促进观”。而后者认为,影子银行较于实体项目具有更高收益,企业更会出于投机逐利进行投资,而可用资源的有限造成实业项目被挤出(李青原,2022;杜勇等,2017),从而抑制企业创新,支持了“影子银行风险观”。

从“影子银行促进观”来看,影子银行收益高、变现能力强、转换成本低(张杰,2015),可以帮助企业在短期内获得更多利润(邓路等,2020;杜勇等,2017)。而上市企业一直是信贷偏好对象,可以充当信用中介^⑤、参与信用链条^⑥,成为影子银行投资主体(李建军和韩珣,2019),以此改善短期绩效,提升信用等级,更便于融资,从而提升创新投入与产出(段军山和庄旭东,2021)。预防性储蓄理论认为(Leland,1978),企业会运用闲置资金进行短期金融投资,在资金不足时可快速变现,降低经营风险(杜勇等,2017;胡奕明等,2017)。因此,影子银行还能充当资金“蓄水池”(黄贤环等,2021),在资金短缺时出售来反哺创新项目。而《资管新规》极大提升投资准入门槛,明确可用于投资的产品标准,可能会限制影子银行信贷功能,打击企业经营能力和盈利能力(刘贯春等,2018)。考虑到创新也存在高风险特性,管理层出于风险规避,很可能选择中断或者不敢推进创新项目。

然而,当前金融安全形势日趋严峻,影子银行带来的风险更值得重视。从“影子银行风险观”来看,一方面,影子银行会加剧企业“金融化”,挤出创新等实体项目。在全球经济增速减缓、虚拟经济泡沫等因素影响下,更多实体企业出于“利润追逐”动机投资影子银行(李建军和韩珣,2019;杜勇等,2017)。尝试在短期内高额获利后,企业极易陷入投资获益的“炒钱”陷阱中,呈现“金融化”,加剧盈余波动(Jin等,2022;彭俞超等,2018)。而资源总量有限,实体项目势必会被陆续挤出(韩珣等,2022;彭龙等,2022;段军山和庄旭东,2021)。此时,管理层的自利动机也会被加剧,为了更高的短期绩效,会选择将资金过多投入影子银行,进一步压缩创新等实业项目的投资空间(李建军和韩珣,2019)。《资管新规》要求影子银行业务不得承诺保本保收益、打破刚性兑付,禁止多层嵌套和通道业务,能够有效降低虚高收益率,使得企业从主观上放弃影子银行投资,寻找以创新为主流的新利润增长点。同时,在提高影子银行投资者门槛,加强业务主体监管的要求下,企业不得不专注实业,内部可以释放出更多资源用于提升创新水平。

⑤ 主要以委托贷款、民间借贷等方式直接给融资企业提供资金。

⑥ 主要通过购买银行理财产品、信托产品等,来加入涉及体制的影子银行业务。

另一方面,企业投资影子银行可能存在一系列风险:一是影子银行的借贷审核并没有严格、完善的规章制度,操作过程中极有可能出现借款方无法及时还款和投资失败的情况,对企业投资活动产生负面冲击(李建军和韩珣,2019;沈红波等,2013)。二是大部分影子银行产品存在固有缺陷,像信托企业“资金池”业务,具有滚动发售、集合运作、期限错配、分离定价等特征(李鹏,2019)。在这种模式下,资金难以与项目形成一一对应关系,任意一个投资项目发生问题,整个业务都会出现连锁反应,存在极高投资风险(韩珣等,2022)。三是影子银行业务结构繁多复杂,往往通过高杠杆获益,杠杆越高风险越大。当投资者对市场失去信心时,高杠杆将会成倍放大影子银行的损失,也会通过系统性风险联动传递到投资主体,诱发企业经营危机(Yang等,2019)。由于创新活动具有高风险和不确定性,企业对创新失败需要有相应的高容忍度(Holmstrom,1989)。从企业管理层来看,失败容忍度往往与企业风险息息相关(Tian和Wang,2014;Li和Tang,2010;Mingui等,2013)。当企业承担风险或预期风险水平可控时,管理层容忍度较高,会主动追求和把握机会,考虑开展高风险的创新活动(Shan等,2016)。而当企业风险水平较高时,企业的运营、盈利能力等都会受到挑战,此时管理层具有较低的失败容忍度,更会规避风险选择较为保守的管理策略降低创新活动(He和Tian,2013;Zhou等,2021)。《资管新规》强调“卖者尽责、买者自负”的风险理念,金融机构不得提供通道服务,明确每只产品“三单管理”,禁止开展“资金池”业务,要求产品净值化,这极大地约束了影子银行高杠杆率,降低企业投资风险。此时,管理层失败容忍度较高,对投资项目成功更为乐观,提升创新投资的风险承担意愿,更会把握创新机会,提升创新积极性。

如今,中国防范化解金融风险面临严峻挑战,较于影子银行的促进作用,其风险带来的不利影响可能更大。从“影子银行风险观”来看,影子银行会导致企业“金融化”,侵占创新等实业投资份额,以高杠杆加剧企业投资风险。而《资管新规》通过多项举措管控影子银行风险,优化影子银行运作,放开原有资源侵占,促进企业创新。基于上述分析,本文提出以下假设:

H1:《资管新规》下,影子银行监管优化会提升企业创新。

五、研究设计

(一) 样本与数据来源

本文选择中国2015-2021年沪深A股上市企业为研究样本。所能获取最新数据来自2021年,之所以用2015年作为研究起始年,是因为《资管新规》正式稿发布于2018

年4月27日,为了避免以往数据持续时间过长而受到其他事件的干扰,本文选择2015年作为起始年,实现以事件发生时间为中心的对称均衡的样本期。

本文对样本数据进行如下处理:(1)删除金融行业和房地产行业企业样本;(2)删除《资管新规》发布后上市的企业样本;(3)剔除不满足政策实施前后至少有1期数据的样本。(4)删除ST、PT企业样本;(5)删除数据缺失的企业样本。最终得到15386个样本观测值。为控制异常值,本文对连续变量在1%和99%水平上Winsorize处理。企业创新数据来自中国研究数据服务平台(CNRDS)数据库,影子银行投资依赖度^⑦、相关财务数据和企业治理等数据来自中国经济金融研究数据库(CSMAR)、万德数据库(WIND)和中国中经网统计数据库。

(二) 识别策略与模型设定

《资管新规》由国家统一发布,所有企业都会在同一时间点受到影响,广义双重差分模型(GDD)适用所有个体企业均受到政策冲击,但每个个体企业受到影响程度不同的情形。基于上述分析,《资管新规》可能会对影子银行投资依赖度不同的企业产生不同影响。因此,本文构建以下广义双重差分模型,控制了行业和年度虚拟变量:

$$CII_{i,t+1}/CIO_{i,t+1} = \alpha_1 POST \times DSB I_{i,t} + \alpha_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (1)$$

在模型(1)中,CII为创新投入,CIO为创新产出;POST为《资管新规》正式稿是否发布的虚拟变量,发布之前取值为0,发布之后则取值为1;DSBI为政策发布前3期末的企业平均影子银行投资依赖度的代理变量;CONTROL为一系列控制变量, $\sum YEAR$ 和 $\sum FIRM$ 表示模型控制了年度和企业固定效应。此外,回归结果对公司层面的聚类进行了修正。

(三) 变量定义

1. 企业影子银行投资依赖度。考虑到研究样本为上市企业,拥有多种融资渠道,参与影子银行目的多为获得高额投资收益,故从投资视角,用企业影子银行投资依赖度DSBI反映政策影响差异,其测算方式为《资管新规》政策实施前3期企业的平均影子银行投资规模。借鉴Lu等(2015)、司登奎等(2021)、李建军和韩珣(2019)的研究,本文采用委托贷款、委托理财、民间借贷与购买各类影子信贷产品加总再除以总资产得到企业影子银行投资规模。

2. 企业创新。企业创新是一个动态的过程,参考潘越等(2015)、Mukherjee等(2017)、Chang等(2019)的研究,本文从“投入—产出”角度来更好刻画企业创新。借鉴顾海峰和朱慧萍(2021)、黎文靖等(2021)、彭龙等

^⑦ 影子银行投资依赖度指的是企业在影子银行投资的程度。

(2022)的经验,采用研发支出与营业收入占比来衡量创新投入 *CII*,采用企业专利申请数加1取自然对数来衡量创新产出 *CIO*。

3. 控制变量。本文参照已有研究(黎文靖等, 2021; 姜爱华和费堃桀, 2021; Rajkovic, 2020),控制了可能影响企业创新的一些变量:企业规模(*SIZE*)、无形资产占

比(*IA*)、资产负债率(*LEV*)、资产收益率(*ROA*)、企业年龄(*AGE*)、两职合一(*DUA*)、董事会规模(*BOAR*)、第一大股东持股比例(*LSSR*)、机构投资者持股比例(*INST*)、政府补助(*GS*)、产权性质(*OWN*)、当地经济发展程度(*GDP*)、金融发展水平(*LFD*)和产业结构(*IIS*)。具体变量定义见表2。

表2 变量定义与说明

变量类型	变量名称	变量符号	变量定义
被解释变量	企业创新	<i>CII</i>	创新投入,即研发支出与营业收入占比
		<i>CIO</i>	创新产出,即企业专利申请数加1取自然对数
解释变量	政策变量	<i>DSBI</i>	影子银行投资依赖度,测算方式为《资管新规》政策发布前3期企业的平均影子银行投资规模,数值越大表明企业影子银行的投资依赖程度越高,受到《资管新规》政策的影响越大
	时间变量	<i>POST</i>	政策发生前的年份取值为0,政策发生后的年份取值为1
控制变量	企业规模	<i>SIZE</i>	总资产的自然对数
	无形资产	<i>IA</i>	无形资产/总资产
	资产负债率	<i>LEV</i>	总负债/总资产
	资产收益率	<i>ROA</i>	净利润/总资产
	企业年龄	<i>AGE</i>	企业已上市的年份取对数
	两职合一	<i>DUA</i>	若董事长与CEO为同一人,则取值为1,否则为0
	董事会规模	<i>BOAR</i>	董事会人数的对数
	第一大股东持股比例	<i>LSSR</i>	第一大股东持有的股份占全部股份的比例
	机构投资者持股比例	<i>INST</i>	机构投资者持股数占全部股份的比例
	政府补助	<i>GS</i>	由财政贴息、政府补贴、税费返还等政府补助总额取自然对数
	产权性质	<i>OWN</i>	若企业为国有企业,取值1,否则取0
	经济增长速度	<i>GDP</i>	地区GDP增长率
	金融发展水平	<i>LFD</i>	金融机构贷款总额/GDP
	产业结构	<i>IIS</i>	第二和第三产业增加值/GDP
	年份	<i>YEAR</i>	年份虚拟变量,若观测值落在该年份,则赋值为1,否则为0
	行业	<i>IND</i>	行业虚拟变量,若观测值落在该行业,则赋值为1,否则为0

(四) 描述性统计

表3的Panel A显示了变量描述性统计结果。创新投入 *CII* 的均值为4.243,最小值为0,最大值为29.763;创新产出 *CIO* 的均值为2.236,最小值为0.523,最大值为9.081,说明整体上样本企业创新投入和产出处于较低的水平。*POST* 的均值为0.582,标准差为0.364,这意味《资

管新规》实施后的样本占比为58.2%,样本年份期间较为均衡。*DSBI* 的均值为0.243,中位数为0.225,说明样本中依赖影子银行投资的企业占比较多。综合来看,样本企业的描述性统计数据与之前研究数据相似(李青原等, 2022; 彭俞超和何山, 2020; 蒋敏等, 2020),体现出样本选择较为客观、均衡。

表3的Panel B研究了在单变量下,企业创新投入 CII 和产出 CIO 在政策发布年份前后的变化。可以看出,政策发布后 ($POST=1$) 与政策发布前 ($POST=0$) 相比,企业创新投入 CII 的均值提升了 23.2%^⑧,创新产出 CIO 的均

值提升了 21.7%^⑨。并且两者的均值和中位数差异检验均显著,说明政策颁布后,整体上企业的创新投入和产出都得到一定的提升。这些发现为影子银行监管优化和企业创新之间的正相关关系提供了初步证据。

表3 描述性统计

Panel A: Descriptive statistics								
Variable	N	mean	p50	sd	min	max		
<i>CII</i>	15386	4.243	2.642	3.115	0	29.763		
<i>CIO</i>	15386	2.236	1.988	1.556	0.523	9.081		
<i>POST</i>	15386	0.582	1	0.364	0	1		
<i>DSBI</i>	15386	0.243	0.225	0.219	0	0.902		
<i>SIZE</i>	15386	22.267	22.156	1.553	16.979	27.191		
<i>IA</i>	15386	0.055	0.035	0.377	0	0.924		
<i>LEV</i>	15386	0.439	0.410	0.220	0.011	0.926		
<i>ROA</i>	15386	0.049	0.041	0.687	-0.157	0.221		
<i>AGE</i>	15386	2.442	2.479	0.317	1.343	3.501		
<i>DUA</i>	15386	0.310	0	0.463	0	1		
<i>BOAR</i>	15386	2.228	2.303	0.186	1.082	2.793		
<i>LSSR</i>	15386	0.335	0.311	0.149	0.003	0.897		
<i>INST</i>	15386	0.508	0.527	0.226	0	0.890		
<i>GS</i>	15386	15.511	15.715	2.389	0	22.864		
<i>OWN</i>	15386	0.322	0	0.467	0	1		
<i>GDP</i>	15386	0.124	0.105	0.077	0.005	0.242		
<i>LFD</i>	15386	0.803	0.786	0.438	0.227	2.875		
<i>IIS</i>	15386	0.790	0.735	0.348	0.188	0.947		
Panel B: Univariate analysis								
Variable	POST=0			POST=1			Diff	Diff
	N	Mean	Median	N	Mean	Median	(Mean)	(Median)
<i>CII</i>	6884	3.916	2.314	8502	4.825	2.923	-0.129 ***	-0.122 ***
<i>CIO</i>	6884	1.902	1.857	8502	2.314	2.201	-0.121 ***	-0.115 ***

六、实证设计

(一) 基准检验

表4报告了基准回归结果。第(1)、(3)列没有添加控制变量, $POST \times DSBI$ 与 $CII_{i,t+1}$ 和 $CIO_{i,t+1}$ 的回归系数均在 1%

下显著为正,初步支持了假设 H1。第(2)、(4)列增加了全部控制变量, $POST \times DSBI$ 与 $CII_{i,t+1}$ 和 $CIO_{i,t+1}$ 的回归系数也分别在 1%及 5%水平下显著为正,进一步支持了假设 H1。经济意义上,《资管新规》实施前企业影子银行的依赖度提

⑧ 由 $(4.825-3.916)/3.916$ 计算得出。

⑨ 由 $(2.314-1.902)/1.902$ 计算得出。

高1个标准差,政策实施后,其创新投入和产出分别提高2.59%^⑩和2.48%^⑪。创新产出比投入提升幅度要低的原因可能在于,一方面,大部分创新项目的周期都比较大(陈德球等,2021),所以短期内企业创新产出的提升程度没有创新投入那么快;另一方面,创新项目存在较高风险,即使创

新投入提高了很大幅度,也可能存在创新失败或延误的情况(刘诗源等,2020)。这些结果表明,《资管新规》下,影子银行监管优化能够提升企业创新水平,初步支持了“影子银行风险观”假说,即当前影子银行反而带给企业更多风险,而《资管新规》能够很好控制住风险,促进企业创新。

表4

影子银行监管优化与企业创新

	(1)	(2)	(3)	(4)
VARIABLES	$CII_{i,t+1}$	$CII_{i,t+1}$	$CIO_{i,t+1}$	$CIO_{i,t+1}$
$POST \times DSBI$	0.593 *** (3.72)	0.501 *** (2.63)	0.313 *** (3.14)	0.253 ** (2.35)
$SIZE$		0.086 *** (3.14)		0.135 ** (2.29)
IA		0.169 *** (3.77)		0.236 *** (2.74)
LEV		-0.007 (-1.11)		-0.002 (-0.12)
ROA		0.003 (0.23)		0.083 ** (2.13)
AGE		-0.001 (-0.07)		-0.001 (-0.80)
DUA		-0.074 *** (-2.63)		-0.095 (-1.55)
$BOAR$		0.025 ** (2.18)		0.001 (0.42)
$LSSR$		-0.053 (-1.23)		-0.008 (-0.02)
$INST$		0.084 (0.80)		0.003 (1.06)
GS		0.029 ** (2.15)		0.014 (1.40)
OWN		-0.212 *** (-3.84)		-0.053 *** (-2.87)
GDP		0.041 ** (2.08)		0.027 * (1.77)

⑩ 由 $0.501 \times 0.219 / 4.243$ 计算得出。

⑪ 由 $0.253 \times 0.219 / 2.236$ 计算得出。

续表

	(1)	(2)	(3)	(4)
<i>LFD</i>		0.140*** (3.50)		0.118*** (3.26)
<i>IIS</i>		0.092*** (3.49)		0.073*** (3.16)
<i>Constant</i>	0.156*** (9.42)	0.002 (0.12)	0.478*** (4.91)	0.101 (0.45)
<i>Year & Firm</i>	YES	YES	YES	YES
<i>Observations</i>	13362	13362	13362	13362
<i>R-squared</i>	0.283	0.358	0.220	0.268

(二) 稳健性检验

1. 平行趋势假设检验。本文利用事件研究法 (event study) 来验证平行趋势假设。本文在模型 (1) 的基础上构建以下回归模型:

$$CII_{i,t}/CIO_{i,t} = \sum_{j=-3}^{-1} \gamma_j pre \times DSBI_{i,t} + \gamma_0 current \times DSBI_{i,t} + \sum_{j=1}^3 \gamma_j post \times DSBI_{i,t} + \gamma_5 CONTROL_{i,t} + \sum IND + \sum FIRM + \varepsilon_{i,t} \quad (2)$$

其中, 本文分别构建年份虚拟变量 *pre*、*current*、*post* 与 *DSBI* 的交互项作为解释变量进行回归, *pre*、*current*、*post* 分别代表政策发生之前、当期、之后。 γ_j 系数反映了特定年份下受到政策不同影响的企业间差异, γ_0 为政策发生当期的效果, γ_{-3} 到 γ_{-1} 为政策发生前 1-3 期的效果, γ_1 到 γ_3 为政策发生之后 1-3 期的效果。本文选择政策发生之

前的第 1 期作为模型的基准组。未列表的结果显示^⑫, 政策发生前, 具有不同影子银行投资依赖度的企业之间并不存在显著差异, 满足了平行趋势假设。并且政策发生后, 影子银行监管优化对企业创新投入和产出起到了较为长期的正效应, 持续提升企业创新。

2. 安慰剂检验。借鉴 Cornaggia 和 Li (2019)、陈钊和申洋 (2021) 的做法, 本文通过随机事件模拟来进行安慰剂检验, 随机生成政策发生时间并进行回归。如图 2 所示, 在 500 次的随机抽样中, 核心解释变量的回归 *t* 值均呈现出接近零为均值的正态分布, 表明检验符合随机化的条件, 而基于真实数据得到的回归 *t* 值分别为 2.63 和 2.35 (见表 4 的第 2 列和第 4 列), 均处于安慰剂检验回归 *t* 值分布之外。这表明企业创新水平的上升的确是《资管新规》实施结果, 并未是由其他未控制因素所致。

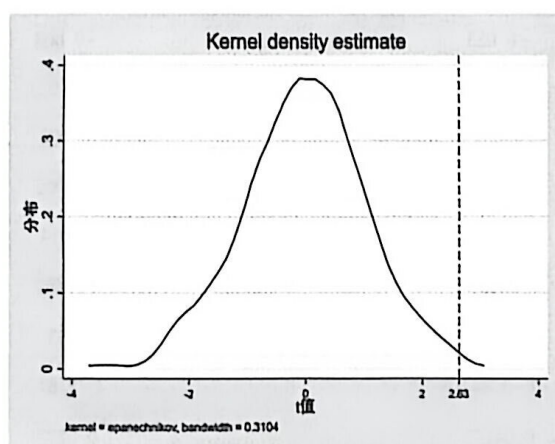


图 2-1 影子银行监管优化与企业创新投入

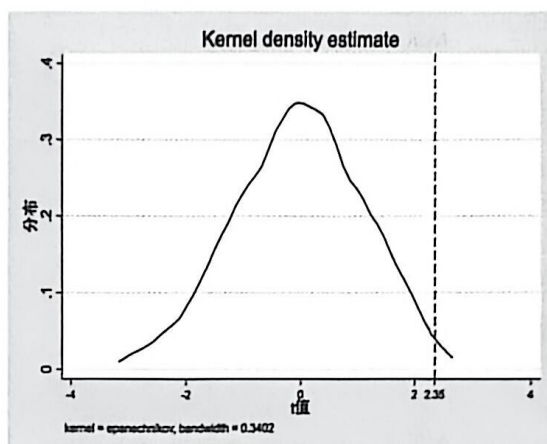


图 2-2 影子银行监管优化与企业创新产出

图 2 安慰剂检验

⑫ 检验结果未列示, 需要者可向作者索取。

3. 排除同期其他重大事件。(1) 排除新冠肺炎疫情影响。2019年底,中国开始出现新冠肺炎疫情,受影响企业的经营状况持续波动,可能会影响创新水平。本文借鉴刘贯春等(2021)的做法,构建新冠肺炎疫情发生时间的虚拟变量 $POST2019$,将其与政策变量的交互项纳入模型进行回归。(2) 排除货币供应政策影响。还可能存在着这样一种解释,为配合《资管新规》顺利推进,央行增加货币供应,这才是提高企业创新的主要原因。为排除这种可能,借鉴李青原等(2022)的做法,本文构造货币供应量 $MONETARY$,用广义货币供给量 $M2$ 的增长率度量,将其与时间变量的交互项纳入模型回归。(3) 排除中美贸易摩擦影响。2017年8月,美国对中国发起“301调查”,加剧中美贸易摩擦,可能通过出口管制、进口竞争和市场压力来影响企业创新(万源星等,2022)。为了控制此影响,本文将企业出口依赖度 EED ^⑬ 与时间变量的交互项纳入模型回归。未列表的结果显示,在排除这三大同期重大事件影响后, $POST \times DSBI$ 的回归系数依然显著为正,研究结果未发生实质性改变。

4. 替换变量度量方式。借鉴姜爱华和费堃桀(2021)、顾海峰和朱慧萍(2021)的研究、彭龙等(2022)的研究,采用企业研发支出与总资产之比作为创新投入的新代理变量 $CII1$;同时采用企业专利引用数量加1取自然对数作为创新产出的新代理变量 $CIO1$ 。未列表的结果显示, $POST \times DSBI$ 回归系数均显著为正,研究结论依旧稳健。

5. 考虑模型设定误差。考虑到样本中部分企业的专利数据为零且较为集中,具有截断特征,普通回归模型可能会存在设定误差,为此,本文借鉴李云鹤等(2022)的经验采用Tobit回归。未列表的结果显示,在考虑模型设定问题后,研究结果仍然稳健。

七、机制检验

(一) 抑制企业金融化

在资源一定的情况下,金融和实业投资之间是相互替

代与竞争的关系(杜勇等,2017),企业金融投资过多会形成金融化,挤出创新等实业项目投资(Jin等,2022)。而高收益、易变现的影子银行是加剧实体企业向金融化转变的关键(彭俞超和黄志刚,2018)。《资管新规》规定影子银行投资者门槛,降低影子银行虚高收益率,减少企业影子银行投资,抑制企业金融化。此时,企业需要在实业项目中寻找新利润增长点,更会尝试创新这种高收益的投资项目来弥补损失,同时释放出更多被侵占的资源来提升创新水平。因此,《资管新规》可能通过抑制企业金融化来促进企业创新。为了检验这个机制,首先,本文参照Liu和Mao(2019)、刘斌和甄洋(2022)的研究思路,构建下述模型来观测核心解释变量对中介变量的影响:

$$FA_{i,t+1} = \theta_1 POST \times DSBI_{i,t} + \theta_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (3)$$

其中, FA 为企业金融化程度,参照相关文献(顾雷雷等,2020;杜勇等,2017),本文采用企业金融化投资总额占总资产的比重来衡量^⑭,其他变量与模型(1)相同。表5列(1)展示了回归结果, $POST \times DSBI$ 的回归系数在1%水平下显著为负,表明《资管新规》实施后,依赖影子银行投资的企业其金融化程度显著降低,实业挤占被放开,会有更多的资源用于企业创新。其次,参照张广冬和邵艳(2022)的做法,本文进行横截面检验,将企业金融化程度按照行业年度中位数划分样本,来进一步验证抑制企业金融化的作用机制。表5列(2)至(4)报告了回归结果。可以看出,当企业金融化程度较高时, $POST \times DSBI$ 的回归系数均在1%水平下显著为正,组间系数差异均显著,说明金融化程度越高的企业,在影子银行监管优化下,越能释放出挤占的资源,从而提升创新投入和产出,证明抑制企业金融化是影子银行监管优化影响企业创新的重要机制。

表5 抑制企业金融化机制

		高金融化组	低金融化组	高金融化组	低金融化组
	(1)	(2)	(3)	(4)	(5)
VARIABLES	$FA_{i,t+1}$	$CII_{i,t+1}$	$CII_{i,t+1}$	$CIO_{i,t+1}$	$CIO_{i,t+1}$
$POST \times DSBI$	-0.324 *** (-4.81)	0.533 *** (2.94)	0.039 (0.53)	0.279 *** (2.62)	0.028 (0.36)

⑬ 企业出口依赖度的计算方式为《资管新规》实施前3期企业的平均出口业务收入占比。

⑭ 金融化投资总额包括交易性金融资产、衍生金融资产发放贷款及垫款净额、可供出售金融资产、持有到期投资、投资性房地产。虽然货币资金和应收账款也属于金融资产,但大部分企业持有的目的在于日常经营而非增值,所以本文金融资产不包括两者。由于企业进行房地产投资主要用于投机而非自用,符合金融虚拟化特征,因此本文金融资产中还包含了投资性房地产净额项目。此外,参考杜勇等(2017)的研究,由于2018年新会计准则里不再使用“持有至到期投资”和“可供出售金融资产”项目,所以本文的2019和2020年的企业数据中,将用“债权投资”代替“可供出售金融资产”项目,用“其他债权投资”与“其他权益工具投资”之和代替“可供出售金融资产”项目。

续表

		高金融化组	低金融化组	高金融化组	低金融化组
<i>Controls</i>	YES	YES	YES	YES	YES
<i>Constant</i>	-0.188 (-1.26)	0.001 (0.06)	0.014 (1.38)	0.083 (0.22)	0.289 (1.45)
<i>Year & Firm</i>	YES	YES	YES	YES	YES
<i>Observations</i>	13362	6852	6510	6852	6510
<i>R-squared</i>	0.466	0.374	0.150	0.286	0.137
系数差异 (P 值)		0.005		0.007	

(二) 降低投资风险

影子银行因高杠杆和弱监管会给投资企业带来极大风险。企业投资影子银行产品，必然会提高无法及时收回资金和投资失败的概率，对创新等实业投资也会产生负面冲击（韩珣等，2022）。同时，由于影子银行操作复杂，涉及多个主体和部门，容易加剧投资企业和金融市场的风险联动性，也会波及到企业现金流，加剧企业经营风险（李建军和韩珣，2019）。《资管新规》禁止刚性兑付、“资金池”行为和通道服务，加强对期限错配的流动性风险管理，控制企业杠杆率，从而降低了企业投资风险。此时，管理层在低风险环境中更会注重长远竞争优势（汪丽等，2012），提高创新积极性（潘红波和杨海霞，2022；顾海峰和朱慧萍，2021）。因此，《资管新规》可能通过降低投资风险来提升企业创新。为检验这一机制，首先本文构建如下模型：

$$RISK_{i,t+1} = \theta_1 POST \times DSBI_{i,t} + \theta_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (4)$$

其中，RISK 为企业投资风险，将其定义为企业投资终止或失败，无法达到预期经济目标的情况，可用投资支出能否提高企业经营绩效来判断：若投资支出增长率与后一期净利润增长率之差大于 0，则说明企业投资风险较高，取值为 1，否则说明企业投资风险较低，取值为 0。其他变量与模型（1）相同。如表 6 列（1）所示， $POST \times DSBI$ 的回归系数在 1% 水平下显著为负，表明《资管新规》降低了对影子银行高投资依赖企业的风险，从而有更多动力进行企业创新。其次，本文根据企业投资风险进行分组，表 6 列（2）至（4）展示了回归结果。从中可见，影子银行监管优化对企业创新的提升效应均在投资风险高的组中显著，组间系数差异均显著，表明投资风险越高的企业，影子银行监管优化越能缓解企业风险担忧，激发企业创新动力，意味着降低投资风险是影子银行监管优化影响企业创新的又一个重要机制。

表 6 降低投资风险机制

	高投资风险组		低投资风险组		高投资风险组		低投资风险组	
	(1)	(2)	(3)		(4)		(5)	
VARIABLES	$RISK_{i,t+1}$	$CII_{i,t+1}$	$CII_{i,t+1}$		$CIO_{i,t+1}$		$CIO_{i,t+1}$	
$POST \times DSBI$	-0.193 ***	0.528 ***	0.044		0.268 **		0.036	
	(-4.23)	(2.85)	(0.62)		(2.50)		(0.48)	
Controls	YES	YES	YES		YES		YES	
Constant	0.054	0.001	0.020		0.094		0.315	
	(1.35)	(0.08)	(1.47)		(0.35)		(1.59)	
Year & Firm	YES	YES	YES		YES		YES	
Observations	13362	7012	6350		7012		6350	
R-squared	0.355	0.370	0.146		0.282		0.132	
系数差异 (P 值)			0.007				0.009	

八、异质性检验

(一) 企业个体特征

1. 产权性质。由于预算软约束和政府隐性担保,国有企业更容易获得政府补助和信贷资源(李青原等,2022),能以更低的成本获得更多信贷资金,更会基于“利润追逐”投资影子银行,放弃投资创新等实业项目。因此,相对于非国有企业而言,国有企业更会依赖影子银行投资。《资管新规》严格限制影子银行高额收益,更会抑制国有企业金融化。创新作为推进国家发展的主流实业项目,肩负责任的国有企业在缺少了高额利润点后,会释放更多资金用于创新活动。基于此,本文依据产权性质OWN进行分组。未列表的结果显示,较于民营企业,影子银行监管优化更能提升国有企业创新水平。这意味着《资管新规》下,影子银行监管优化更会放开国有企业被金融化挤占的资源,充分利用资金优势来提升其创新水平。

2. 创新密集度。企业创新密集度越高,越多注重研发资金和人员的投入,较少涉及金融和房地产等虚拟行业投资(段军山和庄旭东,2021)。而创新密集度越低的企业,存在更多多元化发展和金融领域投资的可能,更会将影子银行视为“利润追逐”的手段。因此,与高创新密集度的企业相比,低创新密集度的企业更会依赖影子银行投资。《资管新规》更会抑制低创新密集度企业的金融化行为,放开更多资金用于高收益的创新项目。基于此,参照海本禄等(2021)的研究,本文选用无形资产IA为创新密集度的界定标准,按照行业年度中位数分组。未列表的结果显示,影子银行监管优化更能提升低创新密集度企业的创新水平。这意味着,影子银行监管优化会减少这些企业的高额盈利渠道,督促专注实业,引导参与创新活动来赢得可观收益和竞争地位。

3. 治理水平。影子银行缺乏政府背书,操作复杂,加剧了投资者和发行机构之间的信息不对称,提高企业投资风险(刘莉亚等,2019)。企业治理水平越低,在面临影子银行投资高风险时,管理层越会为了短期绩效,放弃创新项目,避免风险叠加。《资管新规》作为强监管政策,更会从外部加强低治理水平企业的治理能力,抑制管理层“利润追逐”动机。同时,政策还要求产品信息披露详细,并提供相关市场分析和风险收益测算报告,尽可能减少低治理水平企业的投资风险,以此促进企业创新。基于此,借鉴胡楠等(2021)的方法,本文选取影响公司治理的多个因素进行主成分分析^⑤,并以第一主成分来度量公司治理水平ICG,按照其行业年度中位数进行分组

回归。未列表的结果显示,较于高治理水平企业,影子银行监管优化更能有效促进低治理水平企业的创新水平。这暗示《资管新规》更能够对治理水平低的企业能起到外部监督作用,帮助抑制管理层机会主义行为,提高创新积极性。

(二) 外部宏观环境

1. 产品市场竞争。产品市场竞争作为重要的外部治理机制,能发挥竞争淘汰和标杆对标效应,有效监督管理层,降低其机会主义行为(杨婧和许晨曦,2020)。对于低产品市场竞争的企业而言,它们处于信息不透明的环境中,缺乏足够监督,管理层更容易滋生出机会主义行为,以“利润追逐”为目的投资影子银行,不断挤出创新活动。《资管新规》坚持宏观审慎管理与微观审慎监管相结合,加强外部治理环境,更能影响低产品市场竞争组的企业,规避其金融化,降低投资风险,提高创新积极性。基于此,参照滕飞等(2016)的研究,本文选择赫芬达尔-赫希曼指数(HHI)衡量产品市场竞争程度PMC,以其行业年度中位数来分组回归。未列表的结果显示,较于高产品市场竞争企业,影子银行监管优化提升低产品市场竞争企业的创新水平要更多。这意味着对于低产品市场竞争企业,《资管新规》能够补充产品市场竞争治理作用,加强外部治理力度,规避金融资源挤出实业项目,极大促进企业创新。

2. 区域影子银行发展。在经济转轨过程中,中国采取了优先发展东部沿海地区战略,金融发展水平呈现出区域非均衡差异。在影子银行发展水平越高的地区,企业通过影子银行进行投融资的行为越频繁,更会出现企业金融化和高投资风险。《资管新规》通过监管影子银行业务,更能影响影子银行高发展地区的企业,提升其创新活动。基于此,借鉴彭俞超和何山(2020)的方法,本文计算出《资管新规》实施前3期末,省级委托贷款、信托贷款以及未贴现银行票据之和与社会融资规模之比的平均值,用以衡量企业所处地区影子银行发展水平SBD,并根据行业年度中位数来分组回归。未列表的结果显示,在影子银行高发展地区,影子银行业务往来频繁,企业更会依赖影子银行投资,而《资管新规》限制影子银行多重套利,抑制企业金融化和投资风险,推动区域企业创新发展。

3. 市场化程度。随着中国市场化改革的不断深入,市场逐渐在资源配置上发挥重要作用。但因资源禀赋、地理位置等差异,各地区的市场化程度并不平衡。低市场化程度的地区缺乏健全的制度体系,违规成本和诉讼风险也相

^⑤ 所选取的因素分别是两职合一、董事会规模、独立董事比例、管理层持股比例、第一大股东持股比例、机构持股比例、监事会会议次数、产权性质。

对较低,极易滋生企业寻租行为,加剧企业“利润追逐”动机来过度投资影子银行,从而挤出创新(柳光强和王迪,2021)。*《资管新规》*更能影响处于低市场化程度的企业,减少管理层机会主义动机,保障实体产业发展,提升企业创新水平。基于此,借鉴樊纲等(2003)的研究,将市场化指数作为地区市场化程度DOM的代理指标,进行行业年度中位数分组回归。未列表的结果显示,影子银行监管优化更能提升处于低市场化区域企业的创新水平。这意味着低市场化程度区域制度较不完善,金融监管存在更多漏洞,《资管新规》加强影子银行监管,弥补现有制度的不足,提升参与创新的积极性。

九、结论

(一) 研究结论

任何事物都存在两面性。在中国非正规金融发展前期,影子银行确实为中小企业提供了额外的融资渠道,在一定程度上弥补了正规银行体系不足。但其在弱监管下,却成为倍受推崇的套利工具,在短期内加高杠杆获利,不断助长虚拟经济泡沫、极大扭曲了市场行为,严重威胁社会稳定。据此,本文以《资管新规》优化监管影子银行为准自然实验,从“影子银行促进观”和“影子银行风险观”两个对立假说出发,选择2015-2021年沪深A股上市企业为研究样本,探究影子银行监管优化对企业创新的影响及作用机制。研究发现,在《资管新规》下,影子银行监管优化能够提升企业创新投入和产出;机制检验发现,影子银行监管优化能够通过抑制企业金融化、降低投资风险来促进企业创新,支持了“影子银行风险观”假说;异质性检验中,提升效应在国有企业、创新密集度和治理水平低的企业,以及产品市场竞争、影子银行发展和市场化程度较低的地区更为显著。研究结论证实,在现阶段,影子银行的风险化解工作取得一定的成效,为后续进一步防控金融风险,服务实体经济的导向提供了新的证据。

(二) 启示

本文研究具有一定启示:首先,需要从多角度深刻认识新形势下《资管新规》政策的作用。虽然《资管新规》这种强监管模式可能在短期内给金融机构带去较大整改压力,造成一定的经济成本,但能有效控制影子银行带来的高风险。研究结论证明,《资管新规》对影子银行的监管优化可以更好地提升企业创新活动、支持实体经济发展。未来相关部门需要进一步完善配套立法,确保法律法规一致性执行,以便更好地提升实体经济、保障国家金融安全。

其次,关于进一步推进《资管新规》政策实施。在新冠肺炎疫情对全球经济造成严重冲击下,企业经营困难不断加大,为了做好“六稳”和“六保”工作,《资管新规》开展过渡期来缓解金融机构的整改压力。如今过渡

期结束正式实施,为了保证政策稳步推行,一是需要资本市场和保险市场的政策统筹协调,努力实现金融防控风险和服务实体经济的动态平衡,与利率市场化改革齐头并进。二是在明确金融机构主体责任的同时,建立对金融机构的激励约束制度,稳定并提高金融对实体经济的信贷供给与支持力度。三是在疫情的持续冲击下,建议加大财政政策配套力度,增强政策性金融机构对实体经济的支持能力,探索设立非标资产转化为标准资产的官方评级,促进非标资产向标准资产的转化交易,提高资本市场的资金流动性,满足不同信贷主体的需求。四是发挥对影子银行的正向引导,不可忽视影子银行的积极作用,要以“因势利导”作为风险化解工作目标,建立风险隔离机制,既要控制影子银行带来的高风险,也要鼓励探索更多合法合规的模式创新,做到“疏堵结合”,促进信贷市场健康发展。

最后,加强监管机构间协调机制,尽快实现监管统一。中国金融领域实行的是分业监管为主的体系,在此环境下,监管机构之间应该努力实现监管协调,制定同类业务、同种产品的统一监管架构。尤其是结论证明影子银行监管优化在企业个体特征和所处环境不同中发挥出差异性效果,意味着在保证监管统一的情况下,也要重点关注局部监管,针对这些企业制定出更为细致的监管标准,有利于减少整个金融系统的运行成本,助力国家创新持续发展。

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Shadow Banking Regulation Optimization and Corporate Innovation ——A Quasi-natural Experiment Based on the New Asset Management Regulation

Yu Ziqin & Xiao Xiang

Abstract: Shadow banking has to a certain extent compensated for the lack of formal financial development in China, but it may also amplify systemic financial risks, which is contrary to macroprudential principles. This paper uses the policy of the *New Asset Management Regulation*, which regulates shadow banking, as a quasi-natural experiment, and selects Chinese Shanghai and Shenzhen A-share listed enterprises from 2015~2021 as the research sample to test the impact of shadow banking regulation optimization on corporate innovation and the mechanism of action. The study finds that shadow banking regulation optimization can enhance corporate innovation; the mechanism test finds that shadow banking regulation optimization promotes corporate innovation by inhibiting corporate financialization and reducing investment risk, which supports the "shadow banking risk view" hypothesis; the heterogeneity test finds that for state-owned enterprises, firms with low innovation intensity and governance, and The heterogeneity test finds that the effect of shadow banking regulation optimization on enhancing corporate innovation is more significant for state-owned enterprises, firms with low innovation intensity and governance, and regions with lower product market competition, shadow banking development and marketization. This paper not only recognizes the significance of the policy of the *New Asset Management Regulation* from the perspective of shadow banking risk, but also unveils the value of reducing shadow banking risk for micro enterprise innovation, providing policy insights for the state to implement macroprudential objectives and guide finance to effectively serve the real economy.

Key Words: Shadow Banking Regulation Optimization; New Asset Management Regulation; Corporate Innovation; Financialization; Investment Risk

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Shadow banking regulation and firm investment efficiency: Evidence from China's new regulation of capital management

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ABSTRACT

Though China's shadow banking has compensated for the lack of formal financial development, its rapid expansion may magnify the risks of China's financial system. The *New Regulation of Capital Management (NRCM)* has been issued to regulate shadow banking in China. In this paper, with Chinese A-share listed firms from 2013 to 2021 as samples, we use the optimized generalized double difference approach to study the impact of shadow banking regulation on firm investment efficiency and its effect mechanism. We find that under the *NRCM*, shadow banking regulation, mainly by inhibiting firms' overinvestment, can substantially enhance firms' investment efficiency. Moreover, the mechanism test also finds that, by suppressing corporate financial asset investment and reducing corporate risk and agency costs, the *NRCM* can improve investment efficiency. Our study helps to take a more dialectical view of shadow banking regulatory policies and provides some implications for other developing countries and emerging economies.

1. Introduction

Compared to the financial practices in other developed countries, the financial system in China has been mainly bank-dominated. In China, shadow banking is mainly a product of off-balance-sheet divestiture of domestic assets in the context of restricted credit impulses and typical securitization of assets by traditional banks (Konstantakis et al., 2024; Agnello et al., 2020; Allen et al., 2019). In the macro context, SMEs¹ are faced with credit discrimination, and commercial banks seek regulatory arbitrage (Malik and Saba, 2025). So, Chinese shadow banking, unconstrained by government regulation, has become a partial substitute for commercial bank credit (Allen and Gu, 2021; Guo and Xia, 2014), and gained dramatic expansion in size (Si and Li, 2022; Lu et al., 2015). It is undeniable that shadow banking has, to some extent, compensated for the lack of formal financial development in China (Irani et al., 2021; Jiang et al., 2023). However, there is also arbitrage in which firms evade regulation in pursuit of high profits, which may amplify risks in the Chinese financial system and seriously affect its ability to provide financial services to the economy (Plantin, 2015; Martinez-Miera and Repullo, 2018; Chretien and Lyonnet, 2018; Farhi and Tirole, 2021). Since 2008, the size of shadow banking in China has been growing at an annual rate of more than 20 %, but regulatory reforms have been largely silent due to its hidden nature (Caverzasi et al., 2019; Adrian and Ashcraft, 2012), which contradicts the principles of macroprudential regulation (Freixas et al., 2015; Hanson et al., 2011).

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The policy of the *New Regulation of Capital Management (NRCM)* marked a milestone of shadow banking in China. In November 2017, the People's Bank of China, together with various ministries and commissions, issued the *Exposure Draft of the New Regulation of Capital Management (NRCM)* for public feedback, providing the essential policy guidance for regulating shadow banking and preventing financial risks. Later, the *NRCM* was officially promulgated and implemented, establishing a comprehensive regulatory system covering all subjects involved in shadow banking. After that, the scale of shadow banking did decline significantly, which indicates that, at the macro level, the *NRCM* had effectively regulated shadow banking. At the micro-level, it is of high necessity to research on the policy's impacts on firms in the context of shadow banking regulating. To firms, which are essential subjects supporting the country's economic development, the correlation between investment activity and investment efficiency are of vital significance. Investment activities are the basis for their survival and development on one hand, and investment efficiency reflects a firm's ability to gain favorable resource allocation on the other. Therefore, in the context in which shadow banking is regulated, it is worth exploring the role of shadow banks in investment efficiency and their involvement in firms' investment activities through the credit market.

In addition, we select China as the background for the following reasons: firstly, the uniqueness of the Chinese financial system has led to a higher risk of shadow banking. In an environment where traditional commercial banks are at the heart of the financial market, shadow banking is more likely to become an arbitrage tool for its regulatory evasion (Guo and Xia, 2014; Jiang, 2021). Therefore, the special financial circumstance in China is more suitable for studying the topic of shadow banking regulation. Secondly, China is a developing country and an emerging economy. Developing countries are all characterized by inadequate economic markets prone to regulatory arbitrage, which probably leads to the rapid expansion of shadow banking, bringing high financial risk to the market (Yan et al., 2024). Moreover, since firms' investment resources are not directly available through market mechanisms in most developing countries (Si et al., 2022; Zhang et al., 2020b). Our study of shadow banking regulation in China can provide implications for other developing countries and emerging economies (e.g., India, Thailand, Malaysia, etc.).

Academically, despite the scarcity of the literature on the micro-level economic consequences of shadow banking, the current views can be broadly divided into two major categories, i.e., the "shadow banking promotion view" and the "shadow banking risk view". The "shadow banking promotion view" argues that shadow banking can complement the existing financial system (Lu et al., 2015; Duca, 2016). By contrast, the "shadow banking risk view" holds that shadow banking exacerbates firm maturity mismatches, and amplifies financial market risks (Allen et al., 2019; Bleakley and Cowan, 2010; Reinhart and Rogoff, 2008).

Therefore, we select a sample of A-share listed companies in China from 2013 to 2021 to study the impact of shadow banking regulation on corporate investment efficiency and its mechanism of action. The benchmarking results show that shadow banking regulation under the *NRCM* improves firms' investment efficiency and discourages overinvestment. This initiative supports the "shadow banking risk view" that shadow banking poses more risk to firms and leads to inefficient investment. In order to verify the robustness of the results, we also perform a variety of robustness tests and the conclusions reached still hold.

To continue arguing the derivation of the hypothesis, we tested the mediating effects of firms' financial asset investment, corporate risk, and agency costs. After testing, we find that these mediating effects hold in the following ways: first, *NRCM* can improve firms' investment efficiency by reducing firms' investment in financial assets. This implies that after the implementation of shadow banking regulation, firms have to reduce their participation in shadow banking, curb their over-investment in the financial sector, and prevent a run on their primary business. Second, *NRCM* can improve the investment efficiency of firms by reducing corporate risk. When the level of corporate risk is low, due to the higher expectations of the successful management performance in investment projects, management's willingness will be enhanced to invest, seize investment opportunities, and improve investment efficiency. Third, *NRCM* promotes firms' investment efficiency by reducing agency costs. This suggests that due to shadow banking regulation's conduciveness to the reduction of management's self-interest and informational advantage, management is consequently forced to consider firm development to improve investment efficiency at lower agency costs. These results fully confirm the "shadow banking risk view".

In addition, we also studied individual firm characteristics (nature of firm ownership, innovation intensity, and level of governance) and external macroenvironmental characteristics (product market competition, regional shadow banking development, and degree of marketization) respectively and found that shadow banking regulation under *NRCM* is more likely to improve the investment efficiency of state-owned firms, firms with low innovation intensity, firms with the low level of governance, firms with low product market competition, firms in regions with high shadow banking development, firms in low investment efficiency, and firms in market-oriented regions. Furthermore, the impact of shadow banking regulation on firms' investment levels is also studied and classified into three categories: fixed asset expenditures, R&D expenditures, and acquisition expenditures. *NRCM* can increase firms' investment levels, mainly in terms of increasing their fixed asset and R&D investment levels. This suggests that shadow banking regulation can improve corporate investment activities regarding the efficiency and level of corporate investment.

Our study makes significant contributions in several ways. First, our study extends the research related to shadow banking regulation. Shadow banking emerges due to commercial banks pursuing profits or evading government regulation (Chen et al., 2020c). Because of the insidious nature of shadow banking, regulatory policy has been largely silent on this issue (Adrian and Ashcraft, 2012). The existing literature, lacking study on the direct effects of shadow banking regulation, mainly concentrate on the indirect effects of formal financial regulation on shadow banking (Huang, 2018; Cai et al., 2019; Kashyap and Stein, 2010).² We take the *NRCM* policy to

² Kashyap et al. (2010) found that due to the unique nature of competition in the financial services industry, credit-generating activities may be shifted by the shadow banking sector, increasing the overall financial system vulnerability. Cai et al. (2019) argues that banks actively, rather than passively, use wealth-management products as a tool for regulatory arbitrage or book-keeping behavior. Huang (2018) similarly argues that formal banks engage in regulatory arbitrage through shadow banking and support their shadow banks with implicit guarantees.

regulate Chinese shadow banking as a starting point and provide an in-depth analysis of the economic consequences of shadow banking regulation.

Second, our study complements the economic consequences of shadow banking at the micro-level. The existing literature mainly explores the economic consequences of shadow banking at the macro level, such as financial system fragility, monetary policy effectiveness, and credit resource allocation (Allen et al., 2019; Zhu et al., 2019; Chen et al., 2020c), but less on the impact of shadow banking on firms at the micro-level. These papers also present different views on the role of shadow banking on firms. Among them, the “shadow banking promotion view” argues that shadow banking can complement formal finance and bring more returns to investing firms (An and Yu, 2018; Lu et al., 2015; Duca, 2016), whereas the “shadow banking risk view” argues that shadow banking can exacerbate maturity mismatches and pose significant risks to firms (Allen et al., 2019; Bleakley and Cowan, 2010; Reinhart and Rogoff, 2008). In our research, with in-depth study on the impact of shadow banking regulation on the firm’s investment efficiency, and the detailed analysis of shadow banking’s role from the firm’s investment perspective, we added new findings to complement the existing literature.

Furthermore, our study enriches the macro-level factors influencing the firm’s investment efficiency. In recent years, there has been extensive literature analyzing the factors influencing firm investment efficiency at the macro level, such as political favoritism (Chen et al., 2020c), residual government ownership (Vo, 2019), government intervention (Hao and Lu, 2018), government subsidies (Hu et al., 2019), and so on. However, shadow banking has been neglected as a micro factor. In this paper, we argue that shadow banking is essential in the credit market and closely related to firm investment activities. In our study, we explored shadow banking as a macro factor to complement existing research on the factors influencing investment efficiency.

Finally, our study provides evidence for a dialectical view of shadow banking regulatory policies. Under COVID-19, in view of the severely hit business operations, the *NRCM*, a robust shadow banking regulation approach, may bring more significant pressure on Chinese financial institutions to rectify the situation so as to generating extra cost. However, in the long term, shadow banking is a product spawned by the financing needs of Chinese SMEs and the profit-seeking motive of large firms, which quickly brings the risk of maturity mismatch and overinvestment in the financial sector. The results of this paper confirm that shadow banking regulation under the *NRCM* can improve the firm’s investment efficiency. Therefore, it can be suggested that this policy, with its shadow banking avoidance effect, is conducive to the development of China’s capital market. In addition, our study also has important implications for developing countries and emerging economies on how to improve the financial regulatory environment.

The rest of this study is organized as follows. Section 2 describes the institutional context in China. Section 3 presents a review of the existing literature and formulates hypotheses. Section 4 describes our empirical design. Section 5 provides the benchmark regression results and robustness tests. Section 6 performs the mechanism test. Section 7 contains group tests. Section 8 performs extended tests, and Section 9 summarizes conclusions and directions for future research.

2. Institutional background

After experiencing the global financial crisis in 2008, China’s asset management business has expanded rapidly with the surge of macro credit. According to the data from the China Banking Regulatory Commission (CBRC) and the Insurance Regulatory Commission (IRC), at the end of 2016, a large number of bank assets in China had shifted from on-balance sheet to off-balance sheet, resultantly forming shadow banking, with the scale of broad shadow banking³ exceeding RMB 90 trillion and the scale of narrow shadow banking⁴ reaching RMB 51 trillion.

At the same time, the risks posed by shadow banking cannot be ignored. First, shadow banking will keep pushing up leverage levels. After 2008, China’s debt level has maintained an upgoing trend, reaching 239 % at the end of 2016. To make the financial situation worse, shadow banking has increased the debt and interest burden on social and economic activities, significantly reducing the efficiency of capital turnover and use. Second, it has fueled a virtual economic bubble. Various empty and arbitrage-oriented shadow banking business models have emerged. For example, some banks make interbank financial investments and outsource investments, inflate assets and liabilities, with funds still in the financial system and not flowing to the real economy. Third, it “crowds out” formal financial business. Shadow banking can be leveraged quickly to obtain high profits, and the high profitability tempts many financial institutions into following suit, significantly distorting market behavior. In the “bad money driving out the good money” context, the proper financial business growth is slow or even on the shrink. By contrast, the shadow banks continue to “crowd out”. Fourth, it could be more detrimental to social stability. Financial risks can easily spill over into social risks. Due to China’s inadequate supervision of shadow banking, financial risks began to erupt around 2016, which led to the emergence of various rights violations posing a severe threat to social stability.

In response to the disorderly expansion of shadow banking, the People’s Bank of China, together with various ministries and

³ The shadow banking in a broad sense mainly includes: interbank specific purpose vehicle investments, entrusted loans, fund trusts, trust loans, bank wealth management, non-equity public funds, securities industry capital management, insurance capital management, asset securitization, non-equity private equity funds, online lending P2P institutions, financial leasing companies, loans provided by microfinance companies, commercial factoring companies factoring, financial guarantee firms in the insurance business, non-licensed consumer loans issued by institutions, debt financing plans and structured financing products provided by local exchanges.

⁴ In the narrow sense, shadow banking primarily includes interbank-specific purpose vehicle investments, interbank wealth management, and bank wealth management products invested in non-standard debt instruments and custodial services. It also covers entrusted loans, trust loans, online peer-to-peer (P2P) lending, and non-equity private equity fund products.

commissions, issued a draft of the *NRCM* for public feedback⁵ in November 2017. This draft provides the foundational guidance for preventing financial risks, which mainly regulates and supervises shadow banking in the following ways: First, establishing the classification standards for shadow banking-type asset management products. When issuing asset management products, financial institutions should clarify the types of products to investors according to the prescribed classification standards. They should not change the standards without authorization in name of strengthening the concept of “selling the right products to the right investors”. Second, setting the threshold for qualified investors in shadow banking. Companies need to have net assets of not less than RMB 10 million at the end of the last year, which excludes most SMEs from investing in shadow banking. This principle substantially limits the number of shadow banking investors. Third, reducing the high returns of shadow banking. The *NRCM* emphasizes breaking rigid exchange, eliminating multi-layer nesting, and limiting channel business, i.e., financial institutions shall not take the responsibility to guarantee capital and income when conducting business, but shall effectively perform active management duties instead; meanwhile, they should neither provide channel services for other financial institutions’ capital management products that circumvent regulatory requirements such as investment scope and leverage constraints. All these shadow banking restrictive measures are conducive to the reduction of the inflated yields of shadow banking and allow firms to bear their risks, resultantly forcing them to reduce their incentives of active participation in shadow banking activities. Fourth, comprehensive regulation of shadow banking participating entities. The *NRCM* emphasizes the combination of institutional and functional regulation, i.e., on one hand, instead of adhering to institutional types to asset management products categorized as the same type, it implements functional regulation according to product types and the same regulatory standard; on the other hand, it implements penetrating regulation for multi-layer nested asset management products to identify the final investors of the products upwards and the underlying assets of the products downwards. Meanwhile, *NRCM*, by strengthening macro-prudential management (strengthening monitoring, evaluating and regulating from macro, counter-cyclical, and cross-market perspectives), realizes real-time supervision (comprehensive and dynamic supervision of all aspects of asset management products, including issuance and sales, investment and payment), and hence establishes a comprehensive regulatory system covering all subjects.

In practice, the *NRCM* has effectively regulated Chinese shadow banking, as reflected in the contraction of the size of shadow banking. Fig. 1 shows the change in the size of Chinese shadow banking from December 2014 to December 2021. After the release of the *NRCM* for public feedback in November 2017, the size of shadow banking, after reaching an all-time high in December of that year, began to decline rapidly. Furthermore, after the official implementation of the *NRCM* in April 2018, the scale of shadow banking has witnessed an accelerated decline. Overall, from December 2017 to December 2021, the scale of shadow banking declined from a peak of around RMB 2.7 billion to around RMB 1.8 billion in one year, a decline of about 33.33 %. This indicates that the scale of shadow banking in China has been significantly compressed after the release of the *NRCM*, and the implementation of this policy has been effective at the macro level. Additionally, at the micro-level of firms, shadow banking is also closely related to firm investment and financing. Since firm investment is the primary driving force of economic growth, as to whether shadow banking regulation under the *NRCM* impacts the efficiency of firm investment, this paper will provide an in-depth analysis.

3. Literature review and hypotheses development

3.1. Financial regulation and shadow banking

Shadow banking has emerged in China mainly because of banks’ incentive to circumvent as many regulatory restrictions as possible. Theoretically, when traditional banks are regulated, shadow banking, as a complement and alternative to traditional banks, gradually becomes a tool for regulatory arbitrage (Buchak et al., 2018; Cai et al., 2019). Huang (2018) shows that traditional banks engage themselves in regulatory arbitrage via shadow banking to foster its growth through implicit guarantees. Meanwhile, tightening bank regulation also increases shadow banks’ lending capacity and financial instability. Irani et al. (2021) argue that mandatory regulation of traditional banks may lead to more capital flows to shadow banks. This is why some shadow banking institutions with relatively stable funding could act as liquidity providers during the 2008 financial crisis. Other scholars believe that higher regulatory requirements for traditional banks would trigger more regulatory arbitrage, leading to a massive shift in banking activity to the more loosely regulated shadow banking system (Adrian and Ashcraft, 2012; Kashyap and Stein, 2010). This literature has examined the impact of government regulation of formal banks, which also indirectly indicates its impact on shadow banking.

Until now, shadow banking has been largely silent in many of its characteristic aspects due to their hidden nature and the execution of regulatory reforms (Le et al., 2021; Adrian and Ashcraft, 2012). However, shadow banking may amplify risks in the financial system and reduce overall social welfare (Plantin, 2015; Martinez-Miera and Repullo, 2018; Chretien and Lyonnet, 2018). Plantin (2015), after examining optimal bank capital regulation choices in the presence of regulatory arbitrage, found that tightening capital requirements may stimulate a surge in shadow banking activity, and resultantly increases the overall risk of money-like liabilities for both formal and shadow banking institutions. Moreira and Savov (2017), by developing a macroeconomic model, found that though shadow banking can expand the supply of liquidity and boost asset prices and growth, it may also lead to increased market vulnerability. Moreover, rising uncertainty also raises shadow banking spreads, forcing financial institutions to shift to collateral-intensive

⁵ *NRCM* for public feedback refers to an advanced draft of the *NRCM* document that the Government consults the public before releasing the document, and then makes corresponding adjustments based on the public’s comments before officially releasing the official draft. After comparing the contents of the current draft and the official draft, we found that there is not much difference. In China, the current draft has the same legal effect as the official draft.

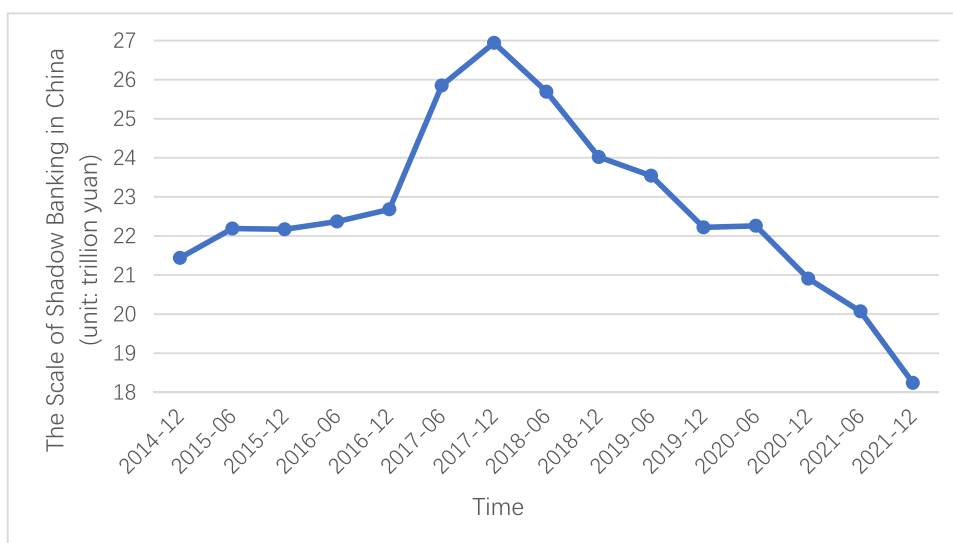


Fig. 1. Scale of Shadow Banking in China. Data source: China CEInet Statistics Database.

financing, ultimately causing liquidity premiums and discount rates to rise and asset prices and investments to fall.

Compared with that in other developed countries, Chinese shadow banking may pose higher risks (Nickles and Schiebel, 2015). Wu and Shen (2019) argue that due to the high leverage characteristics of Chinese shadow banking, it is easy to induce systemic risks if it is not operated correctly. So, in reality, with operations unwarranted, banks engaged in shadow banking tend to take considerable risks. They also found that good governance can significantly reduce the impact of shadow banking on bank risk-taking. Chen et al. (2021) found that shadow banking distorts the relationship between capital and liquidity creation ratios due to inefficient resource allocation in the Chinese market. Lu et al. (2015) hold that Chinese shadow banking activities are not subject to the regulatory capital requirement framework and central bank regulation. Due to the weakness of the Chinese financial system, policymakers must implement financial reforms to bring this informal market under regulation. However, there are few studies on the direct impact of financial regulation on shadow banking in China.

3.2. The impact of shadow banking on firms

Regarding the economic consequences of shadow banking, most of the literature has explored the macro-level aspects of financial system fragility, monetary policy effectiveness, and credit resource allocation (Allen et al., 2019; Zhu et al., 2019; Chen et al., 2020c), but there is a striking scarcity of literature that examines the micro-level effects of shadow banking on firms. The views in this literature can be divided into two categories of the “shadow banking promotion view” and “shadow banking risk view”. According to the former view, shadow banking, with its high returns, can bring more profits to the investing firms and resultantly promote the development of the firms. Si et al. (2022) found that, in the context of the return on financial assets being higher than the return on real assets, firms, under the pressure of reaching higher expected performance in the capital market, tend to manifest a stronger willingness to participate in financial investment to obtain higher profits. Han et al. (2023) also argue that non-financial firms investing in shadow banking can increase their financial efficiency, and in turn increase financial benefits. The latter view suggests that the highly leveraged nature of shadow banking is likely to create additional risks for firms. Reinhart and Rogoff (2008) found that shadow banking product are primarily structured and securitized financial innovations in nature, often accompanied with high leverage and maturity mismatches. Bleakley and Cowan, (2010) showed that shadow banking, while broadening short-term financing and increasing capital investment, introduces more risk, which may depress firm value. Allen et al. (2019) argue that Basel II does not regulate shadow banking, and therefore, the quality of disclosure of financial institutions engaged in shadow banking has been substantially reduced.

Under the overall context of immature development of China’s capital market and the high risk of shadow banking, little literature has been focused on the impact of shadow banking on firm investment as an important decision for the firm and national development. Most of the current studies on the factors influencing the firm’s investment efficiency were conducted from micro intra-firm perspectives, such as information disclosure quality (Dutta and Nezlobin, 2017; Gomariz and Ballesta, 2014; Chen et al., 2017), capital structure (Opie et al., 2019; Eisdorfer et al., 2013), management characteristics (Gao et al., 2017; Xie, 2015), conservatism (Lara et al., 2016), and social responsibility (Benlemlih and Bitar, 2018), etc., which poses limitations on the universality of their findings. By contrast, macro-level perspectives, including government intervention (Chen et al., 2017), government subsidies (Hu et al., 2019), policy regimes (Amberger et al., 2021; Khan et al., 2017), air quality (Jiang et al., 2022), etc., provide a much broader space for further exploration. What’s more relevant to our study is the study of Khan et al. (2017), which reveals that financial development can influence investment decisions by reducing financing constraints and agency problems. However, though their definition of financial

development is based on the macro-perspective of national financial system strategies, their scope is too broad, lacking the support of data in specific perspectives. To complement the previous macro-perspective studies, our study is more specific, with a focus on the level of shadow banking regulation.

In summary, the existing literature has yet directly studied the relationship between shadow banking regulation and firm investment efficiency, nor has it reached a consistent view on the role of shadow banking. By contrast, the *NRCM* provides an appropriate background for this paper on the financial regulation of shadow banking in China. Our study, which explores the impact of the policy on the investment efficiency of Chinese firms, is of paramount value in three aspects. Firstly, it helps to give an excellent positioning to the current Chinese shadow banking. Secondly, it proves the correctness of the *NRCM* as the weightiest financial regulatory policy in China. Thirdly, it extends the relevant research on shadow banking at the micro-firm level. In addition, this paper's findings can provide important implications for other developing countries.

3.3. Hypothesis development

We also try to analyze the impact of shadow banking regulation on firm investment efficiency under the *NRCM* from two opposing perspectives: the “shadow banking promotion view” and the “shadow banking risk view”, and then propose hypotheses.

From the viewpoint of “shadow banking promotion”, on the one hand, shadow banking can bring high returns and enhance corporate profitability. In the macro context of the current downward pressure on China's economy, which is characterized with weak internal and external demand and rising production costs, profits from real investment have witnessed a sharp decline. So, a large amount of capital has turned to chase real estate and financial assets, fueling higher profit margins in these virtual industries (Jin et al., 2022;). Shadow banking, as informal financial instrument, is a product of long-term financial pressure and credit discrimination in China's credit market, featured with high returns, strong liquidity and low conversion costs (Lu et al., 2015). Unlike foreign shadow banks in the form of securitization and financial innovation, Chinese shadow banks, essentially similar to the business model of commercial banks, mainly operate through maturity conversion, liquidity conversion, and leveraged trading to help enterprises gain more profits in the short term so as to enhance their profitability (Nicolas, 2022; Gryglewicz et al., 2020; Baldenius and Michaeli, 2017). As for listed enterprises, being the object of credit preference with multiple financing channels, they are more likely to play the role of an investor in shadow banking, which mainly manifests in the following two categories: firstly, they act as a credit intermediary, providing funds directly to the financing enterprises in the form of entrusted loans, private loans, and so on; secondly, they participate in the credit chain, join the shadow banking business involving the system by purchasing bank wealth management products, trust products, and so on (Ahmad, 2020; Chen and Du, 2020; Lu et al., 2015). As a result, listed firms, by harvesting excess returns through shadow banking investments, achieve capital accumulation on one hand, and improve short-term performance on the other (Chen and Du, 2020; Gryglewicz et al., 2020). However, under *NRCM*, with the significant shrinking of shadow banking size, it is getting more difficult for firms to achieve excess returns through shadow banking investments. Moreover, under capital constraints, management is likely to abandon some investment projects with positive net present value (NPV), leading to underinvestment and reduced firms' investment efficiency.

However, in contrast with the above-mentioned firms' shrinking in shadow banking involvement, the precautionary savings theory (Leland, 1968) suggests that when firms use idle funds in production and operation to make short-term financial investments, the investment can be quickly realized when funds are insufficient, and business risks can also be reduced as well. Due to the high liquidity of shadow banking, firms can preserve and appreciate their capital by investing out of a precautionary savings purpose. Specifically, shadow banking allows firms to invest in risky projects with additional financial support for investment activities on one hand, and reduces the risk of capital breaks on the other, thus creating a “reservoir” effect (Chen et al., 2021a,b,c; Wu and Shen, 2019). Enterprises making shadow bank investments can obtain investment returns in the short term, which can act as a capital buffer and smooth out various risks in the enterprise investment process (Deng et al., 2021; Wu and Shen, 2019). Therefore, under *NRCM*, shadow banking regulation actually inhibit firms from making shadow banking investments and consequently elevate the risk of capital shortage. Resultantly, management is likely to interrupt ongoing projects or shun away from advancing projects for fear of a broken capital chain, leading to underinvestment and reduction in firms' investment efficiency.

Based on the above analyses, we believe that, from the “shadow banking facilitation perspective”, under the *NRCM*, shadow banking regulation can reduce the high revenue streams of firms, which is a major blow to firms' incentive to enhance their profitability. Consequently, this is destined to increase the risk of enterprises and lead to underinvestment, reducing investment efficiency. Based on the above analysis, we propose hypothesis H1a.

H1a. : Under the *NRCM*, the higher the degree of firms' investment in shadow banking, the more it will reduce the investment efficiency.

From the “shadow banking risk perspective”, first, with the development of shadow banking in China, many non-financial companies have changed their business models and invested their funds in shadow banking out of profit motives, resulting in a large influx of funds into the virtual financial sector. After gaining high profits, firms are prone to fall into the “money speculation” cycle of investing in financial assets - gaining high returns - investing in financial assets, hence presenting the phenomenon of “financialization” (Jin and Mai, 2022; Chen et al., 2020a,b; Lin et al., 2016). With no change in disposable capital, the “financialization” of firms will inevitably crowd out investments in their main business to a certain extent, which would definitely undermine their long-term development (Huang et al., 2022; Chen et al., 2018). The *NRCM*, by restricting the number of investors in shadow banks, reducing the high returns of shadow banks, and regulating the subjects of shadow banking business to discourage firms from investing too much money in the financial sector, makes firms to divert their focus to industrial investment, so as to reduce over-investment, and to make

them gradually converge to the optimal investment scale, thus improving their investment efficiency.

Second, since shadow banking is extremely risky due to its high leverage and unregulated operations, problems with any one investment could lead to a chain reaction throughout the business sections (Chen and Jiang 2021; Lu et al., 2015). So, when many shadow banking finance firms use the short-term funds to invest in long-term projects, it poses a challenge for them to repay debt in full and on time. Besides, since shadow banks are outside the financial regulatory system, they will inevitably exert a negative impact on corporate investment activities and elevate corporate risk. (Gopalan et al., 2014; Lin et al., 2011). Moreover, shadow banks also benefit from high leverage, i.e., the higher the leverage is, the higher the risk is. So, when investors lose confidence in the market, high leverage will exponentially magnify the losses of shadow banks, which in turn will be contagious to investment subjects and further enhance corporate investment risk (Yang et al., 2019; Liu et al., 2019). Considering the high risk of the firm's inability to repay, the management is afraid to move forward with the project due to the fear of a break in the capital chain, which leads to a decrease in the efficiency of the firm's investment. In contrast, the *NRCM* clearly emphasizes the "three single management of products" (separate management, separate accounts, and separate accounting) and strengthens product duration management to reduce maturity mismatch and liquidity risk to enhance the risk-taking level of firms, thus improving investment efficiency.

Finally, due to agency costs, management has an absolute information advantage regarding the impact on its own interests and the firm's long-term value (Le et al., 2022; Hazarika et al., 2012). In turn, corporate management intends to allocate corporate resources to maximize its interests, which gives rise to agency problems (Zhang et al., 2020; Aktas et al., 2019; Luo et al., 2019). Corporate investment in shadow banks can exacerbate management's self-interest motive and short-sighted behavior, i.e., management, with a view to maximize its short-term interests, tend to ignore the long-term development of the firm. Resultantly, the management may discontinue its leading business investment and invest too much money in shadow banks (Schmid et al., 2019; Davis, 2017), which may harm the interests of shareholders, trigger conflicts between shareholders and management, and increase agency costs. In contrast, under the *NRCM*, the scale of shadow banking shows a substantial contraction, which effectively limits the high returns obtained by management through shadow banking and regulates the subjects involved in shadow banking in all aspects, thus breaking the information advantage of management, reducing agency costs and improving the efficiency of corporate investment.

In summary, we believe that from the analysis of the "shadow banking risk view", under the *NRCM*, shadow banking regulation optimally restricts the scale of shadow banking, stipulates the investment threshold, comprehensively regulates the participating subjects, forces firms to reduce shadow banking investment, liberalizes resource crowding, cuts management's information advantage, and reduces corporate risk as well as agency costs. Thus, the goal of improving investment efficiency can be achieved. Based on the above analysis, we propose hypothesis H1b.

H1b. : Under the *NRCM*, the higher the degree of firms' investment in shadow banking, the more it will improve the investment efficiency.

4. Research design

4.1. Sample and data sources

This paper selects China's A-share listed firms in Shanghai and Shenzhen from 2013 to 2021 as the research samples. These firms, as the object of credit preference, due to their access to multiple financing channels, are less likely to raise funds from high-cost shadow banks. Therefore, these firms demonstrate more willingness to invest part of their idle funds in shadow banks to get high returns (Lu et al., 2015). So, to study these firms' investment behaviors can better demonstrate the impact of shadow banking regulation on firms' investment efficiency under *NRCM*. Since the latest data available in this paper are of 2021, and the official draft of the *NRCM* for public comment feedback is released on November 17, 2017, to avoid the interference of other events due to the long duration of previous data, this paper selects 2013 as the starting year to achieve a symmetrically balanced sample period centered on the time of the event.

We process the sample data as follows: (1) delete the samples of enterprises in the financial and real estate industries⁶; (2) delete the samples of enterprises listed after the release of the *NRCM*; (3) remove the samples that do not satisfy the data of at least one period before and after the implementation of the policy. (4) delete the samples of ST and PT firms⁷; (5) delete the samples with missing data. Finally, 19380 sample observations were obtained for the Shanghai and Shenzhen A-shares main board. To control outliers, this paper takes Winsorize treatment on continuous variables at 1 % and 99 % levels. Data on Shadow banking investment degree, related financial data, and corporate governance are obtained from CSMAR, WIND database, CCER database, WIEGO statistical database, and corporate innovation data are obtained from the CNRDS database.

⁶ China's real estate industry is special and has significant financial attributes. First, there is the characteristic of high leverage: real estate development and sales usually require a large amount of capital investment, and developers often raise funds through bank loans, trust financing and bond issuance. Secondly, there is the characteristic of financial risk transmission: due to the huge capital demand of the real estate industry, fluctuations in the real estate market can be transmitted to the whole economic system through the financial market. Thirdly, there is an asset securitization feature, whereby the real estate sector can convert real estate into highly liquid financial assets. Therefore, in order to exclude the interference of samples with strong financial attributes, we exclude the samples of firms in the financial and real estate industries.

⁷ ST refers to special treatment firm; PT refers to particular transfer firm.

4.2. Identification strategy and model setting

The double difference model (DID) is a classic method to verify the effect of exogenous policies. If we construct DID directly, we must divide the sample into a “treatment group” and a “control group”. However, with the issuance of the *NRCM*, all firms are affected at the same point in time, making it difficult to distinguish the “treatment group” and “control group” in a strict sense. Therefore, based upon the traditional double-difference method, we constructed and extended the generalized double-difference model (GDD), drawing on existing studies (Nancy, 2008; Nunn and Qian, 2011; Chen et al., 2020; Cao and Chen, 2022). GDD is applied to the situation where all individual firms are affected by the policy shock, though each firm is affected differently. As analyzed above, the *NRCM* may affect firms with different impacts of shadow banking investment.

Thus, we tested the changes in firms’ investment efficiency after the release of the *NRCM* by GDD and constructed the following model. In model construction, we controlled industry and firm dummy variables, circumvented fixed differences between industries, and excluded the effects of other macro factors before and after the policy release.

$$INV_EFF_{i,t} = \sum_{t=-4}^4 \alpha_t pre \times DSBI_i + \alpha_0 current \times DSBI_i + \sum_{t=1}^4 \alpha_t post \times DSBI_i + \alpha_5 CONTROL_{i,t} + \sum IND + \sum FIRM + \varepsilon_{i,t} \quad (1)$$

$$OVER_INV_{i,t} = \sum_{t=-4}^4 \alpha_t pre \times DSBI_i + \alpha_0 current \times DSBI_i + \sum_{t=1}^4 \alpha_t post \times DSBI_i + \alpha_5 CONTROL_{i,t} + \sum IND + \sum FIRM + \varepsilon_{i,t} \quad (2)$$

$$UNDER_INV_{i,t} = \sum_{t=-4}^4 \alpha_t pre \times DSBI_i + \alpha_0 current \times DSBI_i + \sum_{t=1}^4 \alpha_t post \times DSBI_i + \alpha_5 CONTROL_{i,t} + \sum IND + \sum FIRM + \varepsilon_{i,t} \quad (3)$$

In model (1)–(3), *INV_EFF* denotes the firm’s investment efficiency, *OVER_INV* denotes overinvestment, and *UNDER_INV* represents underinvestment; *DSBI* is a proxy variable for the average Shadow banking investment degree of firms at the end of the four periods prior to the publication of the *NRCM* for public feedback. *CONTROL* is a set of control variables, and $\sum IND$ and $\sum FIRM$ indicate that the model controls for industry and firm fixed effects. In addition, the regression results are corrected for firm-level clustering.

Meanwhile, we also constructed year dummy variables of *pre*, *current*, *post* and the interaction term of *DSBI* as explanatory variables for the regressions respectively, with *pre* being before the policy issuance, *current* being the period when the policy is in execution, and *post* being after the policy issuance.⁸ α_t coefficients reflect the differences between firms that are affected differently by the policy in a given year, with α_0 representing the effect of the policy in the current period, α_{-4} to α_{-1} indicating the effect of the 1–4 periods before the policy, and α_1 to α_4 reflecting the effect of the 1–4 periods after the policy. We chose period 1 before policy onset as the model benchmark group to prevent full covariance. Because annual variables are included in the model, year fixed effects are not controlled and industry fixed effects are added. If the parallel trend assumption holds, α_{-4} to α_{-2} should be insignificant, indicating that all periods 4–2 prior to the policy adoption are similar to the trend of firm changes in period 1. And α_0 to α_4 are the dynamic effects of the policy over time.

4.3. Variable definition

4.3.1. Shadow banking investment degree

Considering that the research samples are Chinese Shanghai and Shenzhen A-share main board-listed enterprises, the difference in policy impacts is reflected from the investment perspective by the corporate shadow banking investment degree, *DSBI*, which is measured as the average size of shadow banking investment of the enterprises in the four periods prior to the implementation of the *NRCM* policy.

Drawing on Lu et al. (2015), China’s shadow banking involves entrusted loans, entrusted wealth management, private lending and the purchase of various types of shadow credit products, etc. Based on data availability, we summed the above products and then divided them by the total assets to obtain the scale of shadow banking investment by Chinese firms, which is expressed by the degree of Shadow banking investment degree *DSBI*.

4.3.2. Investment efficiency

Referring to Richardson (2006) measurement of firm investment efficiency, we implemented the model residuals to measure the level of inefficient investment and constructed the following regression model (4).

$$Inv_{i,t} = \rho_0 + \rho_1 Lev_{i,t-1} + \rho_2 Q_{i,t-1} + \rho_3 Age_{i,t-1} + \rho_4 Cash_{i,t-1} + \rho_5 Return_{i,t-1} + \rho_6 Size_{i,t-1} + \rho_7 Inv_{i,t-1} + \rho_7 Inv_{i,t-1} + Industry_i + \varepsilon_{i,t} \quad (4)$$

In model (4), *Inv_{i,t}* represents the new investment expenditure of the firm in the current period, which is equal to the ratio of the cash paid by the firm for the purchase and construction of fixed assets, intangible assets, and other long-term assets minus the net cash recovered from the disposal of the above assets to the total assets at the beginning of the period; *Lev_{i,t-1}* represents the firms’ asset-liability ratio in the previous period. *Q_{i,t-1}* is the ratio of the sum of the market value of shareholders’ equity and the book value of

⁸ The year dummy variables are all defined as 1 for the current year and 0 for all other years.

liabilities to total assets; $Age_{i,t-1}$ is the number of years the firm has been listed in the previous period; $Cash_{i,t-1}$ is the firm's cash ratio in the previous period, which is equal to the ratio of cash holdings to total assets at the beginning of the period; $Return_{i,t-1}$ is the stock yield in the previous period; $Size_{i,t-1}$ is the firm's size, expressed as the logarithm of total assets; $Inv_{i,t-1}$ is the firm's new investment expenditure in the previous period; $Industry_i$ represents the industry dummy variable. Next, model (2) was regressed, and the absolute value of the residuals was used to measure the level of inefficient investment (INV_EFF) of firms. In the measurement, it was found that larger absolute value of the residuals indicates higher level of inefficient investment, which also reflects the lower efficiency of investment of firms. If the residual value is positive, it means that the firm is overinvested ($Over_INV$), whereas if it is negative, it means that the firm is underinvested ($Under_INV$), which is also expressed by the absolute value.

4.3.3. Control variables

In addition, in terms of control variables, we controlled for some variables of firm characteristics, financial position, and operational capacity concerning existing studies (Rajkovic, 2020; Chen et al., 2017; Eisdorfer et al., 2013; Hovakimian, 2011; Biddle et al., 2009). There are diverse types of firms to be considered. Firstly, firms with different inherent characteristics may differ significantly in their investment efficiency (Chen et al., 2017; Eisdorfer et al., 2013; Biddle et al., 2009). Secondly, firms with constrained financial capital can reduce potentially profitable investment activities, whereas excess capital can lead to wasteful expenditures (Hovakimian, 2011). Thirdly, operational capacity may also influence firms' investment decisions (Rajkovic, 2020). Therefore, we controlled for firm size ($SIZE$), intangible assets ratio (IA), leverage (LEV), return on assets (ROA), and age of the firm (AGE). Meanwhile, since firm governance may also affect investment efficiency (Zhao, 2021; Gao et al., 2017; Xie, 2015), here we also controlled for variables related to it: two offices in one (DUA , which takes the value of 1 if the chairman and CEO are the same person and 0 otherwise), the size of the board of directors ($BOAR$), the first most significant Shareholder Shareholding Ratio ($LSSR$) and Institutional Investor Shareholding Ratio ($INST$). Due to Chinese firms' ownership peculiarities and policy subsidy policies, two additional control variables, government subsidy (GS) and ownership nature (OWN), are added in this paper. We provide the calculation details of all variables in Appendix A.

5. Empirical results

5.1. Descriptive statistics

Panel A of Table 1 shows the results of the descriptive statistics of the variables. As can be seen, the mean value of investment efficiency INV_EFF is 0.051, the standard deviation is 0.043, the minimum value is 0, the median is 0.026, and the maximum value is 0.667, which indicates that there are significant differences in the investment efficiency of the sample companies and there is still room for improvement. The mean value of $OVER_INV$ is 0.055, the number is 11628, and the sample accounts for 60 %, while the mean value of $UNDER_INV$ is 0.039, the number is 7752, and the sample accounts for 40 %, indicating that in the sample of A-share main board

Table 1
Summary statistics and univariate analysis.

Panel A: Descriptive statistics								
Variable	N	mean	p50	sd	min	max		
INV_EFF	19380	0.051	0.026	0.043	0	0.667		
OVER_INV	11628	0.055	0.039	0.058	0	0.771		
UNDER_INV	7752	0.039	0.025	0.052	0	0.510		
DSBI	19380	0.262	0.287	0.231	0	0.902		
SIZE	19380	22.246	22.137	1.584	16.589	27.191		
IA	19380	0.052	0.033	0.382	0	0.924		
LEV	19380	0.443	0.412	0.228	0.008	0.928		
ROA	19380	0.045	0.038	0.702	−0.166	0.387		
AGE	19380	2.236	2.285	0.197	1.233	3.501		
DUA	19380	0.313	0	0.470	0	1		
BOAR	19380	2.178	2.342	0.198	1.056	2.803		
LSSR	19380	0.329	0.314	0.161	0.003	0.897		
INST	19380	0.486	0.507	0.269	0	0.890		
GS	19380	14.502	14.701	2.703	0	22.864		
OWN	19380	0.402	0	0.504	0	1		
Panel B: Univariate analysis								
Variable	Pre_1-4			Current & Post_1-4			Diff	Diff
	N	Mean	Median	N	Mean	Median	(Mean)	(Median)
INV_EFF	7912	0.068	0.053	11468	0.033	0.022	0.243 * **	0.182 * **
OVER_INV	5080	0.075	0.062	6548	0.036	0.030	0.257 * **	0.201 * **
UNDER_INV	2832	0.048	0.030	4920	0.029	0.026	0.056	0.048

Note: Table 1 Panel A shows the descriptive statistics for the sample. Panel B demonstrates the results of the univariate tests. Appendix A provides detailed definitions of all variables.

listed companies, the number of over-invested companies is more than that of under-invested companies, and the degree is more serious. We conducted a *t*-test between the two samples of overinvestment and underinvestment, and the *p*-value was 0.0004, which indicates that there is a significant difference between the two groups of samples, validating the sample variability. This is highly in alignment with China's national conditions: on the one hand, with China's economy shifting from high-speed growth to high-quality development, the real economy is facing problems such as a lower level of industrial structure, declining product yields, and higher financing costs resultantly, listed companies are faced with more severe financing constraints. In such an unfavorable economic context, the number of underinvested firms should be on the high side. On the other hand, with the rapid development of China's financial industry as the core industry, the gap between the profits of the virtual economy and the real economy has widened. Out of the profit-seeking nature of capital, firms will continuously reduce their leading business investment and divert a large amount of capital to the virtual economy, ultimately making overinvestment abnormally pronounced in the virtual market.

The mean value of *DSBI* for shadow banking investment degree is 0.262, and the median is 0.287, indicating that more companies rely on shadow banking investment in A-share main board, which confirms the role of shadow banking investors in A-share main board listed companies. The mean value of *OWN* is 0.402, and the median is 0, which indicates that more private companies are on the A-share main board, genuinely reflecting China's national conditions.

Panel B of Table 1 examines the changes in the firm's investment efficiency *INV_EFF*, overinvestment *OVER_INV*, and underinvestment *UNDER_INV* before and after (including the current year) the year of policy release under univariate. It can be seen that in significant mean and median difference tests, compared to the level prior to the policy's execution (Pre_1-4), firms' inefficient investment is reduced by about 51.5 %⁹ and over-investment by 52.0 %¹⁰ after the policy's enactment (Current & Post_1-4). By contrast, under-investment does not pass the difference test. It suggests that the overall investment efficiency of firms has improved after the policy was enacted, which is mainly attributed to firms' significant disincentive to overinvest. These findings provide preliminary evidence for the relationship between regulatory shadow banking and investment efficiency under the *NRCM*.

In addition, the results of the correlations between the main variables are presented in Appendix B of this paper. It can be seen that the correlation coefficients between most of the variables are less than 0.3, and the results of the multicollinearity test show that the mean value of the Variance Inflation Factor (VIF) is 4.23, which is less than the empirically determined critical value of 10, suggesting that there is no serious multicollinearity between the variables.

5.2. Regression results

5.2.1. Baseline results

Table 2 reports the regression results of the relationship between shadow banking regulation and firms' investment efficiency under the *NRCM*. Among them, in columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*, which reflects the level of inefficient investment of the firm, i.e., the larger the value is, the higher the level of inefficient investment of the firm, and the lower the investment efficiency. We then further divided the inefficient investment level into two categories: over-investment and under-investment. In columns (3), (4) and columns (5), (6), the dependent variables are over-investment *OVER_INV* and under-investment *UNDER_INV*, respectively, both of which are featured with larger values, indicating the severity of firm's over-investment and under-investment. Columns (1), (3), and (5) are not added with control variables, while columns (2), (4), and (6) are integrated with control variables and all regressions control for the industry and firm fixed effects. In addition, we also resorted to existing studies (Rajkovic, 2020; Chen et al., 2018) to correct standard errors at the level of heterogeneity and clustering at the firm level.

The results in columns (1) to (6) show that the regression coefficients of the pre_4-pre_2 and *DSBI* cross-product terms are insignificant, indicating that firms with different levels of shadow banking investment degree are not significantly different before the implementation of the *NRCM*. So, the parallel trend hypothesis is satisfied. Meanwhile, the regression coefficients of the cross-product terms of *DSBI* and current to next 4 periods in Columns (1) to (2) are significantly negative, supporting Hypothesis H1b, i.e., the inefficient investment of firms with a high degree of dependence on shadow bank investment can be effectively suppressed under *NRCM*, thus significantly improving their investment efficiency. The results in columns (3) to (6) reflect two different inefficient investment scenarios. The regression coefficients of the cross-product term of *DSBI* with the current to the next 4 periods are significantly negative in columns (3) and (4), but not in columns (5) and (6), which suggests that though the *NRCM* manifests a certain time-dynamic effect to inhibit firms' overinvestment, its effect on underinvestment is limited. This result also indicates that the *NRCM* suppresses firms' overinvestment mainly by improving firms' investment efficiency, and the persistent significance indicates that the policy maintains a longer-term negative impact on the inefficient investment level of firm. Consequently, firms, as the main investor of the shadow banking, under the influence of *NRCM*, can persistently improve their investment efficiency. In addition, this finding also strengthens the logic of Hypothesis H1b and supports the 'shadow banking risk view'. Taken together, the results suggest that the *NRCM* can dampen the level of inefficient investment and improve investment efficiency, which provides strong support for the main conjecture.

In addition, the differences reflected in the coefficients of some control variables under two different scenarios of overinvestment and underinvestment are also noteworthy. In Table 2, the regression coefficients of *SIZE*, *ROA*, and *OWN* with *OVER_INV* are significantly positive, but *UNDER_INV* are significantly negative, indicating that if the enterprise is a large sized state-owned enterprise with

⁹ Calculated by $|(0.033-0.068)/0.068|$.

¹⁰ Calculated by $|(0.036-0.075)/0.075|$.

Table 2
The NRCM and Corporate Investment Efficiency.

VARIABLES	Investment efficiency		Over-investment		Under-investment	
	(1)	(2)	(3)	(4)	(5)	(6)
	INV_EFF	INV_EFF	OVER_INV	OVER_INV	UNDER_INV	UNDER_INV
pre_4 ×DSBI	−0.053 (−0.35)	−0.024 (−0.18)	−0.049 (−0.45)	−0.037 (−0.28)	−0.032 (−0.25)	−0.010 (−0.04)
pre_3 ×DSBI	−0.083 (−0.55)	−0.065 (−0.31)	−0.096 (−0.77)	−0.074 (−0.51)	−0.048 (−0.34)	−0.018 (−0.19)
pre_2 ×DSBI	−0.093 (−0.86)	−0.070 (−0.62)	−0.103 (−0.91)	−0.087 (−0.73)	−0.056 (−0.63)	−0.036 (−0.48)
current×DSBI	−0.114 *** (−2.69)	−0.097 ** (−2.41)	−0.122 *** (−3.13)	−0.103 *** (−2.95)	−0.079 (−0.92)	−0.055 (−0.70)
post_1 ×DSBI	−0.128 *** (−3.07)	−0.106 *** (−2.86)	−0.134 *** (−3.55)	−0.115 *** (−3.28)	−0.088 (−0.98)	−0.068 (−0.86)
post_2 ×DSBI	−0.132 *** (−3.20)	−0.115 *** (−3.01)	−0.142 *** (−3.65)	−0.121 *** (−3.47)	−0.095 (−1.07)	−0.075 (−0.97)
post_3 ×DSBI	−0.113 ** (−2.42)	−0.094 ** (−2.23)	−0.123 *** (−2.74)	−0.102 ** (−2.52)	−0.086 (−0.94)	−0.064 (−0.73)
post_4 ×DSBI	−0.087 ** (−2.06)	−0.068 * (−1.87)	−0.101 ** (−2.48)	−0.080 ** (−2.27)	−0.043 (−0.76)	−0.028 (−0.57)
SIZE		0.139 *** (2.97)		0.154 *** (3.07)		−0.088 ** (−2.43)
IA		−0.095 (−1.04)		−0.096 (−1.48)		0.014 (0.24)
LEV		0.028 (1.39)		0.018 (1.16)		0.011 (0.55)
ROA		0.138 ** (2.54)		0.152 *** (2.71)		−0.107 ** (−2.04)
AGE		−0.017 (−1.18)		−0.023 (−0.73)		−0.012 (−0.89)
DUA		0.012 ** (2.19)		0.013 *** (2.60)		0.008 * (1.74)
BOAR		−0.136 *** (−3.45)		−0.152 *** (−3.52)		−0.114 *** (−3.33)
LSSR		0.030 (0.89)		0.037 (1.49)		0.052 (0.45)
INST		0.022 *** (3.14)		0.038 ** (2.40)		0.017 * (1.82)
GS		0.001 (1.04)		0.001 (1.07)		0.003 (1.16)
OWN		0.018 *** (2.79)		0.009 *** (3.82)		−0.022 ** (−2.47)
Constant	0.165 *** (6.15)	0.040 (1.41)	0.146 *** (5.34)	0.025 (0.77)	0.182 *** (11.48)	0.157 *** (4.94)
Ind & Firm	YES	YES	YES	YES	YES	YES
Observations	19380	19380	11628	11628	7752	7752
R-squared	0.124	0.371	0.130	0.384	0.102	0.133

Note: Table 2 presents the regression results of the NRCM and the efficiency of corporate investment. In Columns (1)–(2), (3)–(4), and (5)–(6), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

high asset return, it is more likely to manifest a high degree of overinvestment and a low degree of underinvestment. In this case, DUA and INST with OVER_INV and UNDER_INV regression coefficients are equally significant. In contrast, the corresponding regression coefficients of BOAR are significantly negative, indicating that the greater the probability that the chairman and CEO are the same person in an enterprise and the more significant the shareholding of institutional investors is, the more likely it is to lead to over-investment and underinvestment. On the contrary, the larger the size of an enterprise's board of directors, the more likely it is to reduce inefficient investment and improve investment efficiency.

5.2.2. Robustness checks

To address endogeneity issues such as omitted variables and reverse causality, and to further strengthen the robustness of the empirical results, this section conducts various tests such as placebo tests.

5.2.2.1. Placebo test. To remove the randomness factor from confounding the findings, borrowing from Cornaggia and Li (2019), we performed a placebo test by simulating random events, randomly generating the time of occurrence of the NRCM and regressing it.

As shown in Figs. 2 and 3, the regression t-values of the core explanatory variables in the 500 random samples all show a normal distribution with a mean close to zero, indicating that the test is consistent with randomization. This suggests that the increase in investment efficiency (the suppression of overinvestment) of firms, which act as shadow banking investment agents, is indeed a result of implementing the *NRCM* rather than a result of other uncontrolled factors.

5.2.2.2. Replacement test model. In order to address potential heterogeneity bias in the GDD model, we created two new variables, *DSBI1* and *DSBI2*, and constructed the traditional DID model for regression. The model is as follows:

$$INV_EFF_{it} = \beta_1 TIME \times TREAT + \beta_2 CONTROL_{it} + \sum YEAR + \sum FIRM + \varepsilon_{it} \quad (5)$$

$$OVER_INV_{it} = \alpha_0 TIME \times TREAT + \beta_2 CONTROL_{it} + \sum YEAR + \sum FIRM + \varepsilon_{it} \quad (6)$$

$$UNDER_INV_{it} = \alpha_0 TIME \times TREAT + \beta_2 CONTROL_{it} + \sum YEAR + \sum FIRM + \varepsilon_{it} \quad (7)$$

In models (5) to (7), in addition to the variables described above, *TIME* is a dummy variable indicating whether the policy is in place. It takes the value of 0 if the year is before 2017 (excluding 2017) and the value of 1 otherwise. *TREAT* is represented by *DSBI1* and *DSBI2*, both of which are dummy variables measuring the extent of firms' investment in shadow banking. *CONTROL* consists of a series of variables, including year and firm fixed effects, represented by $\sum YEAR$ and $\sum FIRM$, respectively. Additionally, the regression results are corrected for firm-level clustering.

For *DSBI1*, we calculated the average size of firms' investment in shadow banking, and controlled for year and industry parameters. If the actual value exceeds the fitted average, it indicates an abnormality, which measures the extent of corporate investment in shadow banking. Thus, this paper constructs the following model to measure the scale of corporate shadow banking investment, controlling for relevant factors:

$$SB_{it} = \gamma_1 SIZE_{it} + \gamma_2 GROWTH_{it} + \gamma_3 CFO_{it} + \gamma_4 ROE_{it} + \gamma_5 OWNERSHARE_{it} + \gamma_6 MARGIN_{it} + \gamma_7 EXTERNAL_{it} + \gamma_8 GOVERN_{it} + \sum YEAR + \sum IND + \varepsilon_{it} \quad (8)$$

The dependent variable *SB* is the size of shadow banking investment in the book of the enterprise, which is equal to the ratio of the sum of the following parameters to total assets. The parameters applied represent other current assets, non-current assets maturing within one-year, other current assets, entrusted finance, other receivables, long-term receivables, and held-to-maturity investments, respectively. Among the parameters, *SIZE* is the size of the enterprise, i.e., the natural logarithm of total assets; *GROWTH* is the growth rate of operating income; *CFO* is the cash flow from operating activities; *ROE* is the return on net assets; *OWNERSHARE* is the shareholding structure, i.e., the proportion of ownership by the effective controller; *MARGIN* is the difference between financial and real returns; *EXTERNAL* is the external financing ability of the enterprise, i.e., the sum of equity financing and debt financing; *GOVERN* is the corporate governance efficiency. The principal component analysis is conducted on the nature of ownership, the proportion of independent directors and the shareholding of executives. After the analysis, the composite index is obtained. Meanwhile, the residuals are obtained by regressing the model with TOBIT. If the residuals are greater than 0, it means that there is an abnormality in the percentage of these subjects, and the enterprise has over-invested in shadow banking. In this case, the *DSBI1* of shadow banking investment degree is taken as 1. If the residuals are less than or equal to 0, it means that the enterprise has not over-invested in shadow banking, and the *DSBI1* of shadow banking investment degree is taken as 0.

For *DSBI2*, we use *DSBI* as the basis. *DSBI2* takes the value of 1 if a firm's four-year average *DSBI* exceeds the industry median, and 0 otherwise.

The regression results are shown in Tables 3 and 4, both of which have passed the parallel trend test. The treatment groups in Table 3 are represented by *DSBI1*, and those in Table 4 by *DSBI2*. From Table 3, the regression coefficients of the cross-multiplier terms of *TIME* and *DSBI1* with investment efficiency *INV_EFF* and overinvestment *OVER_INV* are significantly positive in columns (1) and (2). However, the coefficients with underinvestment *UNDER_INV* are not significant in column (3), yielding the same conclusions as the benchmark test. From Table 4, the regression coefficients of the cross-multiplier terms of *TIME* and *DSBI1* with investment efficiency *INV_EFF* and overinvestment *OVER_INV* are also significant, while those with underinvestment *UNDER_INV* are not, which is consistent with the benchmark test results.

Compared to the GDD model applied in the benchmark test, the traditional DID model for a quasi-natural experiment, such as the nationwide enactment of policies, is inferior in terms of model fit, as shown by the smaller R-squared. However, the results are consistent for both models. Therefore, the traditional DID model can serve as a complementary test to the GDD model under the condition that all firms are affected by the policy.

5.2.2.3. Excluding other significant events in the same period

5.2.2.3.1. Excluding the impact of the COVID-19 epidemic. At the end of 2019, the COVID-19 epidemic began to emerge in China, and the business conditions of affected firms manifested continuous fluctuations, which may affect their investment efficiency. To address this concern, we take the time point of COVID-19 outbreak and exclude the sample after the 2020 outbreak, and the regression results are shown in Table 5. It can be observed that the regression coefficients of the cross-product terms of *DSBI* with current to the next 4 periods and *INV_EFF* and *OVER_INV* in columns (1) to (2) are significantly negative, indicating that the regression results do not change much after the elimination of COVID-19 epidemic effect.

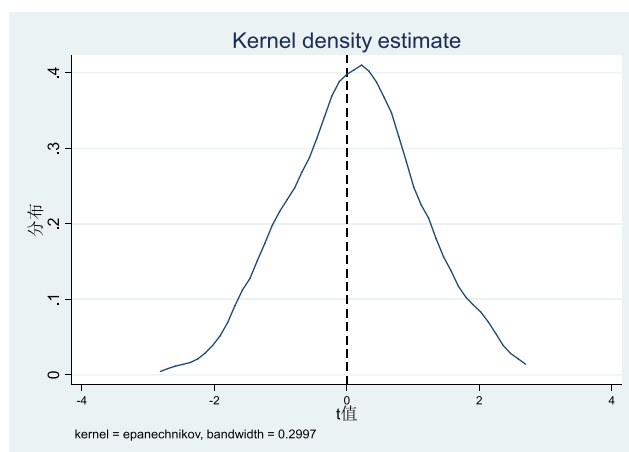


Fig. 2. Shadow banking regulation and efficiency of corporate investment.

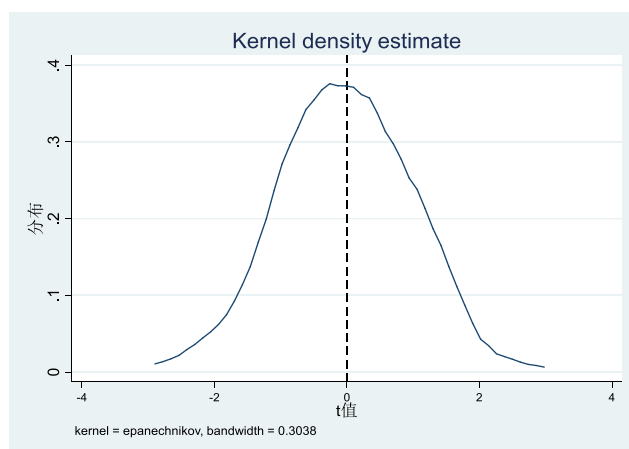


Fig. 3. Shadow Banking Regulation and Corporate Overinvestment.

5.2.2.3.2. Excluding the influence of money supply policy. There is also an alternative explanation that after the implementation of the NRCM, the People's Bank of China has increased the money supply to boost the amount of bank credit placement in order to match the smooth promotion of the policy. This strategy can alleviate the capital pressure to a certain extent, and enterprises can make effective layout according to their strategies, thus improving investment efficiency. To rule out this possibility, we constructed the money supply *MONETARY* measured by the broad money supply M2 growth rate and include its interaction term with the time variable in the model regression. The regression results are shown in Table 6. It can be seen that the regression coefficients of the cross-product term of *DSBI* with current to the next 4 periods and *INV_EFF* and *OVER_INV* in columns (1) to (2) are all significantly negative, indicating that the regression results are still robust after the exclusion of money supply policy effect.

5.2.2.4. Considering the macroeconomic environment at the regional level. To further control for omitted variables at the macro level, we employed regional GDP, total loans to financial institutions as a share of GDP, added value of secondary and tertiary industries as a share of GDP representing the degree of local economic development (GDP), level of financial development (LFD), and industrial structure (IIS), respectively. With this multi-perspective approach taken, we controlled for macroeconomic effects. The regression results are presented in Table 7. The results in columns (1) to (2) show that the regression coefficients of the cross-product term of *DSBI* with current to the next 4 periods and *INV_EFF* and *OVER_INV* are significantly negative, and the study results remain unchanged.

5.2.2.5. Replacement of the variable measure. Regarding the replacement variable measures, we chose new measures for investment efficiency and shadow bank investment dependence. Based on existing studies (Biddle et al., 2009; Benlemlih and Bitar, 2018;

Table 3Replacement test model-denote treatment group by *DSBI1*.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
TIME×DSBI1	−0.105 * ** (−2.96)	−0.113 * ** (−3.24)	−0.018 (−0.59)
SIZE	0.002 * (1.77)	0.005 * ** (2.83)	−0.001 (−0.99)
IA	−0.064 (−1.38)	−0.006 (−0.97)	0.020 (1.14)
LEV	0.025 (1.31)	0.009 (1.16)	0.012 (1.25)
ROA	0.115 * * (2.48)	0.128 * ** (2.79)	−0.086 (−1.31)
AGE	−0.003 (−1.23)	−0.001 (−0.53)	−0.001 (−0.08)
DUA	0.009 * ** (2.83)	0.004 * * (2.36)	0.006 * * (2.04)
BOAR	−0.063 * ** (−3.53)	−0.093 * ** (−3.39)	−0.026 * ** (−2.90)
LSSR	−0.003 (−0.84)	−0.003 (−0.50)	−0.001 (−0.24)
INST	0.080 * ** (2.89)	0.011 * * (2.37)	0.047 * ** (2.76)
GS	−0.003 * * (−2.40)	−0.056 * * (−2.08)	−0.001 * * (−2.14)
OWN	0.035 * ** (3.20)	0.007 * * (2.17)	−0.020 * * (−2.26)
Constant	0.059 (1.51)	0.046 (1.35)	0.174 * ** (10.02)
Year & Firm	YES	YES	YES
Observations	19380	11628	7752
R-squared	0.248	0.256	0.091

Note: Table 3 shows the results of the traditional DID model for the treatment group denoted by *DSBI1*. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (*INV_EFF*), overinvestment (*OVER_INV*), and underinvestment (*UNDER_INV*), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

Rajkovic, 2020), we estimate investment efficiency as the deviation from the expected optimal level of investment (the optimal level of investment reflects a firm's ability to undertake all positive NPV^{11} projects), as reflected in the following model for sub-sector regressions by year in the absolute value of the error term obtained.

$$INV_{it} = \beta_0 + \beta_1 \Delta SALES_{it-1} + v_{it} \quad (9)$$

where *INV* covers five categories, i.e., one, the sum of cash paid for the acquisition of fixed assets, intangible assets, and other long-term assets; two, cash paid for the acquisition of subsidiaries and other business units; three, cash paid for investments minus the net cash recovered from the disposal of fixed assets, intangible assets and other long-term assets; four, net cash received from the disposal of subsidiaries and other business units; five, cash received from the recovery of investments. *INV* is to obtain the net amount divided by the total assets at the beginning of the period. $\Delta SALES$ is the annual rate of change of the firm's operating income. *v* is the residual obtained from the regression of model (3), and its absolute value *AbsINV* is used to measure the level of the firm's inefficient investment. It is found that the larger the absolute value of the residuals is, the higher level of inefficient investment but the lower level of the investment efficiency of the firm can be realized. Conversely, the smaller the absolute value of the residuals is, the higher the investment efficiency of the firm becomes (Gomariz and Ballesta, 2014). To further distinguish the types of investment inefficiency, we then define the variables *OVER_INV1* and *UNDER_INV1* separately. It can be concluded that when the residuals of model (3) are greater than 0, *OVER_INV1* equals the value of the residuals, indicating overinvestment; whereas when the residuals of model (3) are less than 0, *UNDER_INV1* equals the opposite of the residuals, indicating underinvestment.

In terms of shadow banking investment degree, we choose *DSBI1* to replace the *DBSI*.

Based on this, we construct the following model for regression:

$$INV_EFF1_{it} = \sum_{t=-4}^4 \delta_{tpre} \times DSBI1_i + \delta_0 current \times DSBI1_i + \sum_{t=1}^4 \delta_{tpost} \times DSBI1_i + \delta_5 CONTROL_{it} + \sum IND + \sum FIRM + \varepsilon_{it} \quad (10)$$

¹¹ Net present value.

Table 4Replacement test model- denote treatment group by *DSBI2*.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
TIME×DSBI2	−0.092 * ** (−2.71)	−0.102 * ** (−3.12)	−0.006 (−0.37)
SIZE	0.064 * (1.86)	0.081 * ** (2.15)	−0.024 * (−1.73)
IA	0.022 (0.84)	0.051 (1.46)	−0.012 (−1.64)
LEV	0.011 * (1.92)	0.026 (0.71)	−0.004 (−0.88)
ROA	0.128 * (1.70)	0.156 * ** (2.50)	−0.179 (−1.19)
AGE	−0.001 (−0.03)	−0.016 (−1.22)	−0.029 (−0.28)
DUA	0.001 (1.30)	0.004 (1.66)	0.004 (0.31)
BOAR	−0.043 * ** (−3.22)	−0.106 * ** (−3.16)	−0.003 * * (−2.01)
LSSR	−0.023 (−1.31)	−0.048 (−1.02)	−0.007 (−0.81)
INST	0.067 * ** (4.40)	0.112 * ** (3.41)	0.011 * ** (1.97)
GS	−0.003 (−1.63)	−0.001 (−0.58)	−0.005 (−1.07)
OWN	0.028 * ** (5.92)	0.008 * ** (4.14)	−0.039 * ** (−3.78)
Constant	0.068 (1.60)	0.057 (1.41)	0.162 * ** (7.66)
Year & Firm	YES	YES	YES
Observations	19380	11628	7752
R-squared	0.237	0.245	0.086

Note: Table 4 shows the results of the traditional DID model for the treatment group denoted by *DSBI2*. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (*INV_EFF*), overinvestment (*OVER_INV*), and underinvestment (*UNDER_INV*), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

$$OVER_INV1_{it} = \sum_{t=-4}^4 \delta_t pre \times DSBI1_i + \delta_0 current \times DSBI1_i + \sum_{t=1}^4 \delta_t post \times DSBI1_i + \delta_5 CONTROL_{it} + \sum IND + \sum FIRM + \varepsilon_{it} \quad (11)$$

$$UNDER_INV1_{it} = \sum_{t=-4}^4 \delta_t pre \times DSBI1_i + \delta_0 current \times DSBI1_i + \sum_{t=1}^4 \delta_t post \times DSBI1_i + \delta_5 CONTROL_{it} + \sum IND + \sum FIRM + \varepsilon_{it} \quad (12)$$

The corresponding regression results are presented in Table 8. In columns (1) to (2), the regression coefficients of the cross-product term of *DSBI1* with current to the next 4 periods and *INV_EFF1* and *OVER_INV1* are significantly negative, indicating that after the replacement of the variables' measurement methodology, the *NRCM* still enhances the efficiency of corporate investment and the findings still hold.

5.2.2.6. Controlling for interaction fixed effects. In view of the uneven development of different regions in China, as well as the gap of investment efficiency among different provinces and municipalities, we control for the industry and firm effects, and then control for the interaction fixed effects of industry and province (*Ind*×*Pro*). Table 9 presents the results in the condition of control for the interaction fixed effects, from which it can be seen that the regression coefficients of the cross-product term of *DSBI* with current to the next 4 periods and *INV_EFF* and *OVER_INV* in columns (1) to (2) are significantly negative, further manifesting the robustness of the regression results.

5.2.2.7. Balanced panel data test. To further improve the robustness of the results and reduce estimation errors, we further censored the existing sample to obtain balanced panel data. Specifically, the data of selected firms cover all sample periods, yielding a total of 1346 firms with 9 years of data and 12114 samples. The regression results are shown in Table 10. The regression coefficients of the cross-product terms of *DSBI* across the current and previous four periods with *INV_EFF* and *OVER_INV* in columns (1)–(2) are significantly negative, indicating that the results remain robust under the balanced panel data.

Table 5
Excluding the impact of the COVID-19 epidemic.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
pre_4 ×DSBI	−0.017 (−0.13)	−0.031 (−0.22)	−0.006 (−0.02)
pre_3 ×DSBI	−0.054 (−0.25)	−0.066 (−0.40)	−0.012 (−0.13)
pre_2 ×DSBI	−0.063 (−0.52)	−0.073 (−0.65)	−0.028 (−0.36)
current ×DSBI	−0.083 * * (−2.30)	−0.092 * * * (−2.86)	−0.046 (−0.63)
post_1 ×DSBI	−0.094 * * * (−2.77)	−0.107 * * * (−3.16)	−0.056 (−0.71)
post_2 ×DSBI	−0.105 * * * (−2.88)	−0.114 * * * (−3.33)	−0.068 (−0.80)
post_3 ×DSBI	−0.086 * * (−2.15)	−0.090 * * (−2.41)	−0.055 (−0.63)
post_4 ×DSBI	−0.057 * (−1.76)	−0.073 * * (−2.11)	−0.017 (−0.41)
SIZE	0.126 * * * (2.64)	0.143 * * * (2.89)	−0.064 * (−1.67)
IA	−0.056 (−1.46)	−0.031 (−1.06)	0.052 (0.49)
LEV	0.024 (1.04)	0.003 (0.20)	0.080 (1.13)
ROA	0.225 * (1.66)	0.323 * * (2.30)	−0.105 (−0.53)
AGE	−0.012 (−0.52)	−0.020 (−0.62)	−0.009 (−0.36)
DUA	0.008 * * (1.99)	0.009 * * (2.05)	0.005 * (1.68)
BOAR	−0.126 * * * (−3.25)	−0.145 * * * (−3.48)	−0.110 * * * (−2.94)
LSSR	0.011 (0.66)	0.024 (0.93)	0.065 (0.63)
INST	0.015 * (1.82)	0.038 * (1.88)	0.010 * (1.71)
GS	0.001 (0.51)	0.001 (1.06)	0.006 (1.22)
OWN	0.014 * * * (2.62)	0.020 * * * (2.77)	−0.009 * * (−1.97)
Constant	0.028 (1.29)	0.019 (0.86)	0.052 * * * (3.15)
Ind & Firm	YES	YES	YES
Observations	17360	10612	6748
R-squared	0.365	0.379	0.128

Note: Table 5 shows the results after excluding the effect of the COVID-19 epidemic. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

5.2.2.8. Panel data with policy current period removed. To eliminate the influence of potential policy lags and to clarify the results, we remove the current policy period and use panel data from the first four years and the last four years after policy adoption. Table 11 presents the corresponding results, from which it can be seen that the regression coefficients of the cross-multiplier terms of *DSBI* with periods 1–4 in columns (1) to (2) are all significantly negative, further reflecting the robustness of the regression results.

6. Mechanism test

Consistent with the proposed hypothesis, the *NRCM* can improve investment efficiency by discouraging investment in financial assets and reducing corporate risk and agency costs. In the next section, we will test the mechanism effect. Drawing on Stuart (2022) and Dehdari and Gehring (2022), we adopt a grouping approach for mechanism testing. The core of the subgroup test's ability to serve as a mechanism test lies in the fact that if a channel has a significant effect on the outcome variable in the intervention group, but not on the control group or subgroups unrelated to the mechanism, it suggests that the channel may be the mechanism of influence. By dividing the samples into groups, the role of a particular mechanism can be analyzed separately for each group, providing stronger evidence for causal inference.

Table 6

Excluding the influence of money supply policy.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
pre_4 ×DSBI	−0.011 (−0.06)	−0.020 (−0.12)	−0.002 (−0.01)
pre_3 ×DSBI	−0.038 (−0.12)	−0.047 (−0.26)	−0.008 (−0.07)
pre_2 ×DSBI	−0.049 (−0.36)	−0.054 (−0.49)	−0.016 (−0.22)
current×DSBI	−0.062 * * (−2.14)	−0.077 * ** (−2.63)	−0.028 (−0.49)
post_1 ×DSBI	−0.075 * * (−2.50)	−0.083 * ** (−2.96)	−0.034 (−0.58)
post_2 ×DSBI	−0.096 * ** (−2.64)	−0.103 * ** (−3.14)	−0.042 (−0.69)
post_3 ×DSBI	−0.067 * * (−1.97)	−0.077 * * (−2.26)	−0.035 (−0.41)
post_4 ×DSBI	−0.032 (−1.52)	−0.053 * (−1.90)	−0.005 (−0.23)
pre_4 ×MONETARY	−0.035 (−0.34)	−0.042 (−0.48)	−0.014 (−0.11)
pre_3 ×MONETARY	−0.052 (−0.51)	−0.069 (−0.68)	−0.025 (−0.23)
pre_2 ×MONETARY	−0.067 (−0.75)	−0.078 (−0.93)	−0.036 (−0.35)
current×MONETARY	−0.089 * (−1.84)	−0.098 * * (−2.01)	−0.062 * (−1.67)
post_1 ×MONETARY	−0.097 * * (−2.02)	−0.108 * * (−2.26)	−0.078 * (−1.83)
post_2 ×MONETARY	−0.073 * (−1.72)	−0.082 * * (−1.97)	−0.053 (−0.52)
post_3 ×MONETARY	−0.062 (−0.60)	−0.075 (−0.74)	−0.045 (−0.40)
post_4 ×MONETARY	−0.044 (−0.46)	−0.058 (−0.61)	−0.030 (−0.28)
SIZE	0.122 * ** (3.20)	0.136 * ** (3.43)	−0.077 * (−1.85)
IA	−0.019 (−0.84)	−0.075 (−0.88)	0.072 (0.28)
LEV	0.030 (0.22)	0.002 (0.39)	0.048 (0.86)
ROA	0.206 * * (1.98)	0.302 * * (2.48)	−0.097 * (−1.68)
AGE	−0.016 (−0.82)	−0.009 (−0.97)	−0.002 (−0.17)
DUA	0.032 * * (2.31)	0.015 * ** (2.68)	0.008 * (1.73)
BOAR	−0.173 * ** (−2.83)	−0.134 * ** (−3.08)	−0.102 * * (−2.05)
LSSR	0.194 (1.09)	0.324 (1.21)	0.204 (0.51)
INST	0.044 * (1.91)	0.062 * * (2.04)	0.023 * (1.66)
GS	0.004 (0.51)	0.002 (0.25)	0.009 (1.03)
OWN	0.011 * ** (2.90)	0.016 * ** (3.25)	−0.011 * (−1.91)
Constant	0.032 (1.07)	0.018 (0.43)	0.043 * ** (2.62)
Ind & Firm	YES	YES	YES
Observations	19380	11628	7752
R-squared	0.445	0.452	0.216

Note: Table 6 shows the results after excluding the effect of money supply policy. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

Table 7

Considering the macroeconomic environment at the regional level.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
pre_4 ×DSBI	−0.006 (−0.03)	−0.014 (−0.07)	−0.001 (−0.01)
pre_3 ×DSBI	−0.025 (−0.09)	−0.038 (−0.18)	−0.004 (−0.03)
pre_2 ×DSBI	−0.037 (−0.24)	−0.045 (−0.36)	−0.010 (−0.15)
current ×DSBI	−0.052 * * (−2.03)	−0.066 * * (−2.52)	−0.017 (−0.34)
post_1 ×DSBI	−0.062 * * (−2.39)	−0.071 * * * (−2.82)	−0.025 (−0.49)
post_2 ×DSBI	−0.087 * * (−2.48)	−0.092 * * * (−3.05)	−0.033 (−0.56)
post_3 ×DSBI	−0.058 * (−1.88)	−0.063 * * (−2.19)	−0.028 (−0.36)
post_4 ×DSBI	−0.026 (−1.45)	−0.042 * (−1.81)	−0.003 (−0.18)
GDP	−0.155 * * * (−3.64)	−0.117 * * * (−3.06)	−0.130 * * * (−3.33)
LFD	−0.228 * * * (−3.88)	−0.172 * * * (−3.15)	−0.196 * * * (−3.42)
IIS	−0.046 (−0.94)	−0.085 (−1.11)	0.014 (0.87)
SIZE	0.117 * * * (2.71)	0.129 * * * (3.16)	−0.044 * (−1.66)
IA	−0.041 (−0.95)	−0.025 (−1.01)	0.080 (0.79)
LEV	0.032 (1.43)	0.009 (0.56)	0.013 (1.01)
ROA	0.210 * (1.67)	0.328 * (1.77)	−0.032 (−0.41)
AGE	−0.011 (−0.83)	−0.018 (−0.75)	−0.007 (−0.31)
DUA	0.008 * (1.72)	0.012 * * (2.15)	0.005 * (1.68)
BOAR	−0.123 * * * (−3.17)	−0.133 * * * (−3.26)	−0.116 * * * (−2.47)
LSSR	0.012 (0.78)	0.013 (0.82)	0.007 (0.59)
INST	0.024 * (1.74)	0.051 * * (1.97)	0.009 (1.58)
GS	0.001 (0.84)	0.002 (0.89)	0.001 (0.59)
OWN	0.013 * * (2.33)	0.018 * * * (2.76)	−0.010 * (−1.80)
Constant	0.028 (1.34)	0.014 (1.04)	0.040 * * (2.39)
Ind & Firm	YES	YES	YES
Observations	19380	11628	7752
R-squared	0.436	0.443	0.209

Note: Table 7 shows the results after controlling for the effects of the macroeconomic environment at the regional level. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

6.1. Financial assets investment

In today's situation, where the real economy is weak, and the virtual economy is booming, virtual fields such as finance and real estate can bring more income to enterprises. Driven by profit motive, enterprises will continue to invest funds in shadow banks, thus forming the phenomenon of “financialized” over-investment, which will inevitably crowd out the enterprises' leading business investment, which is not conducive to the firm's sustainable development (Feng et al., 2022). Under the NRCM, shadow banking regulation restricts the inflated returns of shadow banks, raises the investment threshold of shadow banks, and regulates the participating business entities. So, under the influence of banking regulation, enterprises, restrained from over-investing in financial assets, shift their focus to the development of their primary business, which is conducive to the improvement of their investment efficiency and avoidance of firms' “financialization”. To test the mechanism of financial assets investment, by drawing on existing

Table 8
Replacing variable measure.

VARIABLES	(1) INV_EFF1	(2) OVER_INV1	(3) UNDER_INV1
pre_4 ×DSBI1	−0.014 (−0.11)	−0.028 (−0.19)	−0.006 (−0.02)
pre_3 ×DSBI1	−0.051 (−0.25)	−0.065 (−0.47)	−0.012 (−0.10)
pre_2 ×DSBI1	−0.063 (−0.53)	−0.071 (−0.66)	−0.029 (−0.36)
current×DSBI1	−0.084 * * (−2.32)	−0.097 * * * (−2.78)	−0.047 (−0.62)
post_1 ×DSBI1	−0.094 * * * (−2.70)	−0.103 * * * (−3.19)	−0.055 (−0.71)
post_2 ×DSBI1	−0.103 * * * (−2.92)	−0.112 * * * (−3.29)	−0.066 (−0.85)
post_3 ×DSBI1	−0.087 * * (−2.13)	−0.090 * * (−2.45)	−0.058 (−0.61)
post_4 ×DSBI1	−0.050 * (−1.78)	−0.074 * * (−2.11)	−0.019 (−0.43)
SIZE	0.113 * * (2.09)	0.123 * * (2.18)	−0.048 * (−1.67)
IA	−0.044 (−1.07)	−0.009 (−0.37)	0.046 (0.37)
LEV	0.022 (0.95)	0.004 (0.39)	0.014 (0.80)
ROA	0.326 * (1.68)	0.323 * * (2.12)	−0.012 * (−1.66)
AGE	−0.011 (−1.03)	−0.018 (−1.64)	−0.009 (−0.28)
DUA	0.005 * * (1.97)	0.006 * * (2.39)	0.004 * (1.66)
BOAR	−0.130 * * * (−2.81)	−0.155 * * * (−3.31)	−0.084 * * * (−2.59)
LSSR	0.015 (0.39)	0.011 (0.89)	0.026 (0.78)
INST	0.018 (1.08)	0.027 (1.42)	0.102 (0.56)
GS	0.001 (1.02)	0.001 (1.26)	0.008 (0.72)
OWN	0.015 * * (2.37)	0.018 * * (2.55)	−0.011 * (−1.92)
Constant	0.041 (1.34)	0.032 (0.44)	0.053 * * * (3.68)
Ind & Firm	YES	YES	YES
Observations	19380	11628	7752
R-squared	0.362	0.373	0.124

Note: Table 8 shows the results after replacing the variable measure. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

research (Wu and Shen, 2019), we use the ratio of financial assets¹² to total assets to measure the degree of a firm's investment in financial assets FAI.

We conducted cross-sectional tests to verify the mechanism of inhibiting firms' investment in financial assets. In the tests, we divided the sample by the annual median of the industry, which is determined by the extent of firms' investment in financial assets. Table 12 reports the regression results. In particular, columns (1) and (3) are the high financial asset investment sample group, and columns (2) and (4) are the low financial asset investment sample group. In column (1)(2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

It can be seen that the coefficients on the cross-regression terms of *DSBI* with the current period and the next four periods are significantly negative when firms have a high level of investment in financial assets (columns (1) and (3)). By contrast, they are not significant in the sample group with low investment in financial assets (columns (2) and (4)). Meanwhile, the differences in the coefficients between groups are all significant, and the difference in the coefficients between groups is more significant between columns

¹² Financial assets = trading financial assets + derivative financial assets + bought-back financial assets + available-for-sale financial assets + held-to-maturity investments + investment properties + long-term equity investments.

Table 9

Controlling for interaction fixed effects.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
pre_4 ×DSBI	−0.013 (−0.09)	−0.027 (−0.15)	−0.004 (−0.01)
pre_3 ×DSBI	−0.048 (−0.16)	−0.050 (−0.32)	−0.007 (−0.05)
pre_2 ×DSBI	−0.054 (−0.38)	−0.062 (−0.46)	−0.020 (−0.27)
current×DSBI	−0.070 * * (−2.22)	−0.081 * * * (−2.74)	−0.033 (−0.56)
post_1 ×DSBI	−0.083 * * * (−2.63)	−0.095 * * * (−3.02)	−0.047 (−0.63)
post_2 ×DSBI	−0.093 * * * (−2.77)	−0.105 * * * (−3.24)	−0.053 (−0.70)
post_3 ×DSBI	−0.072 * * (−2.01)	−0.084 * * (−2.32)	−0.046 (−0.51)
post_4 ×DSBI	−0.041 * (−1.67)	−0.062 * * (−2.03)	−0.010 (−0.32)
SIZE	0.123 * * * (2.81)	0.154 * * * (2.92)	−0.078 * (−1.70)
IA	−0.049 (−1.21)	−0.025 (−0.96)	0.039 (0.28)
LEV	0.025 (1.08)	0.007 (0.17)	0.084 (0.64)
ROA	0.375 * * (2.45)	0.381 * * * (2.63)	−0.101 (−1.17)
AGE	−0.001 (−1.22)	−0.017 (−0.83)	−0.006 (−0.38)
DUA	0.005 * * (2.03)	0.012 * * (2.36)	0.004 * (1.68)
BOAR	−0.121 * * * (−3.15)	−0.156 * * * (−3.58)	−0.111 * * (−2.47)
LSSR	0.016 (0.41)	0.004 (0.26)	0.055 (0.38)
INST	0.008 (0.42)	0.006 (0.61)	0.004 (0.14)
GS	0.001 (1.21)	0.002 (1.47)	0.004 (1.06)
OWN	0.014 * * (2.22)	0.019 * * * (3.83)	−0.006 * * (−2.08)
Constant	0.033 (1.02)	0.026 (0.52)	0.048 * * * (3.32)
Ind & Firm	YES	YES	YES
Ind × Pro	YES	YES	YES
Observations	19380	11628	7752
R-squared	0.393	0.401	0.153

Note: Table 9 presents the fixed effects results of the model controlling for industry-region interactions. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

(3) and (4) than that between columns (1) and (2). This result confirms the mechanism effect of financial asset investment, indicating that *NRCM* can improve firms' investment efficiency by reducing firms' investment in financial assets, which is mainly achieved by inhibiting firms' over-investment in financial assets. This further verifies that *NRCM* can inhibit the over-investment of enterprises in the financial field, release the crowding out of industrial investment. Resultantly, the part of enterprises' actual investment, which exceeds the optimal investment, can be reduced, and the investment efficiency can be improved.

6.2. Corporate risk

Shadow banking can pose significant risks to investing firms due to high leverage and weak regulation. In this context, firms investing in shadow banking products will undoubtedly increase the probability of investment failure due to their inability to recover the funds in time. The overinvestment in shadow banking will also harm innovation and other industrial investments, triggering a financial crisis. At the same time, due to the complexity of shadow banking operations, which usually involves multiple subjects and sectors, it is easy to exacerbate the risk linkage between investing firms and financial markets, which can also exacerbate corporate risk (Li et al., 2014). The *NRCM*, by prohibiting rigid exchange, “capital pooling” and channel services, can effectively reduce enterprise

Table 10
Balanced panel data test.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
pre_4 ×DSBI	−0.019 (−0.13)	−0.028 (−0.21)	−0.005 (−0.02)
pre_3 ×DSBI	−0.033 (−0.24)	−0.051 (−0.42)	−0.012 (−0.11)
pre_2 ×DSBI	−0.045 (−0.35)	−0.067 (−0.55)	−0.021 (−0.23)
current ×DSBI	−0.106 * * (−2.53)	−0.111 * * * (−3.03)	−0.042 (−0.38)
post_1 ×DSBI	−0.114 * * * (−2.95)	−0.126 * * * (−3.39)	−0.053 (−0.56)
post_2 ×DSBI	−0.128 * * * (−3.14)	−0.133 * * * (−3.53)	−0.066 (−0.88)
post_3 ×DSBI	−0.103 * * (−2.32)	−0.116 * * * (−2.65)	−0.056 (−0.71)
post_4 ×DSBI	−0.077 * * (−1.98)	−0.093 * * (−2.37)	−0.022 (−0.49)
SIZE	0.128 * * * (2.80)	0.148 * * * (2.95)	−0.091 * * (−2.50)
IA	−0.088 (−0.96)	−0.081 (−1.31)	0.028 (0.35)
LEV	0.021 (1.31)	0.014 (1.11)	0.020 (0.69)
ROA	0.127 * * (2.37)	0.146 * * * (2.68)	−0.115 * * (−2.16)
AGE	−0.005 (−1.07)	−0.010 (−0.52)	−0.003 (−0.93)
DUA	0.008 * * (2.07)	0.011 * * (2.41)	0.006 (1.61)
BOAR	−0.123 * * * (−3.34)	−0.142 * * * (−3.49)	−0.106 * * * (−2.71)
LSSR	0.026 (0.51)	0.016 (0.38)	0.031 (0.33)
INST	0.014 * * * (3.08)	0.027 * * (2.28)	0.024 * (1.91)
GS	0.001 (0.87)	0.001 (0.51)	0.004 (1.29)
OWN	0.012 * * * (2.68)	0.004 * * * (3.70)	−0.027 * * (−2.55)
Constant	0.033 (1.27)	0.019 (0.49)	0.143 * * * (4.46)
Ind & Firm	YES	YES	YES
Observations	12114	7260	4854
R-squared	0.380	0.391	0.136

Note: Table 10 presents the regression results using balanced panel data. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

risk and promote the enterprise investment efficiency.

We use the following model to measure enterprise risk:

$$RISK_{it+1} = \vartheta_1 POST \times DSBI_i + \vartheta_2 CONTROL_{it} + \sum YEAR + \sum FIRM + \varepsilon_{it} \quad (13)$$

Among them, *RISK* is the enterprise investment risk, defined as the termination or failure of enterprise investment, indicating its inability to achieve the expected economic objectives. *RISK* can be used to judge whether the investment expenditure can improve business performance: if the difference between the growth rate of investment expenditure and the growth rate of net profit in the latter period is greater than 0, it means that the enterprise investment risk is higher, taking the value of 1, otherwise it means that the enterprise investment risk is lower, taking the value of 0.

Next, we conducted a cross-sectional test to examine the mechanism of the role of corporate risk by dividing the sample according to the annual median of the industry. Table 13 reports the regression results. In particular, (1) and (3) are classified as sample groups with high levels of corporate risk, and (2) and (4) are classified as sample groups with low levels of corporate risk. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

Table 11

Panel data with policy current period removed.

VARIABLES	(1) INV_EFF	(2) OVER_INV	(3) UNDER_INV
pre_4 ×DSBI	−0.013 (−0.10)	−0.027 (−0.18)	−0.005 (−0.01)
pre_3 ×DSBI	−0.052 (−0.21)	−0.064 (−0.36)	−0.009 (−0.10)
pre_2 ×DSBI	−0.060 (−0.49)	−0.071 (−0.62)	−0.026 (−0.32)
pre_1 ×DSBI	−0.075 (−0.64)	−0.090 (−0.83)	−0.038 (−0.45)
post_1 ×DSBI	−0.091 * ** (−2.70)	−0.105 * ** (−3.10)	−0.051 (−0.64)
post_2 ×DSBI	−0.102 * ** (−2.81)	−0.112 * ** (−3.28)	−0.062 (−0.76)
post_3 ×DSBI	−0.075 * * (−2.03)	−0.085 * * (−2.32)	−0.049 (−0.57)
post_4 ×DSBI	−0.045 * (−1.68)	−0.065 * * (−2.03)	−0.013 (−0.33)
SIZE	0.139 * ** (2.97)	0.154 * ** (3.07)	−0.088 * * (−2.43)
IA	−0.036 (−0.24)	−0.014 (−0.78)	0.095 (1.34)
LEV	0.028 (1.16)	0.018 (1.39)	0.039 (0.55)
ROA	0.252 * * (2.01)	0.338 * * (2.54)	−0.207 * (−1.74)
AGE	−0.017 (−1.18)	−0.023 (−0.73)	−0.012 (−0.89)
DUA	0.012 * * (2.19)	0.013 * ** (2.60)	0.008 * (1.74)
BOAR	−0.136 * ** (−3.45)	−0.152 * ** (−3.52)	−0.114 * ** (−3.33)
LSSR	0.030 (0.89)	0.037 (1.49)	0.052 (0.45)
INST	0.012 (1.14)	0.007 (0.82)	0.018 (1.40)
GS	0.001 (1.04)	0.001 (1.16)	0.003 (1.07)
OWN	0.018 * ** (2.79)	0.009 * ** (3.82)	−0.022 * * (−2.47)
Constant	0.036 (1.17)	0.028 (0.64)	0.050 * ** (3.41)
Ind & Firm	YES	YES	YES
Observations	17422	10640	6782
R-squared	0.368	0.380	0.130

Note: Table 11 shows the results of the panel data regression after removing the current policy period. In Columns (1)–(3), the dependent variables are the measure of investment efficiency (INV_EFF), overinvestment (OVER_INV), and underinvestment (UNDER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

It can be seen that the coefficients on the cross-regression terms of the *DSBI* with the current period and the next four periods are significantly negative when the level of firm risk is high (columns (1) and (3)). By contrast, they are not significant in the low sample group (columns (2) and (4)). Meanwhile, the differences in the coefficients between the groups are all significant, and the difference in the coefficients between the groups is more significant between columns (3) and (4) than between columns (1) and (2). This result confirms the mechanism effect of firm risk and suggests that *NRCM* can improve investment efficiency by reducing firm risk, especially by suppressing the risk level of overinvested firms. In a low-risk environment, the management shows a higher failure tolerance and a higher expectation of the probability of success of the investment project, indicating its high tendency to seize the investment opportunity and improve the investment efficiency.

6.3. Agency cost

The separation of business operation and firm ownership can give rise to agency problems. Management, as the business decision maker of the firm, has an absolute information advantage, which can easily lead to the deviation of management from the goal of maximizing firm value (Yu and Xiao, 2022). The high investment returns of shadow banks tend to intensify management's opportunistic behavior, i.e., management keeps making shadow bank investments primarily serving private gain, which is detrimental to

Table 12
Financial asset investment mechanism test.

	High financial asset investment (1)	Low financial asset investment (2)	High financial asset investment (3)	Low financial asset investment (4)
VARIABLES	INV_EFF	INV_EFF	OVER_INV	OVER_INV
pre_4 ×DSBI	−0.042 (−0.36)	−0.007 (−0.03)	−0.057 (−0.46)	−0.010 (−0.07)
pre_3 ×DSBI	−0.083 (−0.52)	−0.018 (−0.08)	−0.093 (−0.80)	−0.026 (−0.22)
pre_2 ×DSBI	−0.094 (−0.85)	−0.019 (−0.28)	−0.103 (−0.93)	−0.039 (−0.47)
current×DSBI	−0.113 *** (−2.61)	−0.066 (−0.34)	−0.121 ** (−3.25)	−0.055 (−0.61)
post_1 ×DSBI	−0.123 *** (−3.25)	−0.054 (−0.41)	−0.133 *** (−3.55)	−0.061 (−0.77)
post_2 ×DSBI	−0.133 *** (−3.43)	−0.071 (−0.66)	−0.146 *** (−3.79)	−0.082 (−0.92)
post_3 ×DSBI	−0.111 ** (−2.44)	−0.053 (−0.38)	−0.120 ** (−2.52)	−0.047 (−0.55)
post_4 ×DSBI	−0.080 ** (−2.02)	−0.027 (−0.13)	−0.105 ** (−2.43)	−0.054 (−0.26)
SIZE	0.096 ** (2.21)	0.128 ** (2.45)	0.109 ** (2.12)	0.132 *** (2.68)
IA	−0.054 (−1.07)	−0.137 (−1.43)	−0.030 (−1.02)	−0.060 (−1.18)
LEV	0.021 (0.92)	0.059 (1.27)	0.002 (0.17)	0.008 (1.00)
ROA	0.114 ** (2.12)	0.147 ** (2.55)	0.097 ** (2.27)	0.066 *** (2.66)
AGE	−0.009 (−0.44)	−0.189 (−1.17)	−0.017 (−0.48)	−0.031 (−0.60)
DUA	0.006 * (1.67)	0.010 * (1.86)	0.004 ** (2.04)	0.008 ** (2.47)
BOAR	−0.064 ** (−2.21)	−0.123 *** (−3.04)	−0.081 *** (−2.81)	−0.140 *** (−3.39)
LSSR	0.010 (0.29)	0.070 (0.52)	0.014 (0.32)	0.024 (0.92)
INST	0.008 * (1.72)	0.015 *** (2.87)	0.016 * (1.95)	0.027 ** (2.20)
GS	0.001 (0.36)	0.003 (0.48)	0.001 (0.51)	0.003 (0.97)
OWN	0.006 ** (2.12)	0.012 ** (2.42)	0.004 *** (3.27)	0.007 *** (3.58)
Constant	0.030 (0.87)	0.142 *** (4.06)	0.031 (0.28)	0.134 *** (3.47)
Ind & Firm	YES	YES	YES	YES
Observations	10170	9210	6612	5016
R-squared	0.369	0.132	0.403	0.138
suest coefficients	0.0005		0.0003	

Note: Table 12 demonstrates the results of the mechanism test for financial asset investment. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of other variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

both industrial development and the long-term value of the firm (Schmid et al., 2019; Davis, 2017). This can also trigger conflicts between shareholders and management, consequently increasing agency costs. To solve this problem of management opportunistic investment, the NRCM, by limiting the high returns of shadow banking and regulating all aspects of the subjects involved in shadow banking, has effectively broken the information advantage of the management and reduced agency costs, thus enhancing the firm's investment efficiency.

For the measurement of agency cost, we use the selling and administrative expense ratio to measure the agency cost AC, which is calculated as (selling expense + administrative expense)/operating revenue, and a larger value indicates a higher agency cost. We conducted cross-sectional tests to examine the mechanism of agency cost action by dividing the sample of firms' agency costs by the annual median of the industry. Table 14 reports the regression results. Columns (1) and (3) are the high firm risk level sample group and columns (2) and (4) are the low firm risk level sample group. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

It can be seen that the coefficients on the cross-regression terms of the *DSBI* with the current period and the next four periods are significantly negative when firms' agency costs are high (columns (1) and (3)), but they are not significant in the low-sample group (columns (2) and (4)). Meanwhile, the differences in the coefficients between groups are all significant, and the difference in the

Table 13
Corporate risk mechanism test.

	High corporate risk level	Low corporate risk level	High corporate risk level	Low corporate risk level
	(1)	(2)	(3)	(4)
VARIABLES	INV_EFF	INV_EFF	OVER_INV	OVER_INV
pre_4 ×DSBI	−0.035 (−0.22)	−0.009 (−0.05)	−0.048 (−0.33)	−0.014 (−0.11)
pre_3 ×DSBI	−0.070 (−0.44)	−0.023 (−0.12)	−0.086 (−0.71)	−0.030 (−0.29)
pre_2 ×DSBI	−0.081 (−0.73)	−0.038 (−0.34)	−0.097 (−0.86)	−0.045 (−0.51)
current×DSBI	−0.108 * * (−2.55)	−0.050 (−0.47)	−0.116 * * * (−3.11)	−0.069 (−0.76)
post_1 ×DSBI	−0.112 * * * (−2.93)	−0.066 (−0.56)	−0.124 * * * (−3.41)	−0.079 (−0.85)
post_2 ×DSBI	−0.122 * * * (−3.18)	−0.079 (−0.70)	−0.134 * * * (−3.63)	−0.093 (−1.00)
post_3 ×DSBI	−0.106 * * (−2.39)	−0.042 (−0.41)	−0.111 * * * (−2.67)	−0.055 (−0.63)
post_4 ×DSBI	−0.072 * (−1.94)	−0.033 (−0.24)	−0.096 * * (−2.52)	−0.040 (−0.37)
SIZE	0.081 * * (2.28)	0.103 * * (2.56)	0.097 * * * (2.75)	0.132 * * * (3.16)
IA	−0.034 (−1.03)	−0.047 (−1.22)	−0.023 (−0.75)	−0.047 (−1.42)
LEV	0.010 (0.10)	0.016 (0.79)	0.002 (0.11)	0.021 (1.05)
ROA	0.092 * * (2.01)	0.115 * * (2.47)	0.107 * * (2.19)	0.118 * * (2.57)
AGE	−0.001 (−0.43)	−0.009 (−1.06)	−0.002 (−0.42)	−0.015 (−1.28)
DUA	0.004 * (1.76)	0.007 * * (1.98)	0.005 * (1.74)	0.010 * * (2.31)
BOAR	−0.050 * (−1.75)	−0.103 * * * (−2.87)	−0.103 * * * (−2.91)	−0.136 * * * (−3.26)
LSSR	0.014 (0.31)	0.010 (0.80)	0.004 (0.51)	0.021 (0.73)
INST	0.012 * * (2.54)	0.017 * * * (2.85)	0.023 * (1.78)	0.031 * * (2.19)
GS	0.001 (0.37)	0.001 (0.58)	0.001 (0.80)	0.001 (0.92)
OWN	0.011 * (1.83)	0.016 * * (2.14)	0.004 (0.34)	0.015 * * * (3.95)
Constant	0.034 (1.01)	0.136 * * * (3.89)	0.025 (0.34)	0.125 * * * (3.36)
Ind & Firm	YES	YES	YES	YES
Observations	9938	9442	6226	5402
R-squared	0.364	0.137	0.378	0.143
suest coefficients	0.0017		0.0014	

Note: Table 13 demonstrates the results of the mechanism test for corporate risk. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of other variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

coefficients between groups is more significant between columns (3) and (4) than between columns (1) and (2). This result validates the mechanism effect of agency costs. It suggests that *NRCM* can improve the efficiency of corporate investment by reducing the agency costs of firms, especially by suppressing the agency costs of overinvested firms. Under *NRCM* regulation, management should give up the information advantage and restrain self-interested behavior on the one hand, and consider the optimal investment level on the other hand, so as to reduce the agency cost and improve the investment efficiency.

7. Group testing

To further examine the differences in the impact of shadow banking regulation on firms' investment efficiency in different firm samples, we extend our findings by conducting heterogeneity tests in terms of both individual firm characteristics and the external macro environment, respectively.

Table 14
Agency cost mechanism test.

	High agency cost (1)	Low agency cost (2)	High agency cost (3)	Low agency cost (4)
VARIABLES	INV_EFF	INV_EFF	OVER_INV	OVER_INV
pre_4 ×DSBI	−0.030 (−0.17)	−0.011 (−0.09)	−0.040 (−0.26)	−0.021 (−0.23)
pre_3 ×DSBI	−0.066 (−0.38)	−0.029 (−0.17)	−0.079 (−0.65)	−0.038 (−0.37)
pre_2 ×DSBI	−0.075 (−0.68)	−0.042 (−0.40)	−0.091 (−0.73)	−0.057 (−0.60)
current×DSBI	−0.097 * * (−2.41)	−0.056 (−0.59)	−0.105 * * * (−3.04)	−0.076 (−0.87)
post_1 ×DSBI	−0.107 * * * (−2.83)	−0.073 (−0.64)	−0.112 * * * (−3.36)	−0.084 (−0.98)
post_2 ×DSBI	−0.115 * * * (−3.07)	−0.084 (−0.78)	−0.129 * * * (−3.54)	−0.104 (−1.18)
post_3 ×DSBI	−0.099 * * (−2.21)	−0.052 (−0.59)	−0.103 * * * (−2.59)	−0.060 (−0.71)
post_4 ×DSBI	−0.068 * (−1.81)	−0.040 (−0.32)	−0.085 * * (−2.45)	−0.056 (−0.49)
SIZE	0.090 * (1.84)	0.124 * * (2.17)	0.109 * (1.78)	0.123 * * (2.53)
IA	−0.013 (−0.62)	−0.053 (−0.92)	−0.049 (−1.02)	−0.078 (−1.23)
LEV	0.008 (0.28)	0.022 (1.00)	0.006 (0.14)	0.013 (0.87)
ROA	0.104 * (1.75)	0.116 * * (2.24)	0.089 * * (2.19)	0.137 * * (2.54)
AGE	−0.003 (−0.32)	−0.011 (−1.22)	−0.008 (−0.49)	−0.014 (−0.63)
DUA	0.006 * (1.66)	0.008 * (1.91)	0.006 * * (1.97)	0.009 * * (2.15)
BOAR	−0.078 * * (−2.02)	−0.119 * * * (−3.10)	−0.109 * * (−2.46)	−0.138 * * * (−3.29)
LSSR	0.010 (0.55)	0.020 (0.67)	0.018 (0.74)	0.029 (1.24)
INST	0.011 * (1.78)	0.018 * * * (2.86)	0.034 * (1.85)	0.049 * * (2.25)
GS	0.001 (0.46)	0.003 (0.92)	0.001 (0.21)	0.003 (0.81)
OWN	0.009 * * (2.28)	0.012 * * (2.54)	0.022 (0.30)	0.129 * * * (3.66)
Constant	0.038 (1.15)	0.131 * * * (3.71)	0.029 (0.45)	0.128 * * * (3.58)
Ind & Firm	YES	YES	YES	YES
Observations	9916	9464	6208	5420
R-squared	0.360	0.140	0.374	0.145
suest coefficients	0.0019		0.0016	

Note: Table 14 presents the results of the mechanism test for agency cost. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of other variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

7.1. Individual corporate characteristics

7.1.1. Nature of ownership

The nature of ownership is unique to Chinese firms. Depending on the nature of ownership, listed firms can be divided into state-owned enterprises (SOEs) and private enterprises. Due to financial constraints, credit discrimination, and underdeveloped capital markets, private firms need help to obtain sufficient funds from traditional sources and are often faced with severe financing constraints (Zhu, 2021; Huang et al., 2020). In contrast, the existence of soft budget constraints and implicit government guarantees makes it easier for SOEs, especially large SOEs, to obtain government subsidies and credit resources (Chen et al., 2021; Du, 2021) and to obtain more longer-period credit funds at lower costs. Furthermore, to SOEs, the funds incorporated often exceed the needs of daily production and operation, thus accumulating a large number of pending investment funds. In the current environment of low real investment incentives and high returns on financial assets, SOEs are more likely to invest in shadow banking based on the motive of “regulatory arbitrage”, and consequently squeeze out industrial investment projects involving innovation. In addition, due to the profound “insider control” problem of SOEs (Ren and Shao, 2022; Li et al., 2008), investing in shadow banking intensifies moral hazard and opportunistic behavior of management, which gets indulged in speculative financial arbitrage for private gains and abandons

industrial projects. Therefore, regarding shadow banking investment subjects, compared with their private counterparts, SOEs depend more on shadow banking investment. The *NRCM* strictly limits the high returns of shadow banks, which will further inhibit these SOEs from continuously investing their funds in shadow banks. Under the *NRCM*, we believe that state-owned enterprises have a higher reliance on shadow banking investment than private enterprises, so they will be more likely inhibited from investing in financial assets and reducing agency costs, thus improving investment efficiency.

In order to test the difference in the change of investment efficiency of enterprises with different property rights nature under the *NRCM*, we divide the samples into two groups, i.e., state-owned enterprises and private enterprises, based on the property rights nature *OWN*. Table 15 shows the heterogeneity test results based on the nature of property rights. Among them, columns (1) and (3) are the sample group of state-owned enterprises, and columns (2) and (4) are the sample group of private enterprises. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

The results in columns (1) to (4) show that the regression coefficients of the *DSBI* with the cross-multiplier terms for the current and next 4 periods of the policy are significant only in the group of state-owned enterprises. In contrast, the between-group difference test *suest* coefficients are significant at the 1 % level (0.0006 and 0.0004). It indicates that among the shadow banking investment subjects, the *NRCM* is more likely to enhance the investment efficiency of SOEs than private enterprises. This implies that SOEs are more likely to be influenced by the *NRCM* in terms of investment, more likely to reduce over-investment in financial assets, and more likely to reduce agency costs, thus reaching the goal of promoting investment efficiency.

Table 15
Ownership nature grouping test.

VARIABLES	state-owned enterprises (1) INV_EFF	Private enterprises (2) INV_EFF	state-owned enterprises (3) OVER_INV	Private enterprises (4) OVER_INV
pre_4 × DSBI	−0.037 (−0.22)	−0.008 (−0.06)	−0.048 (−0.30)	−0.018 (−0.17)
pre_3 × DSBI	−0.069 (−0.43)	−0.025 (−0.13)	−0.083 (−0.72)	−0.032 (−0.30)
pre_2 × DSBI	−0.080 (−0.71)	−0.038 (−0.32)	−0.097 (−0.89)	−0.052 (−0.56)
current × DSBI	−0.103 * * (−2.54)	−0.051 (−0.50)	−0.111 * * * (−3.14)	−0.066 (−0.80)
post_1 × DSBI	−0.111 * * * (−2.95)	−0.064 (−0.55)	−0.120 * * * (−3.40)	−0.080 (−0.90)
post_2 × DSBI	−0.119 * * * (−3.11)	−0.079 (−0.86)	−0.132 * * * (−3.63)	−0.097 (−1.06)
post_3 × DSBI	−0.103 * * (−2.30)	−0.047 (−0.44)	−0.110 * * * (−2.64)	−0.055 (−0.66)
post_4 × DSBI	−0.074 * (−1.90)	−0.034 (−0.28)	−0.093 * * (−2.53)	−0.049 (−0.41)
SIZE	0.118 * * (2.25)	0.132 * * * (2.90)	0.092 * (1.88)	0.133 * * * (2.72)
IA	−0.033 (−0.51)	−0.069 (−0.94)	−0.007 (−0.43)	−0.047 (−0.82)
LEV	0.014 (0.27)	0.018 (0.84)	0.004 (0.11)	0.011 (1.09)
ROA	0.080 (1.52)	0.151 * * * (2.93)	0.089 * (1.66)	0.137 * * (2.43)
AGE	−0.007 (−0.19)	−0.013 (−1.02)	−0.011 (−0.21)	−0.016 (−1.45)
DUA	0.006 * (1.86)	0.010 * (2.38)	0.005 * (1.69)	0.010 * * (2.44)
BOAR	−0.110 * * (−2.54)	−0.136 * * * (−3.24)	−0.104 * * * (−2.63)	−0.141 * * * (−3.36)
LSSR	0.006 (0.15)	0.015 (0.68)	0.002 (0.06)	0.013 (0.61)
INST	0.015 * * (2.21)	0.020 * * * (2.98)	0.020 * * (2.06)	0.030 * * (2.26)
GS	0.001 (0.30)	0.001 (0.63)	0.001 (0.74)	0.004 (0.94)
Constant	0.065 (1.49)	0.166 * * * (4.99)	0.044 (0.93)	0.157 * * * (3.98)
Ind & Firm	YES	YES	YES	YES
Observations	7788	11592	4672	6956
R-squared	0.350	0.131	0.365	0.136
suest coefficients	0.0006		0.0004	

Note: Table 15 shows the results of the ownership nature grouping test. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (*INV_EFF*), and overinvestment (*OVER_INV*), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

7.1.2. Innovation intensity

In today's world of increasing technological innovation, innovation is the cornerstone of innovation-intensive firms' survival and development. The more innovation-intensive a firm is, the more likely innovation activities become a daily necessity, and the more the firm focuses on investing in R&D capital and personnel and less on virtual sector investments such as finance and real estate (Su and Liu, 2021). Even if the firm is involved in these investments, it is motivated mainly by "precautionary savings", smoothing out the risk of investment in fixed assets such as machinery and plants needed for corporate innovation, with the ultimate goal of promoting development through innovation (Xuezhong and Zhen, 2021). By contrast, the less innovation-intensive enterprises have more possibilities to diversify their investment in the financial sector. They are more likely to be driven by high returns to invest in shadow banking, which is considered as a means of "regulatory arbitrage" to gain market position. Therefore, compared with high innovation-intensive enterprises, low innovation-intensive enterprises rely more on shadow banking investment, resulting in industrial projects being continuously encroached upon by financialization. Under the *NRCM*, the high leverage of shadow banks is greatly restricted, and the participants are strictly regulated, which inhibits the financialization of low-innovation-intensive enterprises, enhances the risk-taking level, reduces agency costs, and thus improves the efficiency of investment.

To test the differences in investment efficiency changes of firms with different innovation intensities under the *NRCM*, we group firms according to their intangible assets *IA*, with higher values indicating higher innovation intensities. When *IA* is higher than the median of the sample industry year, it is classified as high innovation intensity group. Otherwise, it is classified as a low innovation intensity group. In addition, since *IA* is a control variable in the existing model, we exclude it from this grouping regression. Table 16 shows the results of the heterogeneity test based on innovation intensity. Among them, columns (1) and (3) are the high innovation intensity group, and columns (2) and (4) are the low innovation intensity group. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

The results in columns (1) to (4) show that the regression coefficients of the *DSBI* with the cross-multiplier terms for the current and next 4 periods of the policy are significant only in the low innovation intensity group. In contrast, the between-group difference test *suest* coefficients are significant at the 1 % level (0.0012 and 0.0009). It indicates that among the shadow banking investment subjects, the *NRCM* is more likely to enhance the investment efficiency of firms with low innovation intensity than those with high innovation intensity. This implies that in terms of shadow banking investment, the *NRCM*, shadow banking regulation is more likely to reduce the high profitability channels of low innovation-intensive enterprises, which impels them to focus on industry, reduce agency costs, improve corporate risk-taking, and ultimately promote investment efficiency.

7.1.3. Governance level

Generally, a firm has a tripartite system of checks and balances among the various internal entities through the respective inter-constraint regulating mechanisms executed by shareholders' meeting, the board of directors, and the supervisory board. Regarding the distribution of check-and-balance duties, shareholders have the right to monitor and make decisions on significant events; the board of directors has constructed a system of independent directors and special committees; and the supervisory board exercises monitoring and inspection rights. So, the setting up of the tripartite system can effectively reduce the possibility of management short-sightedness, monitor and inhibit opportunistic management behavior (Saona et al., 2020; Talbi et al., 2015). When the level of corporate governance is low, corporate investment in shadow banking is likely to exacerbate management's short-sightedness and opportunistic behavior. Consequently, the management is prone to choose high-yielding financial investments to cope with short-term performance assessment pressure, thus crowding out industrial projects, which is not conducive to long-term corporate development (Gong et al., 2023; Jin and Mai, 2022). At the same time, the lack of government endorsement and the complexity of shadow banking operations also exacerbate the information asymmetry between investors and issuers, further raising the risk of corporate investment. Therefore, the lower level of corporate governance is, the more likely its management will abandon innovative projects for short-term performance and avoid risk overlapping when facing high risks of shadow banking investments. The *NRCM*, as a solid regulatory policy, restricts the high leverage of shadow banks and comprehensively supervises the participants of shadow banks, which can strengthen the governance capacity of enterprises with low governance level from the outside, inhibit the "regulatory arbitrage" motive of management to invest in shadow banks, and reduce agency costs. In addition, the policy also requires detailed product information disclosure and the provision of relevant market analysis and risk-return calculation reports to minimize the investment risks of low-governance enterprises and enhance their risk-taking level, thereby promoting investment efficiency.

In order to examine the differences in innovation changes among firms with different levels of governance under the *NRCM*, we selected several factors affecting corporate governance to conduct a principal component analysis. We applied the first principal component¹³ to measure the ICG of corporate governance level, with larger values indicating higher levels of corporate governance. When the ICG is higher than the median of the sample industry year, it is classified as a high governance group. Otherwise, it is classified as a low governance group. Table 17 shows the grouping test results based on the level of governance. Among them, columns (1) and (3) are high governance level groups and columns (2) and (4) are low governance level groups. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

The results in columns (1) to (4) show that the regression coefficients of the *DSBI* with the cross-multiplier terms for the current and next 4 periods of the policy are significant in the low governance level group, in which the between-group difference test *suest*

¹³ The selected factors are two concurrent positions, size of the board of directors, proportion of independent directors, proportion of management shareholding, proportion of the first largest shareholder's shareholding, proportion of institutional shareholding, number of supervisory board meetings, and nature of ownership.

Table 16
Innovation intensity grouping test.

	High innovation intensity (1)	Low innovation intensity (2)	High innovation intensity (3)	Low innovation intensity (4)
pre_4 ×DSBI VARIABLES	INV_EFF	INV_EFF	OVER_INV	OVER_INV
pre_4 ×DSBI	−0.010 (−0.07)	−0.034 (−0.29)	−0.012 (−0.10)	−0.046 (−0.39)
pre_3 ×DSBI	−0.020 (−0.13)	−0.075 (−0.46)	−0.029 (−0.26)	−0.088 (−0.76)
pre_2 ×DSBI	−0.024 (−0.33)	−0.083 (−0.77)	−0.042 (−0.55)	−0.095 (−0.85)
current×DSBI	−0.073 (−0.42)	−0.101 ** (−2.52)	−0.065 (−0.67)	−0.116 ** (−3.17)
post_1 ×DSBI	−0.066 (−0.57)	−0.118 *** (−3.16)	−0.070 (−0.83)	−0.120 *** (−3.40)
post_2 ×DSBI	−0.085 (−0.75)	−0.104 *** (−3.38)	−0.094 (−1.08)	−0.139 *** (−3.63)
post_3 ×DSBI	−0.065 (−0.46)	−0.106 ** (−2.33)	−0.057 (−0.64)	−0.191 ** (−2.46)
post_4 ×DSBI	−0.032 (−0.25)	−0.074 * (−1.93)	−0.062 (−0.35)	−0.092 ** (−2.31)
SIZE	0.123 ** (2.05)	0.100 * (1.72)	0.109 *** (2.64)	0.043 * (1.70)
LEV	0.026 (0.79)	0.021 (0.56)	0.012 (1.10)	0.006 (0.52)
ROA	0.132 ** (2.39)	0.082 ** (1.98)	0.134 ** (2.38)	0.083 * (1.93)
AGE	−0.015 (−0.79)	−0.011 (−0.34)	−0.017 (−0.44)	−0.012 (−0.36)
DUA	0.011 ** (2.51)	0.006 * (1.83)	0.009 ** (2.33)	0.005 ** (2.06)
BOAR	−0.115 *** (−3.26)	−0.102 *** (−2.91)	−0.136 *** (−2.83)	−0.112 *** (−2.50)
LSSR	0.024 (1.11)	0.018 (0.10)	0.022 (1.16)	0.016 (0.59)
INST	0.018 *** (2.92)	0.012 * (1.71)	0.023 ** (2.26)	0.014 * (1.83)
GS	0.001 (0.39)	0.001 (0.23)	0.001 (1.03)	0.001 (0.71)
OWN	0.017 *** (2.68)	0.011 ** (1.97)	0.007 *** (3.27)	0.004 * (2.50)
Constant	0.133 *** (3.78)	0.036 (1.11)	0.129 *** (3.66)	0.030 (0.31)
Ind & Firm	YES	YES	YES	YES
Observations	9546	9834	5728	5900
R-squared	0.138	0.358	0.144	0.377
suest coefficients	0.0012		0.0009	

Note: Table 16 shows the results of the innovation intensity grouping test. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

coefficients are 0.0023 and 0.0020, respectively. It indicates that shadow banking regulation is more effective in promoting the investment efficiency of low governance level firms than that of high governance level firms. This also implies that the *NRCM* is more capable of playing an external supervisory role for firms with low governance level, helping to curb management opportunistic behavior and reduce corporate agency costs; while for firms with a high governance level, under the regulation of the *NRCM*, the disclosure of shadow banking business is more transparent, and the operation is more standardized. In addition, the results also show the governance effects of the *NRCM* as a solid financial regulation policy at the micro level.

7.2. External macro environment

7.2.1. Product market competition

As an essential external governance mechanism, product market competition can exert competitive eliminating and benchmarking effects to monitor management and reduce its opportunistic behavior effectively (Ryou et al., 2022). According to the competition sufficient information comparison hypothesis (Shleifer, 1985), the competition provides stakeholders such as shareholders, with the opportunity to compare the performances of rival firms, so as to reduce the degree of information asymmetry between firms and various stakeholders, which is conducive to the full disclosure of management's operating ability and effort. From the analysis of shadow banking investment subjects, the more competitive the product market is, the more likely management will prioritize

Table 17
Governance level grouping test.

VARIABLES	High governance level (1) INV_EFF	Low governance level (2) INV_EFF	High governance level (3) OVER_INV	Low governance level (4) OVER_INV
pre_4 ×DSBI	−0.007 (−0.06)	−0.033 (−0.21)	−0.018 (−0.19)	−0.044 (−0.30)
pre_3 ×DSBI	−0.026 (−0.13)	−0.070 (−0.43)	−0.035 (−0.31)	−0.083 (−0.71)
pre_2 ×DSBI	−0.038 (−0.35)	−0.079 (−0.75)	−0.052 (−0.53)	−0.096 (−0.81)
current×DSBI	−0.052 (−0.50)	−0.103 * (−2.54)	−0.072 (−0.80)	−0.110 * (−3.17)
post_1 ×DSBI	−0.069 (−0.58)	−0.099 * (−2.90)	−0.079 (−0.92)	−0.117 * (−3.45)
post_2 ×DSBI	−0.080 (−0.71)	−0.120 * (−3.14)	−0.100 (−1.11)	−0.133 * (−3.60)
post_3 ×DSBI	−0.049 (−0.52)	−0.103 * (−2.30)	−0.052 (−0.64)	−0.108 * (−2.63)
post_4 ×DSBI	−0.036 (−0.26)	−0.071 * (−1.88)	−0.048 (−0.40)	−0.091 * (−2.43)
SIZE	0.123 * (2.85)	0.102 * (2.39)	0.121 * (2.63)	0.042 * (1.74)
IA	−0.064 (−1.13)	−0.054 (−0.77)	−0.058 (−0.94)	−0.027 (−0.16)
LEV	0.047 (1.46)	0.001 (0.03)	0.014 (1.01)	0.007 (0.82)
ROA	0.118 * (2.16)	0.100 * (1.95)	0.131 * (2.47)	0.086 (1.45)
AGE	−0.011 (−1.05)	−0.002 (−0.27)	−0.019 (−0.56)	−0.011 (−0.31)
DUA	0.009 * (2.17)	0.006 * (1.75)	0.004 * (2.41)	0.003 * (1.72)
BOAR	−0.118 * (−3.22)	−0.096 * (−2.65)	−0.119 * (−3.11)	−0.088 * (−2.68)
LSSR	0.024 * (2.74)	0.010 * (2.16)	0.030 * (2.28)	0.016 * (1.91)
INST	0.014 * (2.94)	0.010 * (2.39)	0.034 * (2.19)	0.028 * (1.67)
GS	0.002 (1.21)	0.001 (0.41)	0.004 (0.71)	0.001 (0.33)
OWN	0.014 * (2.44)	0.008 * (2.08)	0.006 * (3.48)	0.003 * (2.71)
Constant	0.134 * (3.83)	0.038 (1.22)	0.127 * (3.57)	0.033 (0.42)
Ind & Firm	YES	YES	YES	YES
Observations	9680	9700	5808	5820
R-squared	0.136	0.356	0.146	0.380
suest coefficients	0.0023		0.0020	

Note: Table 17 shows the results of the governance level grouping test. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

long-term development of the firm and reduce opportunistic behavior of investing in shadow banking (Firk et al., 2021; Yung, 2022). For firms with low product market competition, in an environment of information opacity and inadequate sufficient supervision, management is more likely to develop opportunistic behavior and invest in shadow banking for “regulatory arbitrage”, consequently resulting in overinvestment. Therefore, the less competitive the product market is, the more likely firms would invest in shadow banking for speculative purposes, thus reducing their investment efficiency. The NRCM insists on the combination of macro-prudential management and micro-prudential regulation, emphasizes the identification of final investors upwards and underlying assets downwards, and strengthens the external governance environment to better influence enterprises with low product market competition, so as to avoid their financialization, reduce agency costs, improve the risk-taking level, and ultimately promote investment efficiency.

In order to test the differences in investment efficiency changes of enterprises with different product market competition levels under the NRCM, this paper selects the Herfindahl-Hirschman Index (HHI) to measure the product market competition level PMC. It is found that the higher the value indicates, the lower the product market competition level is. When the PMC is lower than the median of the sample industry year, it is categorized as the low-product market competition group. Otherwise, it is categorized as the high governance level group. Table 18 shows the heterogeneity test results based on product market grouping. Among them, columns (1)

Table 18
Product market competition grouping test.

VARIABLES	High product market competition (1) INV_EFF	Low product market competition (2) INV_EFF	High product market competition (3) OVER_INV	Low product market competition (4) OVER_INV
pre_4 × DSBI	−0.014 (−0.13)	−0.026 (−0.12)	−0.025 (−0.29)	−0.038 (−0.21)
pre_3 × DSBI	−0.032 (−0.25)	−0.060 (−0.30)	−0.046 (−0.48)	−0.072 (−0.58)
pre_2 × DSBI	−0.056 (−0.50)	−0.069 (−0.59)	−0.064 (−0.77)	−0.083 (−0.88)
current × DSBI	−0.067 (−0.70)	−0.091 * (−2.33)	−0.088 (−0.98)	−0.097 * (−2.96)
post_1 × DSBI	−0.086 (−0.78)	−0.099 * (−2.71)	−0.090 (−1.16)	−0.106 * (−3.28)
post_2 × DSBI	−0.097 (−0.84)	−0.108 * (−2.94)	−0.117 (−1.26)	−0.120 * (−3.43)
post_3 × DSBI	−0.061 (−0.72)	−0.082 * (−2.15)	−0.078 (−0.89)	−0.094 * (−2.44)
post_4 × DSBI	−0.048 (−0.49)	−0.059 * (−1.73)	−0.064 (−0.53)	−0.072 * (−2.20)
SIZE	0.116 * (2.62)	0.102 * (2.05)	0.133 * (2.60)	0.119 * (2.36)
IA	−0.067 (−0.84)	−0.048 (−0.63)	−0.086 (−1.41)	−0.077 (−0.52)
LEV	0.010 (0.86)	0.007 (0.52)	0.013 (1.04)	0.008 (0.80)
ROA	0.109 * (2.03)	0.086 * (1.66)	0.132 * (2.25)	0.103 * (1.93)
AGE	−0.007 (−0.84)	−0.004 (−0.38)	−0.013 (−1.10)	−0.008 (−0.26)
DUA	0.009 * (2.04)	0.006 * (1.83)	0.010 * (2.17)	0.003 * (1.92)
BOAR	−0.121 * (−3.33)	−0.119 * (−3.18)	−0.120 * (−3.07)	−0.103 * (−2.83)
LSSR	0.026 (0.64)	0.019 (0.42)	0.028 (0.83)	0.010 (0.30)
INST	0.017 * (2.70)	0.010 * (1.66)	0.022 * (2.26)	0.017 * (1.90)
GS	0.001 (0.81)	0.001 (0.42)	0.002 (0.87)	0.001 (0.57)
OWN	0.014 * (2.86)	0.011 * (2.34)	0.006 * (3.06)	0.003 * (2.89)
Constant	0.130 * (3.75)	0.047 (1.40)	0.125 * (3.47)	0.042 (0.61)
Ind & Firm	YES	YES	YES	YES
Observations	9750	9630	5850	5778
R-squared	0.137	0.354	0.148	0.377
suest coefficients	0.0035		0.0032	

Note: Table 18 shows the results of the product market competition grouping test. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

and (3) are the high product market competition level group, while columns (2) and (4) are the low product market competition group. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

The results in columns (1) to (4) show that the regression coefficients of the *DSBI* with the cross-multiplier terms for the current and next 4 periods of the policy are significant in the low product market competition group. The low product market competition group and the between-group difference test suest coefficients are 0.0035 and 0.0032, respectively. It indicates that shadow banking regulation optimally enhances the innovation level of low-product market competition firms more than that of high-product market competition firms. Therefore, for low product market competition firms, the *NRCM* can replace the role of product market competition governance to strengthen external governance, so as to avoid the crowding out of financial resources from industrial projects, reduce agency costs, and ultimately greatly enhance the efficiency of corporate investment. For high product market competition firms, the *NRCM* can optimize the level of corporate risk-taking under the regulation of shadow banking, which can also promote investment to a certain extent. For enterprises with high product market competition, the *NRCM* can reduce enterprise risk to some extent and promote investment efficiency. This result also suggests that the *NRCM* can serve as an alternative governance function to monitor product

market competition.

7.2.2. Regional shadow banking development

At the macro level, in the process of economic transformation, China has adopted a strategy of prioritizing the development of the eastern coastal region, resulting in uneven regional distribution in the level of financial development. In regions with higher levels of financial development, the number and scale of formal financial institutions are more significant. As a result, enterprises are more likely to finance with formal institutions and have higher availability of funds. By contrast, enterprises in regions with lower levels of financial development have difficulties in meeting average financing needs. So, shadow banking will flourish more in these regions to make up for the lack of formal credit (Zhang et al., 2023; Chen et al., 2020). Therefore, the higher the level of shadow banking development is, the more frequently enterprises would invest through shadow banking, and the more likely financialization of enterprises and high investment risks will occur, which would eventually lead to inefficient investment. The *NRCM*, by optimizing the regulation of shadow banking, is more likely to influence enterprises in regions with the high development of shadow banking, inhibit

Table 19

Regional shadow banking development grouping test.

VARIABLES	High shadow banking development (1) INV_EFF	Low shadow banking development (2) INV_EFF	High shadow banking development (3) OVER_INV	Low shadow banking development (4) OVER_INV
pre_4 ×DSBI	−0.039 (−0.32)	−0.008 (−0.05)	−0.054 (−0.41)	−0.012 (−0.10)
pre_3 ×DSBI	−0.080 (−0.48)	−0.020 (−0.11)	−0.090 (−0.76)	−0.028 (−0.25)
pre_2 ×DSBI	−0.091 (−0.80)	−0.022 (−0.34)	−0.098 (−0.90)	−0.040 (−0.51)
current×DSBI	−0.109 * ** (−2.59)	−0.068 (−0.39)	−0.118 * ** (−3.21)	−0.059 (−0.68)
post_1 ×DSBI	−0.120 * ** (−3.17)	−0.056 (−0.50)	−0.129 * ** (−3.47)	−0.070 (−0.86)
post_2 ×DSBI	−0.129 * ** (−3.37)	−0.074 (−0.70)	−0.143 * ** (−3.72)	−0.088 (−1.00)
post_3 ×DSBI	−0.107 * * (−2.37)	−0.057 (−0.42)	−0.116 * * (−2.45)	−0.050 (−0.63)
post_4 ×DSBI	−0.076 * (−1.95)	−0.030 (−0.20)	−0.101 * * (−2.38)	−0.058 (−0.33)
SIZE	0.086 * (1.73)	0.103 * ** (2.78)	0.096 * * (2.21)	0.125 * ** (2.63)
IA	−0.029 (−0.09)	−0.059 (−0.81)	−0.058 (−0.85)	−0.075 (−1.22)
LEV	0.018 (0.61)	0.021 (0.94)	0.011 (0.37)	0.016 (0.84)
ROA	0.085 * * (2.00)	0.116 * * (2.38)	0.111 * * (2.02)	0.129 * * (2.55)
AGE	−0.005 (−0.55)	−0.009 (−0.91)	−0.012 (−0.31)	−0.019 (−0.52)
DUA	0.004 * (1.68)	0.006 * (1.94)	0.008 * (1.89)	0.011 * * (2.25)
BOAR	−0.105 * ** (−2.89)	−0.113 * ** (−3.12)	−0.109 * ** (−2.79)	−0.137 * ** (−3.24)
LSSR	0.016 (0.12)	0.021 (1.10)	0.012 (0.52)	0.028 (0.98)
INST	0.007 * * (2.38)	0.019 * ** (2.86)	0.017 * (1.89)	0.030 * * (2.15)
GS	0.001 (0.51)	0.001 (0.92)	0.001 (0.74)	0.002 (1.03)
OWN	0.008 * (1.75)	0.011 * * (2.37)	0.004 * ** (3.03)	0.007 * ** (3.48)
Constant	0.034 (0.98)	0.140 * ** (3.95)	0.028 (0.39)	0.124 * ** (3.24)
Ind & Firm	YES	YES	YES	YES
Observations	10954	8426	6772	4856
R-squared	0.134	0.367	0.137	0.401
suest	0.0006		0.0004	
coefficients				

Note: Table 19 shows the results of the regional shadow banking development grouping test. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

corporate financialization, and improve risk-taking, thus promoting investment efficiency.

To test the differences in innovation changes of firms in different shadow banking development regions under the *NRCM*, we calculate the average ratio of the sum of provincial entrusted loans, trust loans, and undiscounted bank notes to social financing scale at the end of the three periods before the implementation of the *NRCM*. With the calculation result, we can make accurate measurement of the shadow banking development in the region where the firm is located, and group regressions based on the annual median of the industry. Table 19 shows the heterogeneity test results based on regional shadow banking development. In particular, columns (1) and (3) are the group of regions with high shadow banking development, and columns (2) and (4) are the group of regions with low shadow banking development. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

The results in columns (1) to (4) show that the regression coefficients of the *DSBI* with the cross-multiplier terms for the current and next 4 periods of the policy are significant in the group of high shadow banking development regions, while the between-group difference test *suest* coefficients are significant at the 1 % level (0.0006 and 0.0004, respectively). It indicates that shadow banking business transactions are frequent in regions with high shadow banking development. With shadow banking as the main financial access, the subject firms are more likely to make shadow banking investments to obtain high returns. To counter the trend of shadow banking proliferation, the *NRCM* restricts multiple arbitrages of shadow banking and prohibits maturity mismatch, thus inhibiting corporate financialization, enhancing the corporate risk-taking level, and resultantly promoting corporate investment efficiency.

7.2.3. Marketization degree

As China's market-oriented reform progresses, the market is playing an increasingly important role in resource allocation. However, there is an uneven distribution of marketization across regions due to differences in resource endowment and geographic location. From the perspective of shadow banking investment, for regions with a higher degree of marketization and a more robust institutional system, since the market plays a dominant role in resource allocation, enterprises' speculative arbitrage face higher violation costs and litigation risks (Jafri, 2019). Meanwhile, the probability of opportunistic behavior of management in the process of shadow banking investment is also lower. By contrast, for regions with a low degree of marketization and lacking in a sound institutional system, the relatively low costs of violations and litigation risks make it easier for enterprises to be engaged in rent-seeking behavior and intensify their "regulatory arbitrage" motive to over-invest in shadow banking (Du et al., 2017), thus crowding out innovation. To deal with these speculative behaviors in regions of low marketization degree, the *NRCM* can regulate shadow banking and better influence enterprises with low marketization, reduce management's opportunistic motives, lower agency costs, and raise corporate investment efficiency.

Since the marketization index covers the development of various factors and the institutional environment, it can comprehensively reflect the regional marketization degree. So, to test the differences in investment efficiency of enterprises with different degrees of marketization under the *NRCM*, we use marketization index as a proxy for the industry annual median group regression. Table 20 presents the heterogeneity test results based on the degree of marketization. Among them, columns (1) and (3) are the high degree of marketization group, and columns (2) and (4) are the low degree of marketization group. In columns (1) and (2), the dependent variable is investment efficiency *INV_EFF*; in columns (3) and (4), the dependent variable is overinvestment *OVER_INV*.

The results in columns (1) to (4) show that the regression coefficients of the *DSBI* with the cross-multiplier terms for the current and next 4 periods of the policy are significant only in the low marketization group. In contrast, the between-group difference tests *suest* coefficients are significant at the 1 % level (0.0011 and 0.0008, respectively). This indicates that shadow banking regulation is more likely to enhance firms' investment efficiency in low-marketization regions with more loopholes in financial regulations, and the *NRCM* can regulate shadow banking to make up for the deficiencies of the existing system. Therefore, it can be concluded that the *NRCM* can reduce management's opportunistic motives, curb corporate financialization, reduce agency costs, and improve corporate investment efficiency.

8. Further testing

Investment efficiency is the deviation of the firm's investment level from the expected optimal capital level, reflecting a dynamic perspective of the firm's investment effect. To enrich the research perspective and draw on existing studies (Gao et al., 2021), we further investigate the impact of the *NRCM* on firms' investment levels, from a static perspective of firms' investment effects. We expect that the *NRCM* can reduce the investment and agency costs of firms' financial assets and improve the level of firms' risk-taking, which will lead to a more rational allocation of firms' resources and impel management to liberate more funds for real economy investment and thus improve the quality of investment.

According to this analysis, based on existing studies (Hao and Lu, 2018), we define the investment level *INVEST* as (R&D investment + cash paid for the acquisition of fixed assets, intangible assets, and other long-term assets + net cash paid for the acquisition of subsidiaries and other business units - net cash recovered from the disposal of fixed assets, intangible assets and other long-term assets - (Net cash received from the disposal of subsidiaries and other business units). Meanwhile, the level of investment can be divided into three major components: *FIXEX* for investment in fixed assets, *RDEX* for investment in R&D, and *ACQEX* for investment in M&A.¹⁴ *FIXEX* is (cash paid for the acquisition of fixed assets, intangible assets, and other long-term assets - net cash received from the

¹⁴ Mergers and Acquisitions..

Table 20
Marketization degree grouping test.

VARIABLES	High marketisation level (1) INV_EFF	Low marketisation level (2) INV_EFF	High marketisation level (3) OVER_INV	Low marketisation level (4) OVER_INV
pre_4 ×DSBI	−0.023 (−0.25)	−0.017 (−0.07)	−0.034 (−0.38)	−0.029 (−0.18)
pre_3 ×DSBI	−0.045 (−0.38)	−0.056 (−0.26)	−0.058 (−0.60)	−0.067 (−0.47)
pre_2 ×DSBI	−0.064 (−0.63)	−0.060 (−0.51)	−0.072 (−0.86)	−0.077 (−0.76)
current×DSBI	−0.085 (−0.81)	−0.086 * (−2.24)	−0.096 (−1.07)	−0.089 * (−2.82)
post_1 ×DSBI	−0.094 (−0.87)	−0.081 * (−2.62)	−0.102 (−1.25)	−0.095 * (−3.15)
post_2 ×DSBI	−0.104 (−0.95)	−0.097 * (−2.88)	−0.128 (−1.38)	−0.114 * (−3.33)
post_3 ×DSBI	−0.076 (−0.86)	−0.074 * (−2.06)	−0.087 (−0.93)	−0.083 * (−2.32)
post_4 ×DSBI	−0.054 (−0.60)	−0.050 * (−1.67)	−0.076 (−0.69)	−0.068 * (−2.11)
SIZE	0.128 * (2.85)	0.084 * (2.52)	0.136 * (2.47)	0.081 * (1.82)
IA	−0.071 (−0.86)	−0.036 (−0.23)	−0.050 (−1.22)	−0.029 (−1.05)
LEV	0.019 (0.86)	0.013 (0.45)	0.013 (1.04)	0.002 (0.06)
ROA	0.106 * (2.28)	0.064 * (1.78)	0.117 * (2.46)	0.075 * (2.03)
AGE	−0.013 (−1.05)	−0.008 (−0.76)	−0.021 (−0.52)	−0.010 (−0.27)
DUA	0.009 * (2.07)	0.004 * (1.74)	0.008 * (2.33)	0.003 * (1.89)
BOAR	−0.112 * (−3.21)	−0.073 * (−2.80)	−0.122 * (−3.16)	−0.100 * (−2.69)
LSSR	0.021 (0.64)	0.015 (0.34)	0.021 (0.99)	0.010 (0.24)
INST	0.017 * (2.87)	0.013 * (2.49)	0.027 * (2.20)	0.016 * (1.85)
GS	0.001 (0.90)	0.001 (0.45)	0.001 (1.00)	0.001 (0.70)
OWN	0.010 * (2.53)	0.004 * (2.13)	0.004 * (3.45)	0.007 * (2.15)
Constant	0.125 * (3.59)	0.042 (1.34)	0.112 * (3.47)	0.053 (0.68)
Ind & Firm	YES	YES	YES	YES
Observations	8528	10852	5116	6512
R-squared	0.146	0.352	0.158	0.372
suest coefficients	0.0011		0.0008	

Note: Table 20 shows the results of the marketization degree grouping test. In Columns (1)–(2), and (3)–(4), the dependent variables are the measure of investment efficiency (INV_EFF), and overinvestment (OVER_INV), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

disposal of fixed assets, intangible assets and other long-term assets)/total assets; *RDEX* is an investment in R&D (net cash paid for acquisition of subsidiaries and other business units - net cash received for the disposal of subsidiaries and other business units)/total assets; and *ACQEX* is (net cash paid for acquisition of subsidiaries and other business units - net cash received for the disposal of subsidiaries and other business units)/total assets.

Table 21 presents the regression results of the *NRCM* and different investment levels of firms. The dependent variables in columns (1), (2), (3), and (4) are investment level *INVEST*, investment in fixed assets *FIXEX*, investment in R&D *RDEX*, and investment in M&A *ACQEX*, respectively. The regression coefficients of the interaction term with *IMVEST*, *FIXEX*, and *RDEX* in columns (1)–(3) are significantly positive, respectively, while the regression coefficient with *ACQEX* is insignificant. This indicates that the *NRCM* can increase the level of corporate investment, mainly in terms of increasing corporate investment in fixed assets and R&D. The results suggest that the *NRCM* can indeed increase the industrial investment of enterprises, reduce the virtual investment in the financial sector, and ensure the long-term development of enterprise industry. In contrast, the *NRCM* does not affect M&A investment, probably because M&A investment needs to take into account many factors, such as the operating condition of the target enterprise, the content of its primary business, the size of the enterprise, cultural differences, etc. In addition, the main M&A party can only choose the M&A target among a limited number of enterprises. Therefore, M&A investment is a decision made by the main M&A party and the result of

Table 21The *NRCM* and different investment levels of firms.

VARIABLES	(1) IMVEST	(2) RDEX	(3) FIXEX	(4) ACQEX
pre_4 ×DSBI	0.082 (0.66)	0.063 (0.47)	0.043 (0.28)	0.011 (0.17)
pre_3 ×DSBI	0.108 (0.97)	0.072 (0.55)	0.059 (0.43)	0.020 (0.35)
pre_2 ×DSBI	0.125 (1.23)	0.087 (0.67)	0.076 (0.58)	0.035 (0.52)
current×DSBI	0.136 * ** (3.66)	0.107 * ** (3.28)	0.095 * * (2.41)	0.048 (0.73)
post_1 ×DSBI	0.149 * ** (3.82)	0.120 * ** (3.47)	0.114 * ** (2.64)	0.057 (0.82)
post_2 ×DSBI	0.127 * ** (3.43)	0.115 * ** (3.16)	0.107 * * (2.55)	0.041 (0.64)
post_3 ×DSBI	0.103 * ** (3.19)	0.090 * ** (2.94)	0.083 * * (2.30)	0.030 (0.46)
post_4 ×DSBI	0.092 * ** (2.85)	0.079 * ** (2.62)	0.069 * * (2.06)	0.023 (0.24)
SIZE	0.106 * ** (2.94)	0.102 * ** (2.75)	0.103 * ** (2.80)	0.101 * ** (2.67)
IA	0.119 * ** (3.03)	0.127 * ** (4.09)	0.098 * ** (2.74)	0.006 (0.26)
LEV	0.007 (1.09)	0.002 (0.66)	0.011 (1.26)	0.003 (0.37)
ROA	0.187 * ** (3.22)	0.109 * ** (3.06)	0.182 * ** (2.70)	0.077 (1.43)
AGE	0.001 (1.30)	0.001 (1.01)	0.001 (1.23)	0.001 (1.06)
DUA	0.010 (1.32)	0.002 (1.22)	0.005 (0.81)	0.001 (0.02)
BOAR	0.001 (0.08)	0.001 (0.34)	0.003 (0.78)	0.008 (1.12)
LSSR	0.114 * ** (2.70)	0.101 * * (2.51)	0.113 * ** (2.67)	0.117 * ** (2.76)
INST	−0.023 (−1.11)	−0.011 (−1.08)	−0.015 (−1.34)	−0.033 (−1.40)
GS	0.001 (0.27)	0.001 (0.11)	0.001 (0.29)	0.002 (0.65)
OWN	−0.016 * ** (−2.61)	−0.002 * (−1.84)	−0.008 * * (−2.09)	−0.010 * * (−2.47)
Constant	0.003 (0.28)	0.009 (0.72)	0.011 (1.15)	0.053 * * (2.11)
Ind & Firm	YES	YES	YES	YES
Observations	19380	19380	19380	19380
R-squared	0.440	0.433	0.425	0.125

Note: Table 21 presents the regression results of the *NRCM* and different investment levels of firms. The dependent variables in columns (1), (2), (3), and (4) are investment level (IMVEST), investment in fixed assets (FIXEX), investment in R&D (RDEX), and investment in M&A (ACQEX), respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

a comprehensive decision by both M&A companies.

9. Conclusion

This paper studies the relationship between *NRCM* and firms' investment efficiency. We attempt to argue from two opposing hypotheses: one hypothesis argues that *NRCM* regulation of shadow banking may cut down on firms' cash flows and high sources of earnings, significantly hitting firms' operative capability and their profitability, increasing corporate risk, leading to corporate underinvestment, and ultimately reducing firms' investment efficiency; while the other hypothesis argues that the *NRCM* restricts shadow banking, sets investment thresholds, and comprehensively regulates participating entities, forcing firms to reduce shadow banking investments, liberalize resource crowding, cut management information advantages, and reduce agency costs, thus improving their investment efficiency. Based on the above analysis, we took Chinese firms from 2013 to 2021 as our samples and found that *NRCM* can improve firms' investment efficiency, which corroborates the second hypothesis. When we divided our sample into two subsamples of overinvestment and underinvestment, we found that *NRCM* reduces firms' overinvestment and demonstrates no effect on underinvestment. In addition, our findings hold after a series of robustness tests, such as parallel trend hypothesis tests and placebo tests. This helps to analyze the significance of the *NRCM* at the micro level of firms, proving the impacts this policy exerts on shadow

banking in macro capital markets and the efficiency of firms' investments. At the same time, we enrich the literature on the relationship between related shadow banking and firms with some research implications.

In order to test the ideas suggested by the hypotheses, we investigated the mechanism role of firms' investment in financial assets, risk-taking level and agency costs: first, *NRCM* can inhibit overinvestment and enhance corporate investment efficiency by reducing corporate investment in financial assets; second, *NRCM* can promote corporate investment efficiency by reducing corporate risk and enhancing corporate risk-taking level. Finally, *NRCM* can improve firms' investment efficiency by reducing agency costs. This result validates the correctness of our second hypothesis, which explains why *NRCM* can improve corporate investment efficiency from three perspectives: corporate financial asset investment, risk-taking level, and agency costs, respectively. Moreover, this result also suggests that we need to understand the role played by the *NRCM* from dual perspectives: on the one hand, such strong regulation by the *NRCM* may put more significant pressure on financial institutions to rectify the situation, limiting access to financing for some firms and reducing the high returns of corporate investment in the financial sector; on the other hand, the *NRCM* does play a role in regulating financial financing management business, improving the efficiency of capital allocation in China's capital market, and enhancing the efficiency of corporate investment. Therefore, in the long run, *NRCM* can better help enterprises carry out their activities and support the development of China's real economy.

In addition, we conducted tests of heterogeneity based on individual firm characteristics and the external macro environment, as well as tests of *NRCM* and different levels of firm investment. We found that *NRCM* is more effective in enhancing the investment efficiency of state-owned firms, firms with low innovation intensity, firms with low governance, firms with low product market competition, firms in regions with high shadow banking development, and firms in regions with low marketization. Further, we examined different investment levels of firms by using *NRCM*. We found that *NRCM* can improve firms' investment levels, mainly in terms of increasing firms' investment in fixed assets and R&D, but has no obvious effect on acquisition investment. This suggests that *NRCM* can increase firms' absolute investment levels to a large extent. Our findings provide a new perspective on the study of shadow banking, i.e., *NRCM*, based on shadow banking regulation, gives us an appropriate approach to explore the impact on firms, as the existing literature does not examine the economic consequences of shadow banking regulation. Moreover, the findings corroborate the relevant literature on the crowding-out effect of the financialization of firms on the industrial economy (Cao et al., 2021; Davis et al., 2017; Tomaskovic-Devey et al., 2015), i.e., the more firms invest in the financial sector, the more likely their main business will be crowded out due to overall capital constraints. This also illustrates the efforts made by China to defuse the virtual economy bubble and boost the real economy.

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We don't have institutional e-mail address, please send mail to my personal email unity_yu@163.com, thank you.

CRedit authorship contribution statement

Xiang Xiao: Supervision. **Ge Ge:** Data curation. **Ziqin Yu:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization.

Declaration of Competing Interest

No conflict of interest exists in the submission of this manuscript, and manuscript is approved by all authors for publication. The manuscript does not involve studies with human participants and/or animals. I would like to declare on behalf of my co-authors that the work described was original research that has not been published previously, and not under consideration for publication elsewhere, in whole or in part. All the authors listed have approved the manuscript that is enclosed.

Appendix A. Variable definition

Variable Name	Variable Symbol	Variable Definition
Explained variables		
Investment efficiency	INV_EFF	Model (3) absolute value of residuals from the regression
Overinvestment	OVER_INV	Model (3) absolute value of residuals greater than 0
Underinvestment	UNDER_INV	Model (3) absolute value of residuals less than 0
Explanatory variables		
Shadow banking dependency	DSBI	Calculated by adding up entrusted loans, entrusted wealth management, private lending and purchase of various shadow credit products and dividing by total assets
Control variables		
Firm size	SIZE	Natural logarithm of total assets
Intangible assets ratio	IA	Intangible assets/total assets
Leverage	LEV	Total liabilities/total assets

(continued on next page)

(continued)

Variable Name	Variable Symbol	Variable Definition
Return on assets	ROA	Net profit/total assets
Age of the firm	AGE	Take the logarithm if the firm has been listed for the year
The chairman and CEO are the same people	DUA	If the chairman and CEO are the same people, the value is 1, otherwise, it is 0
The size of the board of directors	BOAR	The logarithm of the number of board of directors
The first largest Shareholder Shareholding Ratio	LSSR	The proportion of shares held by the first largest shareholder in all stocks
Institutional Investor Shareholding Ratio	INST	The proportion of the number of stocks held by institutional investors to all stocks
Government subsidy	GS	The total amount of government subsidies (such as financial subsidies, government subsidies, tax rebates, etc) is taken as the natural logarithm
Ownership nature	OWN	If the firm is a state-owned firm, the value is 1, otherwise, it is 0
For robustness variables		
Investment efficiency1	INV_EFF1	Model (4) absolute value of residuals from the regression
Overinvestment1	OVER_INV1	Model (4) absolute value of residuals greater than 0
Underinvestment1	UNDER_INV1	Model (4) absolute value of residuals less than 0
Shadow banking dependency	DSBI1	The residuals are calculated using model (6). If the residuals are greater than 0, firms are overinvesting in shadow banking and DSBI1 is taken to be 1; if the residuals are less than or equal to 0, DSBI1 is taken to be 0.
Shadow banking dependency	DSBI2	DSBI2 takes the value of 1 if a firm's four-year average DSBI exceeds the industry median, and 0 otherwise.
Mechanism variables		
Financial asset investment	FAI	Measured using the ratio of financial assets to total assets. Financial assets = trading financial assets + derivative financial assets + buy-back financial assets + available-for-sale financial assets + held-to-maturity investments + investment properties + long-term equity investments
Corporate risk	CR	Calculated from Eq. (9).
Agency Costs	AC	Measured using the selling and administrative expense ratio, calculated as (selling expenses + administrative expenses)/operating revenue
Other Variables		
Investment Level	IMVEST	The level of total investment (IMVEST) can be divided into three major components: fixed assets expenditure (FIXEX), R&D expenditure (RDEX), and acquisition expenditure (ACQEX). IMVEST is (investment in R&D + cash paid for the acquisition of fixed assets, intangible assets, and other long-term assets + net cash paid for the acquisition of subsidiaries and other business units - net cash received from the disposal of fixed assets, intangible assets, and other long-term assets - net cash received from the disposal of subsidiaries and other business units)/end of period Total assets; FIXEX is (cash paid for the acquisition of fixed assets, intangible assets and other long-term assets - net cash recovered from the disposal of fixed assets, intangible assets and other long-term assets) / total assets; RDEX is an investment in research and development/total assets; ACQEX is (net cash paid for acquisition of subsidiaries and other business units - net cash received for the disposal of subsidiaries and other business units) / total assets at the end of the period

Appendix B. Correlation analysis

Variable	INV_EFF	DSBI	SIZE	IA	LEV	ROA	AGE
INV_EFF	1						
DSBI	0.122 * **	1					
SIZE	0.064 * **	0.036 * **	1				
IA	-0.024	0.028	0.033 * **	1			
LEV	0.022	0.073	0.028 * **	0.053 * **	1		
ROA	0.133 * **	0.065 * **	0.056 * **	0.014	-0.246 * **	1	
AGE	-0.012	0.025	0.064 * **	0.023	-0.342 * **	0.158 * **	
DUA	0.007 * *	0.084 * **	0.015	0.049 * **	-0.053 * **	0.026 *	0.007
BOAR	-0.123 * **	0.034 * **	0.010	-0.036 * **	0.136 * **	-0.149 * **	0.012
LSSR	0.020	0.062 * **	0.007	0.013	-0.066 * **	0.040 * **	-0.015
INST	0.015 * **	0.015	0.136 * **	0.061 * **	0.014	0.037 * **	0.112 * **
GS	0.001	0.011	0.025	-0.055 * **	0.023	0.013	0.013
OWN	0.012 * **	0.067 * **	0.046 * **	-0.047 * **	0.007	0.017	0.003
Variable	DUA	BOAR	LSSR	INST	GS	OWN	
DUA	1						
BOAR	-0.017	1					
LSSR	-0.063 * **	0.034 * **	1				
INST	-0.152 * **	0.185 * **	0.261 * **	1			
GS	-0.014	0.008	0.010	0.009	1		
OWN	-0.308 * **	0.240 * **	0.202 * **	0.345 * **	0.172 * **	1	

Note: Appendix B presents the Pearson correlation coefficients of the main variables. The definitions of the variables are presented in Appendix 1. ***, **, and * indicate the 1 %, 5 %, and 10 % significance levels, respectively.

Data availability

Data will be made available on request.

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Shadow banking Regulation and the stock price synchronicity --A quasi-natural experiment based on China's new asset management regulation

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ABSTRACT

Shadow banking has somewhat compensated for China's lack of formal financial development. However, it may also amplify the financial system's risks, which runs counter to the initial expectation of macroprudential management. With the regulation of shadow banking in China under the New Asset Management Regulation (NAMR), this paper investigates the impact of shadow banking regulation on the stock price synchronicity of China's A-share listed companies and its mechanism from 2013 to 2021. The mechanism test finds that shadow banking regulation can reduce stock price synchronicity by reducing firms' agency costs and improving information transparency. Our study enriches the related research on shadow banking regulation. It provides evidence on the microeconomic consequences of shadow banking from the perspective of stock price synchronicity for other developing countries and emerging economies.

1. Introduction

One of the causes of the global financial crisis in 2008 was the unlimited expansion of shadow banking under the deregulation regime. According to the Federal Reserve (FED) (2010), the Financial Stability Board (FSB) (2011), and other scholars' definitions (Chen et al., 2020), shadow banking can be roughly positioned as an institution or business that operates partially outside the traditional commercial banking sector, and is less regulated in amount. Compared with developed countries, China has a stronger bank-dominated financial system. Different from banks, Chinese shadow banking is a product of off-balance sheet divestiture of domestic assets in the context of restricted credit impulses (Agnello et al., 2020; Allen et al., 2019). Under credit discrimination and regulatory arbitrage, Chinese shadow banking, which is not subject to government regulation, has expanded dramatically (Lu et al., 2015). Undeniably, shadow banking has complemented the lack of formal financial development in China (Irani et al., 2020), but it may also exacerbate regulatory arbitrage and amplify the financial system's risks (Plantin, 2015), which contradicts the principles of macroprudential regulation (Freixas et al., 2015; Hanson

et al., 2011). However, there has been few empirical studies on shadow banking regulation so far, and at the micro level, the effects of shadow banking regulation on corporate activities still remain unexplored. In this paper, we explore the economic consequences of shadow banking regulation at the micro level of firms.

Introducing the New Asset Management Regulation (NAMR) provides a good mechanism for regulating shadow banking in China. On April 27, 2018, the NAMR was officially promulgated and implemented, providing various shadow banking on one hand, and implementing comprehensive regulations on shadow banking participants on the other. The scale of shadow banking has declined significantly since the release of the draft of the NAMR for public feedback. According to our statistical report, as of December 2021, the scale of shadow banking in China has been declining from a peak of ¥2.7 billion to ¥1.8 billion, a decline of about 33.33%. This indicates that at the macro level, the NAMR can effectively regulate shadow banking. Then, at the micro level, because shadow banking brings additional financing channels to firms, many firms have already been involved in shadow banking practices. However, overzealous participation in shadow banking will likely induce self-interested management behavior, increase agency

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costs, reduce information transparency, and make it challenging to convey idiosyncratic information to the market challenging. Stock price synchronicity reflects the correlation between firms' stock price movements and the average movements of the capital market, which represents the information efficiency of the capital market and is closely related to the disclosure of firm-specific information. As an emerging economy, China's capital market price synchronicity has always been among the world's highest, and the capital market's allocation efficiency is low. In particular, the "stock market crash" induced by the "thousands of stock stops" in 2015 hit investor confidence hard, and this extreme phenomenon of stock price synchronicity in the securities market poses a significant threat to the triggering of systemic financial risks. So, will the shadow banking regulation under the NAMR affect the stock price synchronicity of firms? If it will, what is its mechanism of action? We attempt to explore this question.

Regarding the economic consequences of shadow banking, the existing literature has mostly explored macro-level aspects such as financial system fragility and monetary policy effectiveness (Allen et al., 2019; Chen et al., 2020, 2021; Zhu et al., 2019), but less on the micro-level effects of firms. The existing literature can be mainly divided into the two categories of "shadow banking promotion view" and "shadow banking risk view". The "shadow banking promotion view" argues that shadow banks provide more capital to firms (Chen et al., 2020; Chernenko & Sunderam, 2014; Duca, 2016; Lu et al., 2015) whereas the "shadow banking risk view" argues that shadow banking brings more risk to firms (Allen et al., 2019; Bleakley & Cowan, 2010; Reinhart & Rogoff, 2008). As can be seen, no uniform conclusion has been reached concerning the role of shadow banking, and there needs to be more literature examining the topic of shadow banking regulation. Faced with high returns and consequent high risks of shadow banking, management may be induced with self-interested motives and short-sighted behaviors, which exacerbate agency costs and information asymmetry, causing management to hide more idiosyncratic information and consequently enhance stock price synchronicity (Aktas et al., 2019; Zhang et al., 2020). Regarding the macro-level influences on stock price synchronicity, they are mainly related to the trade secret protection law (Kim et al., 2021), mixed ownership reform (Wang et al., 2022), the use of financial derivatives (Su et al., 2022), the opening of high-speed railways (Zhou et al., 2023), the liberalization of the stock market (Li et al., 2022), and policy signals (Hou & Yang, 2021), etc. However, less literature deals with the impact of shadow regulation on the firm's stock price synchronicity.

Therefore, we take Chinese A-share listed firms from 2013 to 2021 as our research sample and analyze them from two opposing perspectives: the "shadow banking promotion view" and the "shadow banking risk view", and the NAMR released in 2017 is used as the basis for our analysis. The study examines the impact of shadow banking regulation on stock price synchronicity and its mechanism of action. We find that shadow banking regulation can reduce stock price synchronicity, which rules out the hypothesis that "shadow banking promotes the view". The mechanism test finds that shadow banking regulation can reduce stock price synchronicity by reducing agency costs and increasing information transparency, which confirms the hypothesis of the "shadow banking risk view". Further tests find that the effect of shadow banking regulation on reducing stock price synchronicity is more significant for state-owned firms and firms with weak external regulation.

We use China as the background of our study for the following reasons: first, the uniqueness of the Chinese financial system leads to higher risks of shadow banking. Compared with that in China, shadow banking in developed countries has developed over a more extended period, and their capital markets are better. In developed countries, shadow banking, more stable and no longer overly dependent on traditional commercial banks, remains a relatively independent state (Nickles & Schiebel, 2015). However, China's shadow banking system has only developed more recently. Traditional commercial banks are still at the core of the financial market and play an essential role in almost all

shadow banking operations. In such a traditional bank-dominated context, Chinese shadow banking is more likely to become a means of arbitrage to avoid regulation, which is definitely accompanied with higher potential risks (Guo & Xia, 2014). Therefore, China is more suitable for studying the topic of shadow banking regulation. Second, China, as a developing country and an emerging economy, shares the common feature of economic market with other developing countries. In developing countries characterized with less robust economic markets, credit discrimination and high investment returns have led to a rapid expansion of shadow banking, which poses high financial risks to the market (An & Yu, 2018). At the same time, compared to mature capital markets in the West, emerging capital markets generally have higher stock price synchronicity and capital market information inefficiency due to weaker property rights protection, less efficient corporate governance, and poorer quality of information disclosure (Morck et al., 2000). Therefore, our study of shadow banking regulation in China can provide some representative implications for other developing countries and emerging economies.

Our study makes essential contributions in several ways. First, our study extends the research related to shadow banking regulation. Due to the covert nature of shadow banking, regulatory policy has been largely silent on this issue (Plantin, 2015). The existing literature has focused less on the study of shadow banking regulation directly but mostly on the indirect effects of formal financial regulation and shadow banking (Irani et al., 2021; Buchak et al., 2018; Adrian & Ashcraft, 2012). So, we decide to take the NAMR regulating Chinese shadow banking as a starting point and provide an in-depth analysis of the economic consequences of shadow banking regulation.

Second, our study complements the economic consequences of shadow banking at the micro level. The existing literature mainly explores the economic consequences of shadow banking at the macro level, such as financial system fragility, monetary policy effectiveness, and credit resource allocation (Allen et al., 2019; Chen et al., 2020; Zhu et al., 2019), but less on the impact of shadow banking on micro firms. Therefore, we study the impact of shadow banking regulation on the firms' stock price synchronicity to add new findings to the existing literature, which is still to be unified in its view of shadow banking.

In addition, our study enriches the macro influences on firms' stock price synchronicity. Although there has been a large body of literature analyzing the macro level, most of them are mainly related to the trade secret protection law (Kim et al., 2021), mixed ownership reform (Wang et al., 2022), the use of financial derivatives (Su et al., 2022), the opening of high-speed railways (Zhou et al., 2023), and the liberalization of the stock market (Li et al., 2022). Shadow banking as a macro factor has yet not yet received extensive attention. This paper argues that shadow banking is closely related to business activities. We provide an in-depth discussion of shadow banking regulatory policies, which significantly complements existing research on the macro impact of shadow banking regulation on stock price synchronicity.

Finally, our study provides other emerging economies and developing countries a helpful guidance. To figure out its influences, shadow banking in emerging and developing economies must be thoroughly discussed and understood. The Chinese, as a member of emerging economies and developing countries, has low resource allocation efficiency in its market (Chen et al., 2021a). In such a market, shadow banking activities, not subject to the regulatory capital requirement framework and central bank supervision (Lu et al., 2015), due to the highly leveraged characteristics, are prone to induce systemic financial risks (Wu & Shen, 2019). However, our findings confirm that shadow banking regulation under the NAMR can reduce firms' stock price synchronicity, suggesting that implementing this policy can not only help circumvent the risks associated with shadow banking, but also facilitates the development of China's capital market.

The remainder of our study is organized as follows. Part 2 describes the institutional context in China. In Part 3, we conduct a literature review. In part 4, we develop the hypotheses. Part 5 presents the study

design. Part 6 provides the baseline regression results and robustness tests. Section 7 tests the mediating mechanism, Section 8 conducts extended tests, and Section 9 summarizes the conclusions and future research directions.

2. Background

One of the reasons for the emergence of the global financial crisis in 2008 was the disorderly expansion of shadow banking under financial deregulation. Similarly, the repeated "money shortages" in the Chinese interbank market after 2013 also reflects a certain degree of disorderly development of shadow banking in China. The rapid expansion of shadow banking continues to push up leverage levels, fuel virtual economic bubbles, and create "crowding out" of formal financial services, which is detrimental to social stability. In particular, since 2013, China's economy has been shifting gears from high-speed to medium-high growth. The frequent fluctuations in financial markets during the same period indicate a rapid rising probability of economic and financial vulnerability crisis.

In response to the disorderly expansion of shadow banking in China, the National Financial Work Conference 2017 proposed "strengthening supervision and improving the ability to prevent and resolve financial risks", requiring financial supervision to focus on regulating shadow banking. In terms of policy, in November of that year, to regulate and supervise shadow banking, the People's Bank of China and various ministries and commissions concerned also issued a draft of the NAMR for public comment: 1. to break the rigid exchange and prohibit capital pool business; 2. to transform the net value of shadow banking products; 3. to classify and manage products and raise the requirement of investor appropriateness; 4. to strictly distinguish standardized assets from non-standard assets; 5. to limit leverage level; 6. to prevent liquidity risk and operational risk; 7. to avoid risk and operational risk; 8. to encourage the establishment of bank capital management subsidiaries and require independent custody; 9. to raise the industry entry threshold and strictly restrict non-financial institutions; 10. to unify regulatory standards, conduct comprehensive supervision of shadow banking participants, and eliminate regulatory arbitrage.

Under this series of regulations, the NAMR has significantly affected the regulation of shadow banking, and powerfully contracted the size of shadow banking in China. Fig. 1 shows the size of shadow banking in China from December 2014 to December 2021. As shown, after the release of the Exposure Draft of the NAMR for public feedback in November 2017, the size of shadow banking reached its highest level in December of that year, after which it began to decline rapidly. In particular, after the official implementation of the NAMR in April 2018, the scale of shadow banking began to decline at more accelerated rate. Overall, from 2017 to 2021, the scale of shadow banking has been declining from ¥2.7 billion to ¥1.8 billion, a decline of about 33.33%, indicating that this policy is effective at the macro level. By contrast, at the micro level, though shadow banking brings additional financing channels to firms, due to many firms' involvement in shadow banking, it also raises risks for firms. In this case, the management will carry out surplus management to enhance agency costs for their interests, hide more damaging information to reduce information transparency, hinder the speed of incorporating the private information of the company into the stock price, and increase the difficulty and cost of informed trading for investors, thus enhancing the stock price synchronicity. Therefore, it is of high necessity to find out whether shadow banking regulation affect firms' stock price synchronicity under the NAMR. In this paper, we conduct an in-depth analysis to find out the answer to this question.

3. Literature review

3.1. Economic consequences of shadow banking

Shadow banking has grown substantially over the past two decades,

and has been regarded as a significant attribute to systemic risk and financial fragility (Fahri & Tirole, 2021; Moreira & Savov, 2017; Pozsar, 2014). Meanwhile, shadow banking has been largely silent in many aspects of regulatory reform due to its greater invisibility (Plantin, 2015). However, the risks posed by shadow banking in China may be higher compared to that in other developed countries (Nickles & Schiebel, 2015). Because of the inefficient allocation of resources in Chinese markets (Chen et al., 2021a), the weakness of the financial system, the lack of regulatory capital requirement framework and central bank supervision for shadow banking activities (Lu et al., 2015), and the presence of high leverage characteristics, systemic financial risks are easily induced (Wu & Shen, 2019). Therefore, it is of significance to conduct more research to examine shadow banking regulation in China.

Regarding the economic consequences of shadow banking, the existing literature has mostly explored macro-level aspects such as financial system fragility, monetary policy effectiveness, credit resource allocation, capital and liquidity creation in the banking sector (Allen et al., 2019; Chen et al., 2020, 2021b; Zhu et al., 2019). By contrast, there is much less literature examining the impact of shadow banking on the micro level of firms. The existing literature can be divided into two categories of "shadow banking promotion view" and "shadow banking risk view". According to Chernenko and Sunderam (2014), shadow banking is vital in providing liquidity to firms. It changes the channel of monetary policy transmission from the standard narrow transmission to broad transmission. Lu et al. (2015) argue that since shadow banks in China can provide short-term liquidity, SMEs¹ rely more on them because of their limited access to funds in the traditional financial market. Moreover, Chen et al. (2020) argue that the surge in shadow banking in China is usually driven by rising demand for financing from specific real sectors.

Reinhart and Rogoff (2008) find those shadow banking products are primarily structured and securitized financial innovations, often with high leverage and maturity mismatches. Bleakley & Cowan, 2010 find that while shadow banking broadens short-term financing and increases firm capital investment, it creates a mismatch between short-term liquidity levels and long-term investment, ultimately depressing firm value. Allen et al. (2019) argue that the Basel Accord does not regulate shadow banking, and therefore the quality of disclosure of financial institutions engaged in shadow banking has decreased.

However, the existing literature has not yet reached a consistent conclusion on the role of shadow banking. Meanwhile, given the uneven development of China's credit market and the high risks associated with the disorderly expansion of shadow banking, more literature needs to focus on the impact of shadow banking regulation on micro firms. The NAMR provides an appropriate context that helps to give a proper positioning to current Chinese shadow banking from the regulatory level.

3.2. Factors influencing firm stock price synchronicity

The concept of stock price synchronicity was first systematically explained by Roll (1998), who argued that firm-specific information and other contingent fanaticism unrelated to the specific information are regarded as the relevant causes of stock price volatility of individual firms. This derives two views: the "information efficiency view" and the "irrationality view". The "informational efficiency view" suggests that stock price volatility can be largely explained by firm-specific information, and that the more firm-specific information is contained in the stock price, the lower the stock price synchronicity is, and the more efficient the transfer of information about resources in the capital market becomes (Morck et al., 2000). The "irrational factor view", on the other hand, suggests that stock price synchronicity decreases because of an increase in the amount of non-firm-specific information in the stock

¹ Small and medium-size enterprise.

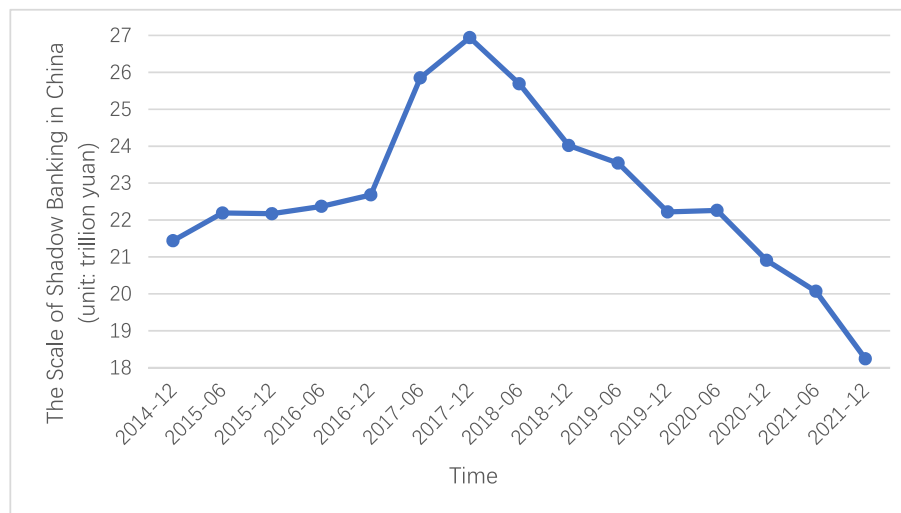


Fig. 1. Scale of shadow banking in China.

Data source: China CEInet Statistics Database

price, i.e., the noise effect, and that a low level of stock price synchronicity does not necessarily mean that the capital market is efficient (West, 1988; De Long et al., 1990).

The central difference between these two views is whether low company stock price synchronicity reflects efficient capital market information or a large amount of noise in the market. In contrast, markets in emerging economies have high stock price synchronicity for two main reasons: first, the institutional development is not comprehensive enough and disclosure regulations have not yet been fully implemented (Chan & Hameed, 2006; Gul et al., 2010); second, the cost of obtaining information is high, which can limit the incorporation of information about firm idiosyncrasies into the stock price, resulting in high stock price synchronicity (Kim & Yi, 2006). As a representative of an emerging economy, China is more likely to be concerned about whether there are significant differences in synchronization across firms because these firms are in a uniform institutional environment (Ai et al., 2023; Jiang et al., 2022). Therefore, we believe that it is more appropriate to consider the factors affecting stock price synchronicity from the "information efficiency view" for studying the information content of stock prices in the Chinese stock market and judging the information efficiency of the market.

Regarding the intra-firm influences on stock price synchronicity, most scholars believe that the quality of information is the core factor that affects stock price synchronicity. Jin and Myers (2006) argue that low transparency of corporate information increases the difficulty for investors to obtain information about the company. Investors in an information disadvantageous position tend to make an adverse choice to include the average quality of the whole market in the consideration of the individual firms. Thus, it is challenging to integrate the firm-level trait information into the stock price, thus leading to a higher stock price synchronicity. By the same token, it is also challenging for the idiosyncratic information to enter the stock price, which leads to a higher stock price synchronicity. Fernandes and Ferreira (2009) compare developed and non-developed country capital markets and find that developed countries have more sophisticated market policies and investor protection mechanisms, which effectively elevates more trading insider information and lowers stock price synchronicity. The exploration of other internal factors around information quality has also emerged in recent years, such as management competence (Gan & Hu, 2023), large controlling shareholders (Boubaker et al., 2014), shareholding structure (Gul et al., 2010), disclosure of key auditing matters (Zhai et al., 2021), and corporate ESG performance (Hu et al., 2023), among others.

The external influences on stock price synchronicity are mainly related to stakeholders and macro policies. On the stakeholder side, Cheong et al. (2021) argue that firms that compared with their competitors, firms advertising more usually manifest lower stock price synchronicity, implying that the stock price movements of these firms are driven more by firm-specific information than by the general trends in the industry and the market. Haga et al. (2022) find that more public peer-to-peer disclosure stimulates the acquisition of private firm-specific information and reduces stock price synchronicity. Barka et al. (2023) find that, unlike short-term investors, long-term investors reduce asymmetric information and help firms disseminate firm-specific information into stock prices.

Regarding macro policies, Kim et al. (2021) find that implementing trade secret protection laws enhances firms' stock price synchronicity due to increased proprietary costs of disclosure, in response to which firm managers conceal more information. Wang et al. (2022) examine the relationship between China's mixed-ownership reforms and the degree of stock price synchronicity and find that the higher the degree of mixed-ownership, the lower the degree of stock price synchronicity of SOEs is. Su et al. (2022) examine the effect of the use of financial derivatives on the amount of firm-specific information incorporated into stock prices from the perspective of emerging market policies and find that the use of financial derivatives prevents firm-specific information from entering the stock price, thus increasing stock price synchronicity.

Other scholars have examined factors such as the opening of high-speed rail (Zhou et al., 2023), stock market liberalization (Li et al., 2022), and policy signals (Hou & Yang, 2021). However, the existing literature has paid less attention to the impact of shadow banking or shadow regulation on firms' stock price synchronicity. Therefore, in this study, we use NAMR as a quasi-natural experiment to explore the impact of shadow banking regulation on stock price synchronicity in China, in an attempt to construct a mechanism for the role of "external macro policy - internal corporate governance - stock price synchronicity" and enrich the literature on stock price synchronicity.

4. Hypothesis development

First, we analyze the impact of firms' participation in shadow banking investment on stock price synchronicity from two opposing perspectives, the "shadow banking promotion view" and the "shadow banking risk view", and thus formulate hypotheses.

From the "shadow banking promotion view", China's existing financial system is dominated by banks. Under the strict regulation of

commercial banks, large and small firms are incentivized to participate in shadow banking to achieve regulatory arbitrage. On one hand, the primary motivation for large firms to actively participate in shadow banking is to obtain high returns (Allen et al., 2019; An & Yu, 2018). On the other hand, SMEs are more susceptible to strict credit discrimination due to high risk and low collateralization (Xia & Gan, 2020), and are therefore forced to raise funds from informal channels of shadow banking (Lu et al., 2015). Thus, with high demand and supply, shadow banking in China essentially complements the lack of formal credit (Allen et al., 2019).

For firms investing in shadow banking, on the one hand, shadow banking can bring high returns and enhance corporate profitability. Faced with the current downward pressure on China's economy and sharp falling profits from real investment, much capital has been poured into real estate and financial assets (Jin et al., 2022). Unlike foreign shadow banking in the form of securitization and financial innovation, Chinese shadow banking, essentially similar to the business model of commercial banks, help firms gain more profits in the short term and enhance corporate profitability mainly through maturity conversion, liquidity conversion, leveraged trading, and other operations (Lu et al., 2015; Yang et al., 2019). Firms can realize excess returns through shadow banking investment, which achieves capital accumulation and improves short-term performance. It is also found that the better the business condition of a firm is, the higher the level of information disclosure would be when firms have incentives to truthfully disclose the business condition of the firm, reducing the probability of hiding poor primary performance and violating the disclosure (Cheung et al., 2010).

On the other hand, shadow banking can also act as a "reservoir" of capital, which can help to cope with the problem of corporate capital shortage. According to the precautionary savings theory (Keynes, 1936), firms will use idle funds to make short-term financial investments, which can be quickly liquidated in case of a shortage of funds and reduce business risks (Chen et al., 2021a). Shadow banking has high liquidity and strong liquidity ability, which can quickly revitalize cash, improve asset liquidity, realize capital preservation and appreciation, prevent future cash flow uncertainty, and also play the role of a financial buffer, smoothing all kinds of risks in the process of firm investment (Wu & Shen, 2019), which is conducive to firms in grasping the investment opportunities of the entity, and enhancing the advantages of the leading business. Exemplary operating conditions of the central business, which is conducive to improving the quality of information disclosure, are more likely to increase the disclosure of particular information, reduce information asymmetry, and reduce stock price synchronicity.

Therefore, from the viewpoint of "shadow banking promotion", shadow banking can provide firms with more investment income, play the role of capital "reservoir", which is conducive to the central business operation of firms, the disclosure of more special information, and the reduction of stock price synchronicity. Based on the above analysis, we put forward the hypothesis H1a.

H1a. Firms participating in shadow banking investment will reduce stock price synchronicity.

From the "shadow banking risk view", for firms investing in shadow banking, shadow banking increases management's incentives to manipulate information, weakens the effectiveness of external regulation, and increases firms' agency costs and information asymmetry. As shadow banking in China has long been outside the banking regulatory system (Chen et al., 2021a; Lu et al., 2015), it can generate high returns in the short term (Lu et al., 2015). Driven by interests, management's investment horizons are short-term, which directly leads to the dilemma of investment. On the one hand, over-investment in shadow banking is easy to fall into the cycle of "currency speculation", which would lead to the emergence of "financializing" phenomenon; on the other hand, real investments, which are conducive to the long-term development of the firm, are neglected, and the agency situation between management and shareholders gets consequently worsened (Jin & Mai, 2022; Tori &

Onaran, 2020; Davis, 2017). Meanwhile, since shadow banks mainly provide short-term debt (Yu & Xiao, 2022), firms will be more likely to utilize short-term funds from shadow banks to support long-term investment activities, thus creating a "maturity mismatch" (Bleakley & Cowan, 2010; Luo et al., 2019). In this case, the maturity time of short-term debt is often shorter than the payback period of long-term investment, which puts firms in the predicament of "borrowing new and repaying old" and elevates financial and operational risks. Furthermore, high corporate risk exacerbates management's self-interested motives and short-sighted behavior, i.e., management will abuse unregulated shadow banking for personal gain and raise agency costs (Aktas et al., 2019; Zhang et al., 2020). In this case, in order to hide negative corporate information, such as the weakening of the central business, the management and significant shareholders are more prone to manipulate the quality of disclosure increase deliberately, leading to the deterioration of disclosure quality, concealment of information about corporate idiosyncrasies, and the rise of the stock price synchronicity (Feng et al., 2022; Gopalan et al., 2014; Xu & Xuan, 2021). At the same time, participation in shadow banking also increases the complexity of corporate earnings structure and intensifies the degree of information asymmetry, which makes it difficult for external investors to grasp the normal operating conditions of the firm (Wu et al., 2021), thus weakening their monitoring power. So, the more serious the information concealment brought about by the principal-agent problem is, the higher the stock price synchronicity will be.

Therefore, from the viewpoint of "shadow banking risk", corporate investment in shadow banking will cause the management to short-sightedly increase the risk of the firm and "squeeze out" the main business, which will increase the agency cost and the degree of information asymmetry, resulting in the management to hide more idiosyncratic information and increase the stock price synchronization. Based on the above analysis, we propose hypothesis H1b.

H1b. Firms participating in shadow banking investment will increase stock price synchronicity.

We then explore the impact of shadow regulation on stock price synchronicity under the NAMR, again relying on the two opposing views above, and develop hypotheses as a result.

From the "shadow banking facilitation view", under the NAMR, shadow banking is strictly regulated, and the massive contraction also cuts down the additional financing channels for firms, reduces the complementary role of shadow banking to formal credit, and the corresponding credit supply decreases significantly at the financing level. After implementing the NAMR, firms are now required to pay higher costs for financing from shadow banks under restricted financing channels (Yang et al., 2019), thus exacerbating their financing constraints. In such a shadow banking regulatory context, the more severe the financing constraints are, the more difficult it is for firms to obtain bank credit and the more anxiety firms show in trying to secure bank credit, especially when the size of shadow banking is tightened (Ryan et al., 2014). As a result, the management of these firms typically show more substantial incentives to disclose information selectively, and are more likely to conceal damaging information (Deng et al., 2020). Resultantly, this can reduce the quality of firms' disclosure and information transparency, increase the difficulty and cost of informed trading for investors, and increase stock price synchronicity.

Meanwhile, under shadow banking regulation, faced with the escalating difficulty for firms to obtain some liquidity support from shadow banks, their performance will be challenged. In this case, the management's short-sightedness and self-interested motivation are constantly induced to reduce the internal and external challenges and pressures brought by performance volatility and control transfer risks. Consequently, there will be a more vital willingness and motivation to engage in surplus management and selective disclosure of negative news (He & Ren, 2023), which will in turn result in the decline of the decision-making validity of the company's financial reports, reduce the

transparency of the information, and impede the incorporation of the company's private information into the of stock prices, leading to higher stock price synchronicity.

Therefore, from the "shadow banking promotion view", under the NAMR, shadow banking regulation may exacerbate corporate financing constraints, trigger management's self-interested incentives to engage in surplus management to enhance agency costs, hide more damaging information to reduce information transparency, and thus enhance stock price synchronicity. Based on the above analysis, we propose hypothesis H2a.

H2a. Under the NAMR, shadow banking regulation will enhance the stock price synchronicity.

From the "shadow banking risk view", due to agency costs, management has an absolute informational advantage regarding the impact on its own interests and the firm's long-term value (Hazarika et al., 2012; Le et al., 2022). In turn, the management intends to allocate the firm's resources according to the maximization of its interests, giving rise to some agency problems (Aktas et al., 2019; Zhang et al., 2020). For example, investments made by firms into shadow banks can exacerbate management's self-interested motives and short-sighted behavior, i.e., management will ignore the long-term development of the firm in order to maximize its short-term interests and may interrupt the investment in its central business (Davis, 2017; Schmid, 2019). In this case, management may hide more bad news or even weave false information because of the exacerbated agency costs, leading to the listed company conveying more low-quality information to the outside world. Therefore, this is why currently, the stock price cannot accurately and truthfully reflect the company's idiosyncratic information.

Under NAMR regulation of shadow banking, on the one hand, NAMR requires that shadow banking business shall not promise to guarantee capital and income, break rigid payment, prohibit multi-layer nesting and channel business, and set the corresponding penalty mechanism, which can effectively reduce the shadow bank's inflated rate of return, and make the firms give up the shadow banking investment subjectively to look for a new profit growth point. Under the requirements of raising the threshold of shadow banking investors and strengthening the regulation of business entities (realizing the combination of institutional and functional regulation, penetrating regulation, and real-time regulation), firms are forced to pull funds out of shadow banking and redirect their focus on industrial projects. Developing industrial projects will lead management to disclose more company-level idiosyncratic information to signal to the market that the main business operation is developing well, which is conducive to the increase of information transparency, the release of more idiosyncratic information, and the reduction of stock price synchronicity.

On the other hand, the NAMR prohibits financial institutions from defrauding or misleading investors to buy products beyond their risk-bearing capacity, bans providing channel services for products of other financial institutions to circumvent the regulatory requirements on the scope of investment, leverage constraints, and emphasizes the risk concept of "seller's responsibility and buyer's responsibility", etc., to break the rigidity of redemption and eliminate multiple nesting. At the same time, to prohibit the development of "capital pool" business, the policy specifies that the funds of each product should be managed separately, accounted for separately, and requires the management of product netting, which powerfully restrains the high leverage of shadow banks and reduces the risk of corporate investment. Under low risky environment, with the reduction of firm agency cost and the elimination of the management's needs to speculate in order to whitewash the performance, there will be more incentives for the management to truthfully disclose the operating conditions of the firm, release qualitative information with a signaling effect, and resultantly reduce stock price synchronicity.

Therefore, from the perspective of the "shadow banking risk view", under NAMR, shadow banking regulation reduces the high rate of return

of shadow banking, standardizes the main participants of shadow banking, which breaks the information advantage of management, reduces the agency cost, improves the transparency of information, and ultimately reduces stock price synchronicity. Based on the above analysis, we propose hypothesis H2b.

H2b. Under the NAMR, shadow banking regulation will reduce the stock price synchronicity.

5. Study design

5.1. Sample and data sources

This paper selects A-share listed firms in China from 2013 to 2021 as the samples. The latest data we have access to are from 2021. Since the NAMR for public feedback is released on November 17, 2017, we choose 2013 as the starting year to avoid interference from other events due to the long duration of previous data. To achieve symmetrical and balanced samples, the period for the samples is centered on the event occurrence time.

In this paper, the sample data are processed as follows: (1) delete the financial industry samples; (2) delete the samples listed after the release of the consultation draft of the NAMR for public feedback; (3) delete the samples that cannot satisfy the estimation window period and event window period in the event study method; (4) delete the samples that do not satisfy the data of at least one period before and after the implementation of the policy. (5) delete ST and PT² samples; (6) remove samples with missing data. Finally, 18560 sample observations are obtained. To control outliers, in this paper, Winsorize continuous variables are set at the 1% and 99% levels, respectively. Data on shadow bank investment dependence, stock price synchronicity, related financial data, and corporate governance are from China CSMAR, WIND, and China Economic Information NET database.

5.2. Identification strategy and model setting

For hypotheses H1a and H1b, this paper constructs the following model for testing:

$$SYN_{i,t+1} = \alpha_0 + \alpha_1 SBD_i + \alpha_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (1)$$

In model (1), $SYN_{i,t+1}$ is the degree of stock price synchronicity of firm i in year $t+1$; SBD is a proxy variable for the average shadow banking investment dependence of firms at the end of the 4 periods prior to the release of the policy. $CONTROL$ is a set of control variables, with $\sum YEAR$ and $\sum FIRM$ indicating that the model controls for both year- and firm-specific fixed effects. In addition, the regression results are corrected for firm-level clustering.

For hypotheses H2a and H2b, double difference modeling (DID) is a classic method to verify the effect of exogenous policy impact. Suppose this paper directly constructs the double difference model. In that case, the sample needs to be divided into a "treatment group" and a "control group". However, with the state issuance of NAMR, all firms are affected at the same point in time, making it difficult to distinguish the "treatment group" and "control group" in a strict sense. Therefore, the generalized double-difference (GDD) model is applied to a situation where all individual firms are affected by the policy, but each firm is affected differently. As we analyzed above, the NAMR may affect firms with different degrees of reliance on shadow banking investments. Therefore, we construct the following GDD model.

² ST refers to special treatment firm; PT refers to particular transfer firm.

$$SYN_{i,t+1} = \beta_0 + \beta_1 POST * SBD_i + \beta_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (2)$$

In model (2), in addition to the variables already introduced in the model (1), POST is a dummy variable for whether the NAMR for public comment back is published, taking the value of 0 before publication and 1 after publication. The regression results are corrected for firm-level clustering.

5.3. Definition of variables

5.3.1. Corporate shadow banking dependence

According to Lu et al. (2015), considering that the research sample is Chinese-listed firms with multiple financing channels and the purpose of participating in shadow banking is primarily to obtain high investment returns, from the investment perspective, the policy impact difference is reflected by the firm shadow banking investment dependence SBD, which is measured as the average shadow banking investment size of the firms at the end of the 4 periods before the release of the policy. Therefore, this paper adds entrusted loans, entrusted financial management, private lending, and the purchase of various types of shadow credit products together, and then the added sum is divided by the total assets to get the average shadow banking investment size of firms.

5.3.2. Stock price synchronicity

We construct proxy variables for stock price synchronicity based on Morck et al. (2000) and Durnev et al. (2003). First, the returns of each stock for each week in a year are regressed on the following model:

$$RET_{i,w,t} = \gamma_0 + \gamma_1 MKTRET_{w,t} + \gamma_2 INDRET_{i,w,t} + \varepsilon_{i,w,t} \quad (3)$$

Where, $RET_{i,w,t}$ is the individual stock return of company i in the w week of year t , $MKTRET_{w,t}$ is the total market capitalization-weighted composite return of China's A-share market in the w week of year t , $INDRET_{i,w,t}$ is the total market capitalization-weighted return of the industry that company i is located in in the w week of year t , and $\varepsilon_{i,w,t}$ is the residual. From model (3), we can estimate the fitting coefficient R^2 , which is standardized by using the following formula to obtain $SYN_{i,t}$.

$$SYN_{i,t} = \ln \left(\frac{R^2_{i,t}}{1 - R^2_{i,t}} \right) \quad (4)$$

Where the larger the indicator, the more consistent the movement of the firm's stock price is with the overall movement of the market; the higher the stock price synchronicity is, and the lower the content of idiosyncratic information is reflected in the stock price; the smaller the indicator, the lower the stock price synchronicity is, and the more idiosyncratic information is reflected in the stock price. We set the stock price synchronicity indicator $SYN_{i,t+1}$ to be obtained by lagging $SYN_{i,t}$ by one period. Since there are different ways to calculate individual stock returns, we name the stock price synchronicity indicator calculated by the individual stock returns without cash dividend and the individual stock returns with cash dividend as $SYN1_{i,t}$ and $SYN2_{i,t}$, respectively.

5.3.3. Control variables

Regarding control variables, this paper refers to existing studies (Bai et al., 2022; Jin et al., 2022; Shi et al., 2022; Yu & Xiao, 2022). First, we control for the firm's excess stock turnover rate $DTURN_{i,t}$ in year t , a variable that is more directly related to firm synchronization. At the same time, we also control some variables of firm characteristics, financial status, and governance ability: firm size $SIZE_{i,t}$; gearing ratio $LEV_{i,t}$; return on assets $DUA_{i,t}$; book-to-market ratio $BM_{i,t}$; two-ranks-at-one-place $DUA_{i,t}$, i.e., if the chairman of the board of directors is the same person as the CEO, it takes the value of 1, otherwise it is 0; the size of the board of directors is the same, and it is 1, otherwise 0; board size $BOAR_{i,t}$; shareholding ratio of the largest shareholder $LSSR_{i,t}$

and age of the firm $AGE_{i,t}$. Due to the ownership peculiarities of Chinese firms, this paper also adds the control variable of the nature of property rights $OWN_{i,t}$. The paper provides the computational details of all variables in Appendix A.

6. Empirical results

6.1. Descriptive statistics

Panel A of Table 1 shows the results of descriptive statistics of the variables. The two proxies for stock price synchronicity, SYN1 and SYN2, have a mean of -0.128 and -0.124 , respectively, and a standard deviation of 0.992 and 0.998 , respectively, which implies that there is a significant variation in stock price synchronicity across the different firms in the sample. SBD has a mean of 0.346 and a median of 0.335 , which is higher than the median, suggesting that more firms in the sample rely on shadow banking. POST has a mean of 0.570 and a standard deviation of 0.405 , which implies that the proportion of the sample after the implementation of NAMR is 57% , and the sample year period is more balanced. OWN has a mean of 0.430 and a median of 0 , which suggests that there are more private firms in the sample, which aligns with the general pattern of China's thematic research. Taken together, the descriptive statistics of the sample firms are more similar to those reported in previous studies (Bai et al., 2022; Jin et al., 2022; Shi et al., 2022; Yu & Xiao, 2022), reflecting a more objective and balanced selection of the sample for this paper. This paper demonstrates the correlation between the main variables in Appendix B. The correlation coefficients between most of the variables are less than 0.3 , and the results of the multicollinearity test indicate that the mean value of the variance inflation factor (VIF) is 4.57 , which is less than the empirically determined critical value of 10 , suggesting that there is no severe multicollinearity between the variables.

Panel B of Table 2 examines the change in firms' stock price synchronicity before and after the year of policy release under univariate. Compared with that prior to policy release ($POST = 0$), the mean value of SYN1 decreases by 42.2% ³ and the mean value of SYN2 decreases by 42.0% ⁴ after the policy is released ($POST = 1$). The mean and median difference tests for both are significant, indicating that firms' overall stock price synchronicity is somewhat reduced after the enactment of the policy. These findings prove a negative relationship between shadow banking regulation and firms' stock price synchronicity.

6.2. Regression results

6.2.1. Baseline results

For hypotheses H1a and H1b, Table 2 reports the regression results of the relationship between shadow banks and firms' stock price synchronicity. We need to focus on the coefficient α_1 of SBD in the model (1), which reflects the impact of firms' investment in shadow banking on stock price synchronicity. In column (1) of Table 2, the dependent variable is SYN1; in column (2), the dependent variable is SYN2. Both columns (1) and (2) are the results of model (1) after controlling for year and firm fixed effects. This paper also builds on existing research (Rajkovic, 2020; Chen et al., 2018) by correcting standard errors at the heterogeneity level and clustering them at the firm level.

The results in columns (1)–(2) of Table 2 show that the regression coefficients of SBD with $SYN1_{t+1}$ and $SYN2_{t+1}$, respectively, are all significantly positive at the 1% level. This implies that the more firms invest in shadow banks, the higher the stock price synchronicity is, validating Hypothesis H1b. This also suggests that firms' investment in shadow banks leads management to hide more idiosyncratic information and resultantly enhances stock price synchronicity, which

³ Calculated as: $((-0.145) - (-0.102))/(-0.102)$.

⁴ Calculated as: $((-0.142) - (-0.1))/(-0.1)$.

Table 1
Summary statistics and univariate analysis.

Panel A: Descriptive statistics						
Variable	N	mean	p50	sd	min	max
SYN1	18560	-0.128	-0.057	0.992	-3.211	2.116
SYN2	18560	-0.124	-0.060	0.998	-3.217	2.121
SBD	18560	0.346	0.335	0.397	0	1
POST	18560	0.570	1	0.405	0	1
DTURN	18560	-0.036	-0.008	0.315	-0.920	0.843
SIZE	18560	22.226	22.115	1.279	16.121	27.955
LEV	18560	0.471	0.468	0.207	0.011	0.926
ROA	18560	0.023	0.035	0.124	-0.287	0.168
BM	18560	1.675	0.690	2.268	0.101	16.559
DUA	18560	0.218	0	0.413	0	1
BOAR	18560	2.262	2.303	0.184	0	2.996
LSSR	18560	0.370	0.351	0.158	0.003	0.990
AGE	18560	3.009	3.056	0.294	1.343	3.759
OWN	18560	0.430	0	0.516	0	1

Panel B: Univariate analysis								
Variable	POST = 0			POST = 1			Diff	Diff
	N	Mean	Median	N	Mean	Median	(Mean)	(Median)
SYN1	8250	-0.102	-0.035	10310	-0.145	-0.072	0.132***	0.126***
SYN2	8250	-0.100	-0.038	10310	-0.142	-0.074	0.131***	0.124***

Table 1 Panel A shows the descriptive statistics for the sample. Panel B presents the results of a univariate analysis. In Panel B, the sample is divided into two subsamples according to POST. For each of the subsamples, mean (median) values of SYN1, SYN2 measures are reported. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. [Appendix A](#) provides detailed definitions of all variables.

Table 2
Shadow banking and corporate stock price synchronicity.

	(1)	(2)
VARIABLES	SYN1 _{t+1}	SYN2 _{t+1}
SBD	0.130*** (4.16)	0.112*** (4.05)
DTURN	-0.249*** (-11.08)	-0.248*** (-11.03)
SIZE	-0.049*** (-5.13)	-0.045*** (-5.08)
LEV	0.065*** (7.48)	0.070*** (7.49)
ROA	-0.078*** (-3.64)	-0.074*** (-3.59)
BM	0.244*** (20.51)	0.242*** (20.26)
DUA	-0.009 (-1.06)	-0.003 (-0.94)
BOAR	-0.029*** (-3.69)	-0.017** (-2.08)
LSSR	0.037*** (3.82)	0.039*** (3.95)
AGE	-0.012*** (-3.11)	-0.016*** (-3.30)
OWN	-0.014** (-2.39)	-0.019** (-2.45)
Constant	0.240 (0.76)	0.251 (0.95)
Year	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.371	0.369

Table 2 presents the regression results of the shadow banking and corporate stock price synchronicity. In Columns (1)–(2), the dependent variables are the SYN1 and SYN2, respectively. [Appendix A](#) provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

preliminarily supports the "shadow banking risk perspective" ([Allen et al., 2019](#); [Bleakley & Cowan, 2010](#)). At the same time, this paper lays the foundation for the subsequent research on the relationship between

shadow banking regulation and corporate stock price synchronicity under the NAMR.

For hypotheses [H2a](#) and [H2b](#), [Table 3](#) reports the regression results of the relationship between NAMR and firms' stock price synchronicity. We need to focus on the coefficient β_1 of $POST * SBD_{it}$ in the model (2),

Table 3
NAMR and corporate stock price synchronicity.

	(1)	(2)
VARIABLES	SYN1 _{t+1}	SYN2 _{t+1}
POST*SBD	-0.163*** (-9.09)	-0.147*** (-8.92)
DTURN	-0.249*** (-11.04)	-0.248*** (-11.00)
SIZE	-0.048*** (-5.11)	-0.044*** (-5.06)
LEV	0.065*** (7.48)	0.070*** (7.49)
ROA	-0.078*** (-3.62)	-0.074*** (-3.53)
BM	0.242*** (20.48)	0.240*** (20.24)
DUA	-0.006 (-1.01)	-0.002 (-0.87)
BOAR	-0.029*** (-3.62)	-0.017** (-2.03)
LSSR	0.036*** (3.76)	0.038*** (3.89)
AGE	-0.011*** (-3.07)	-0.015*** (-3.27)
OWN	-0.014** (-2.34)	-0.019** (-2.42)
Constant	0.232 (0.58)	0.246 (0.75)
Year	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.396	0.393

Table 3 presents the regression results of the NAMR and corporate stock price synchronicity. In Columns (1)–(2), the dependent variables are the SYN1 and SYN2, respectively. [Appendix A](#) provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

which reflects the change in stock price synchronicity of firms with different degrees of investment in shadow banking before and after the policy release. In column (1) of Table 3, the dependent variable is SYN1; in (2), the dependent variable is SYN2. Columns (1) and (2) are both results from the model (2) after controlling for year and firm fixed effects. The paper similarly corrects for standard errors at the heterogeneity level and clusters at the firm level.

The results in columns (1)–(2) of Table 3 show that the regression coefficients of POST*SBD with SYN1_{t+1} and SYN2_{t+1} are both significantly negative at the 1% level. In terms of economic significance, for column (1), a one standard deviation increase in firms' exposure to shadow banking regulation under NAMR reduces their SYN1 by 50.6%⁵; for column (2), a one standard deviation increase in firms' exposure to shadow banking regulation under NAMR reduces their SYN2 by 47.1%,⁶ implying that shadow banking regulation substantially reduces firms' stock price synchronicity. These results show that under NAMR, the regulation of shadow banking reduces the stock price synchronicity of firms to a certain extent, which verifies hypothesis H2b and supports the "shadow banking risk view".

In addition, the phenomenon reflected by the coefficients of some control variables is also noteworthy. In columns (1)–(2), the regression coefficients of LEV_t, BM_t, and LSSR_t with SYN1_{t+1} and SYN2_{t+1}, are significantly positive, which indicates that the higher the gearing ratio, book-to-market ratio, and the proportion of the first largest shareholder's shareholding are, the higher will be the agency cost and the degree of information asymmetry of the firms. Meanwhile, the more idiosyncratic information the management will be prone to, the higher will be the stock price synchronicity of the firms. The regression coefficients of DTURN_t, SIZE_t, ROA_t, BOAR_t, AGE_t, and OWN_t with SYN1_{t+1}, SYN2_{t+1} are all significantly negative, indicating that the higher firm stock excess turnover rate is, the stronger the stock liquidity, and the firm's adequate information exposure can lead to lower stock price synchronicity. Besides, the bigger the firm is, and the larger the board scale is, the higher the return on assets. In addition, larger size, higher return on assets and longer listing time are the common features of the property right of a state-owned firm, which indicates that the firm operation is more standardized. Regarding the management, it is subject to more regulations, i.e., the more regulations are enacted, the more the management will reduce the agency cost, improve the transparency of information, and reduce the stock price synchronicity of the firm.

6.2.2. Robustness checks

In order to address endogeneity issues such as the omission of other influencing factors and reverse causation, and to strengthen the robustness of the empirical results, this paper conducts tests such as replacing the measure of synchronization of corporate stocks, parallel trend hypothesis test, placebo test, taking the promulgation of the official draft of NAMR as the event, and exclusion of other significant events in the same period, respectively.

6.2.2.1. Replacement of variable measures. This paper replaces the measures of stock price synchronicity and shadow bank investment dependence. Drawing on Gul et al. (2010) and Piotroski and Roulstone (2004), we use the following re-estimation of the fitted coefficients:

$$RET_{i,w,t} = \gamma_0 + \gamma_1 MKTRET_{w,t} + \gamma_2 MKTRET_{w,t-1} + \gamma_3 INDRET_{i,w,t} + \gamma_4 INDRET_{i,w,t-1} + \varepsilon_{i,w,t} \quad (5)$$

The definition of variables is the same as that of the model (3), and the stock price synchronicity indexes calculated with individual stock returns without cash dividends and with individual stock returns considering cash dividends are named as SYN3_{it} and SYN4_{it},

respectively. Meanwhile, considering that the financial leakage behavior among firms has a certain degree of concealment, we refer to the study of Jiang et al. (2022), and take "other receivables" as a proxy variable for private lending, and then compute the new shadow banking investment dependence SBD1. Therefore, we construct the following regression model (6):

$$SYN_{i,t+1} = \mu_0 + \mu_1 POST * SBD1_i + \mu_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (6)$$

Table 4 presents the regression results of shadow banking and corporate stock price synchronicity after replacing the measure of variables. In columns (1)–(2), the regression coefficients of SBD1 are all significantly positive, which is consistent with the main test, indicating that firms' participation in shadow banking investment enhances stock price synchronicity after the replacement of the variable measures, and the conclusions of this part of the paper remain robust.

Table 5 presents the regression results of NAMR and firm stock price synchronicity after replacing the variable measures. In columns (1)–(2), the regression coefficients of POST*SBD1 are all significantly negative, which is consistent with the primary test, indicating that shadow banking regulation still reduces firm stock price synchronicity after the replacement of the variable measures, and the conclusions of this paper remain robust.

6.2.2.2. Parallel trend hypothesis testing. The use of the conventional double difference model (DID) has a strict precondition that the "control

Table 4

Measures of replacement variables (shadow banking and corporate stock price synchronicity).

	(1)	(2)
VARIABLES	SYN3 _{t+1}	SYN4 _{t+1}
SBD1	0.124*** (3.86)	0.105*** (3.70)
DTURN	-0.251*** (-11.24)	-0.250*** (-11.21)
SIZE	-0.052*** (-5.28)	-0.051*** (-5.18)
LEV	0.069*** (7.53)	0.073*** (7.55)
ROA	-0.075*** (-3.71)	-0.073*** (-3.63)
BM	0.247*** (21.16)	0.245*** (21.77)
DUA	-0.005 (-0.80)	-0.003 (-0.46)
BOAR	-0.032*** (-3.77)	-0.018** (-2.23)
LSSR	0.033*** (3.03)	0.026*** (2.76)
AGE	-0.018*** (-3.82)	-0.009* (-1.85)
OWN	-0.009** (-2.28)	-0.012** (-2.34)
Constant	0.337 (1.17)	0.356 (1.26)
Year	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.362	0.359

Table 4 shows the results of the regression of shadow banking on firms' stock price synchronicity after replacing the measures of stock price synchronicity and shadow banking investment dependence. In Columns (1)–(2), the dependent variables are the SYN3 and SYN4, respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

⁵ Calculated as: $(-0.163) \cdot 0.397 / (-0.128)$.

⁶ Calculated as: $(-0.147) \cdot 0.397 / (-0.124)$.

Table 5

Measures of replacement variables (NAMR and corporate stock price synchronicity).

	(1)	(2)
VARIABLES	SYN3 _{t+1}	SYN4 _{t+1}
POST*SBD1	-0.152*** (-8.86)	-0.137*** (-8.63)
DTURN	-0.252*** (-11.11)	-0.251*** (-11.02)
SIZE	-0.052*** (-5.20)	-0.051*** (-5.11)
LEV	0.069*** (7.43)	0.072*** (7.47)
ROA	-0.075*** (-3.64)	-0.073*** (-3.58)
BM	0.246*** (21.11)	0.244*** (21.06)
DUA	-0.005 (-0.72)	-0.003 (-0.41)
BOAR	-0.032*** (-3.70)	-0.018** (-2.17)
LSSR	0.033*** (2.86)	0.026*** (2.68)
AGE	-0.017*** (-3.73)	-0.008* (-1.76)
OWN	-0.009** (-2.21)	-0.012** (-2.29)
Constant	0.324 (0.96)	0.343 (1.05)
Year	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.383	0.371

Table 5 shows the results of regressing NAMR on firms' stock price synchronicity after replacing the measures of stock price synchronicity and shadow bank investment dependence. In Columns (1)–(2), the dependent variables are the SYN3 and SYN4, respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

group" and "experimental group" in the sample must have parallel trends, i.e., the same trend of change before the policy execution. However, the NAMR is a nationwide policy that will affect all sample firms, so we choose the generalized double difference model (GDD) to solve this problem, in which all sample firms are the "experimental group", and there is no "control group" in a strict sense. Since no control group exists, we utilize an event study to test the parallel trend hypothesis. If the parallel trend hypothesis is valid, the impact of the NAMR on the stock price synchronicity of firms will only occur after the release of the policy. Therefore, before the release of the policy, the trend of firms affected by the policy should remain the same.

In order to test the parallel trend hypothesis, this paper constructs the following regression model based on model (2):

$$SYN_{i,t} = \sum_{t=-4}^{-1} \varphi_{t,pre} * SBD_i + \varphi_{0,current} * SBD_i + \sum_{t=1}^4 \varphi_{t,post} * SBD_i + \gamma_5 CONTROL_{i,t} + \sum IND + \sum FIRM + \varepsilon_{i,t} \quad (7)$$

In model (7), this paper constructs the interaction terms of year dummy variables pre, current, post, and SBD as explanatory variables for regression. Pre is before the execution of the policy, current is the current period of policy execution, and post refers to post policy execution. δ_t coefficients reflect the differences between firms affected by different effects of the policy in a specific year; δ_0 is the effect in the period when the policy is executed; δ_{-4} to δ_{-1} are the effects in periods 1–4 before the policy execution; and δ_1 to δ_4 are the effects in periods 1–4 after the policy occurs. In this paper, period 1 before the policy execution is chosen as the benchmark group of the model to prevent

full covariance. Since model (7) does not have consistent year variables, it does not control for year dummy variables, but instead, it controls for industry dummy variables. If the parallel trend assumption holds, then δ_{-4} to δ_{-2} should be insignificant, indicating that all the periods from 4 to 2 before the policy execution share similar trends in firm changes like that of period 1. Instead, δ_0 to δ_4 are the dynamic effects of the policy over time.

Table 6 presents the results of the parallel trend test. In columns (1)–(4), the regression coefficients of the cross-multiplier terms from pre_4 to pre_2 with SBD are not significant, which suggests that there is no significant difference between firms with different reliance on shadow banking investments before the policy execution, which proves the validity of the parallel trend hypothesis. The coefficients of the current*SBD are significantly negative, and the regression coefficients of the cross-multipliers of the SBD terms from post_1 to post_4 are also significantly negative, suggesting that shadow banking regulation acts

Table 6

Parallel trend hypothesis test.

	(1)	(2)
VARIABLES	SYN1	SYN2
pre_4*SBD	-0.019 (-1.09)	-0.013 (-0.98)
pre_3*SBD	-0.025 (-1.40)	-0.020 (-1.27)
pre_2*SBD	-0.049 (-1.55)	-0.038 (-1.40)
current*SBD	-0.136*** (-7.49)	-0.122*** (-7.31)
post_1*SBD	-0.157*** (-8.56)	-0.133*** (-8.43)
post_2*SBD	-0.130*** (-6.80)	-0.115*** (-6.69)
post_3*SBD	-0.116*** (-4.59)	-0.094*** (-4.43)
post_4*SBD	-0.082** (-2.44)	-0.071** (-2.32)
DTURN	-0.113*** (-5.10)	-0.112*** (-5.02)
SIZE	-0.019** (-2.09)	-0.015* (-1.94)
LEV	0.043*** (4.13)	0.057*** (4.06)
ROA	-0.058** (-2.22)	-0.040* (-1.78)
BM	0.136*** (16.51)	0.133*** (16.22)
DUA	-0.003 (-0.94)	-0.002 (-0.82)
BOAR	-0.017* (-1.74)	-0.009 (-1.51)
LSSR	0.017*** (2.73)	0.019*** (2.98)
AGE	-0.008*** (-2.66)	-0.013*** (-2.88)
OWN	-0.009* (-1.95)	-0.013** (-2.02)
Constant	0.135 (0.32)	0.144 (0.45)
Ind	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.474	0.471

Table 6 presents the results of the parallel trend test. In Columns (1)–(2) the dependent variables are the SYN1 and SYN2, respectively. Appendix A provides detailed definitions of all variables. Besides, pre is before the policy occurs, current is the current period when the policy occurs, and post is after the policy occurs. To prevent complete covariance, period 1 before the occurrence of the policy is chosen as the benchmark group of the model. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

as a longer-term reduction in firms' stock price synchronicity after the policy execution.

6.2.2.3. Placebo test. In order to eliminate the interference of stochastic factors on the conclusion, we conduct a placebo test by leveling forward the time of policy implementation, i.e., after changing the time of policy occurrence, if the estimated coefficients of the regression are significant, the reduction of corporate stock price synchronicity is likely to be resulted from the influence of other stochastic factors, rather than as the result of the shadow banking regulation under the New NAMR Regulation. Since the release of the consultation draft of NAMR was in 2017, this paper assumes 2016 as the year of the dummy event and constructs model (8) based on model (1) for the placebo test.

$$SYN_{i,t} = \delta_0 + \delta_1 POST_2016 * SBD_i + \delta_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (8)$$

In model (8), which removes the variables that have been defined in the model (1), POST_2016 is the dummy event year that this paper assumes 2016 to be the dummy event year, which takes the value of 0 before 2016 and takes the value of 1 in the current year of 2016 and beyond. Similarly, this paper needs to focus on the coefficient δ_1 of POST_2016 $\times$ SBD, which passes the placebo test if it is insignificant or does not pass.

Table 7 presents the results of the placebo test with 2016 as the time of the event. The regression coefficient of POST_2016 $\times$ SBD is insignificant, indicating that it passes the placebo test.

6.2.2.4. Excluding other significant events in the same period. At the end

Table 7
Placebo test.

VARIABLES	(1) SYN1 _{t+1}	(2) SYN2 _{t+1}
POST_2016*SBD	-0.013 (-0.45)	-0.007 (-0.33)
DTURN	-0.253*** (-11.38)	-0.252*** (-11.32)
SIZE	-0.058*** (-5.43)	-0.052*** (-5.34)
LEV	0.071*** (7.76)	0.074*** (7.77)
ROA	-0.085*** (-3.94)	-0.083*** (-3.86)
BM	0.257*** (20.71)	0.255*** (20.50)
DUA	-0.013 (-1.34)	-0.006 (-1.04)
BOAR	-0.035*** (-3.93)	-0.026** (-2.38)
LSSR	0.044*** (3.93)	0.047*** (4.05)
AGE	-0.018*** (-3.30)	-0.023*** (-3.56)
OWN	-0.023*** (-2.69)	-0.027*** (-2.75)
Constant	0.440*** (16.65)	0.461*** (17.76)
Year	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.171	0.169

Table 7 presents the results of the placebo test. In Columns (1)–(2) the dependent variables are the SYN1 and SYN2, respectively. Appendix A provides detailed definitions of all variable randomly selected as the year of occurrence of virtual events through a random function in 2013–2016. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

of 2019, the COVID-19 epidemic began to appear in China, and the operating conditions of the affected firms continued to fluctuate, implying that the relevant firms' data became abnormal from 2020 onwards. So, we excluded the unique samples after 2020 and 2021. Meanwhile, since the release of the NAMR exposure draft in 2017, to maintain the balanced symmetry of the time of the event, we continue to exclude 2013 and 2014 firms. Finally, the sample firms from 2015 to 2019 are retained, presenting a symmetrical and balanced sample period centered on the time of the event.

Table 8 demonstrates the regression results excluding the effect of the COVID-19 epidemic. It can be found that the regression coefficients of POST*SBD are all significantly negative, indicating that there is no significant change in the regression results after the impact of the COVID-19 epidemic has been excluded.

6.2.2.5. The promulgation of the official draft of the NAMR as an event. The consultation draft of the New NAMR was issued on November 17, 2017. However, the Chinese stock market showed no obvious reaction initially because the New NAMR had not yet been formally implemented. In the second quarter of 2018, China issued the official draft text of the New Asset Regulation, which marked the formal implementation of the relevant supporting rules. In this paper, considering the different strengths of the official draft and the opinion draft, the following model (9) is reset for regression with the promulgation of the official draft of the New NAMR as the event.

$$SYN_{i,t} = \theta_0 + \theta_1 POST1 * SBD_i + \theta_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (9)$$

Table 8
Test for excluding other major events in the same period.

VARIABLES	(1) SYN1 _{t+1}	(2) SYN2 _{t+1}
POST*SBD	-0.160*** (-8.96)	-0.145*** (-8.84)
DTURN	-0.245*** (-10.96)	-0.243*** (-10.93)
SIZE	-0.045*** (-5.02)	-0.042*** (-4.96)
LEV	0.063*** (7.39)	0.069*** (7.41)
ROA	-0.077*** (-3.57)	-0.073*** (-3.48)
BM	0.241*** (20.36)	0.239*** (20.17)
DUA	-0.003 (-0.91)	-0.001 (-0.79)
BOAR	-0.026*** (-3.55)	-0.015* (-1.95)
LSSR	0.035*** (3.62)	0.036*** (3.78)
AGE	-0.010*** (-2.91)	-0.014*** (-3.16)
OWN	-0.013** (-2.29)	-0.018** (-2.35)
Constant	0.240 (0.73)	0.252 (0.96)
Year	YES	YES
Firm	YES	YES
Observations	10518	10518
R-squared	0.395	0.392

Table 8 presents the regression results using 2015–2019 as the study period, to exclude the effects of special important event COVID-19. In Columns (1)–(2) the dependent variables are the SYN1 and SYN2, respectively. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

In model (9), in addition to the variables already defined, POST1 is a dummy variable for whether the official draft of NAMR is released, which takes the value of 0 before and the value of 1 after the release.

Table 9 reports the results after re-regressing the issuance of the official draft of the NAMR. The regression coefficients of POST1 $\times$ SBD in columns (1)–(2) are all significantly negative, indicating that the stock price synchronicity of firms gets reduced after the promulgation of the official draft of the NAMR. It implies that both the draft of NAMR and the promulgation of the official draft can reduce stock price synchronicity, and the conclusion of this paper is strengthened.

7. Mechanism test

Consistent with the hypotheses proposed, this paper argues that NAMR can reduce stock price synchronicity by reducing firms' agency costs and enhancing firms' information transparency. Based on argument, we use the Sobel mediating factor test (Baron & Kenny, 1986; Rehman et al., 2021) to test the mediating role and construct the following model:

$$SYN_{i,t+1} = \alpha_1 POST * SBD_i + \alpha_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (\text{path a})$$

$$MED_{i,t+1} = \rho_1 POST * SBD_i + \rho_2 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (\text{path b})$$

Table 9

The promulgation of the official draft of the NAMR as an event test.

VARIABLES	(1) SYN1 _{t+1}	(2) SYN2 _{t+1}
POST1*SBD	−0.152*** (−8.65)	−0.131*** (−8.47)
DTURN	−0.246*** (−10.92)	−0.242*** (−10.88)
SIZE	−0.045*** (−5.03)	−0.041*** (−4.92)
LEV	0.062*** (7.36)	0.068*** (7.40)
ROA	−0.075*** (−3.57)	−0.071*** (−3.48)
BM	0.239*** (20.31)	0.237*** (20.14)
DUA	−0.004 (−0.94)	−0.001 (−0.75)
BOAR	−0.027*** (−3.55)	−0.015* (−1.92)
LSSR	0.033*** (3.62)	0.036*** (3.77)
AGE	−0.008*** (−2.97)	−0.012*** (−3.16)
OWN	−0.012** (−2.29)	−0.017** (−2.36)
Constant	0.245 (0.66)	0.253 (0.87)
Year	YES	YES
Firm	YES	YES
Observations	16530	16530
R-squared	0.394	0.392

Table 9 reports the results after recalculation and regression using the promulgation of the official draft of the NAMR as an event. In Columns (1)–(2) and (3)–(4), the dependent variables are the SYN1 and SYN2, respectively. Appendix A provides detailed definitions of all variables. Besides, POST1 is a dummy variable for whether the official draft of the NAMR is released, taking the value of 0 before release and 1 after release. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

$$SYN_{i,t+1} = \sigma_1 POST * SBD_i + \sigma_2 MED_{i,t} + \sigma_3 CONTROL_{i,t} + \sum YEAR + \sum FIRM + \varepsilon_{i,t} \quad (\text{path c})$$

Where α_1 in the model (path a) is the total effect of shadow banking regulation on firms' stock price synchronicity; MED is the intermediary variable, and ρ_1 in the model (path b) is the effect of shadow banking regulation on the intermediary variable; σ_1 in the model (path c) is the effect of the intermediary variable on firms' stock price synchronicity. Total effect = direct effect + intermediary effect, i.e., $\alpha_1 = \sigma_1 + \rho_1 \sigma_2$. Also, the paper controls for year- and firm-level fixed effects.

Determining the mediating role of MED using the Baron and Kenny (1986) methodology requires three conditions to be met: (1) the coefficients of POST*SBD in the model (path a) must be statistically significant, representing the significant effect of shadow banking regulation on firm stock price synchronicity; (2) the coefficients of POST*SBD in the model (path b) must also be statistically significant and have a significant effect on the mediating variable MED; (3) in the model (path c), the coefficient of the mediating variable MED must be statistically significant, representing a significant effect on the stock price synchronicity of firms, and the coefficient of the third regression of POST*SBD also has to be smaller than the first regression.

7.1. Agency costs

The existence of agency costs can lead to the absolute information advantage of management (Hazarika et al., 2012; Le et al., 2022). The more a firm relies on shadow banking investments, the more likely it will fall into the "investment trap", interrupting its primary business investments and raising agency costs (Davis, 2017; Schmid, 2019). Under NAMR regulation of shadow banking, with firms forced to focus on their primary business, and with management releasing more idiosyncratic information to signal to the market, both agency costs and stock price synchronicity are reduced. For the mediation test of agency costs, drawing on existing research (Ang et al., 2000), we use the management on-the-job consumption rate as a measure, i.e., overhead/operating income, whose higher value indicates higher agency costs of the firm.

Table 10 demonstrates the results of the mediation effect test for agency costs. The dependent variables in columns (1)–(3) and (4)–(6) are SYN1 and SYN2, respectively. The regression coefficients of POST*SBD with AC_{t+1} in columns (2) and (5) are significantly negative, indicating that shadow banking regulation under NAMR can reduce the agency costs of firms. In columns (3) and (6), the regression coefficients of POST*SBD are significantly negative, while the regression coefficients of AC are significantly positive, verifying the partial mediation effect of agency costs. In addition, the P-values obtained from Sobel's test are all 0, and the proportion of mediation effect in the total effect is 34% and 33%, respectively. This indicates that under NAMR, shadow banking regulation can reduce corporate stock price synchronicity by reducing agency costs, proving that reducing corporate agency costs is an important influence mechanism of NAMR to reduce corporate stock price synchronicity.

7.2. Information transparency

The reason for firms' low stock price synchronicity is that the management has not disclosed information on company-level traits to the market. Under the NAMR, shadow banking regulation regulates the participants of shadow banking, thus breaking management's information advantage, increasing information transparency, and reducing stock price synchronicity. For the mediation test of information transparency, we measure information transparency (Opaque) by the absolute value of the firm's total manipulable accrued profits in the first three aggregation periods, drawing on existing research (Hutton et al., 2009). We find that the higher its absolute value is, the lower the information transparency of the firm is. The specific construction method

Table 10
Mediation effects of agency costs.

VARIABLES	(1) SYN1 _{t+1}	(2) AC _{t+1}	(3) SYN1 _{t+1}	(4) SYN2 _{t+1}	(5) AC _{t+1}	(6) SYN2 _{t+1}
POST*SBD	-0.163*** (-9.09)	-0.131*** (-6.36)	-0.158*** (-8.82)	-0.147*** (-8.92)	-0.131*** (-6.36)	-0.155*** (-8.69)
AC			0.134*** (3.52)			0.132*** (3.31)
DTURN	-0.249*** (-11.04)	-0.022 (-0.38)	-0.243*** (-10.81)	-0.248*** (-11.00)	-0.022 (-0.38)	-0.241*** (-10.73)
SIZE	-0.048*** (-5.11)	-0.028** (-2.49)	-0.043*** (-4.92)	-0.044*** (-5.06)	-0.028** (-2.49)	-0.039*** (-4.83)
LEV	0.065*** (7.48)	-0.065 (-1.10)	0.056*** (7.23)	0.070*** (7.49)	-0.065 (-1.10)	0.063*** (7.35)
ROA	-0.078*** (-3.62)	-0.190*** (-3.62)	-0.072*** (-3.41)	-0.074*** (-3.53)	-0.190*** (-3.76)	-0.068*** (-3.35)
BM	0.242*** (20.48)	-0.011 (-0.26)	0.231*** (20.07)	0.240*** (20.24)	-0.011 (-0.26)	0.229*** (19.86)
DUA	-0.006 (-1.01)	0.155*** (3.72)	-0.003 (-0.85)	-0.002 (-0.87)	0.155*** (3.72)	-0.001 (-0.72)
BOAR	-0.029*** (-3.62)	-0.107 (-0.61)	-0.025*** (-3.39)	-0.017** (-2.03)	-0.107 (-0.61)	-0.013* (-1.76)
LSSR	0.036*** (3.76)	-0.110*** (-2.71)	0.031*** (3.45)	0.038*** (3.89)	-0.110*** (-2.71)	0.033*** (3.62)
AGE	-0.011*** (-3.07)	0.054 (1.39)	-0.007*** (-2.73)	-0.015*** (-3.27)	0.054 (1.39)	-0.010*** (-3.04)
OWN	-0.014** (-2.34)	-0.102* (-1.82)	-0.010** (-2.03)	-0.019** (-2.42)	-0.102* (-1.82)	-0.013** (-2.17)
Constant	0.232 (0.58)	0.258 (1.18)	0.187 (0.29)	0.246 (0.75)	0.258 (1.18)	0.195 (0.42)
Year	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES
Observations	16530	16530	16530	16530	16530	16530
R-squared	0.396	0.334	0.405	0.393	0.334	0.402

Table 10 shows the results of the test for mediating test for the agency costs. In Columns (1)–(3) and (4)–(6), the dependent variables are the SYN1 and SYN2, respectively. Appendix A provides detailed definitions of other variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

is as follows.

$$OPAQUE_{it} = AbsV(DTAC_{i,t-2}) + AbsV(DTAC_{i,t-1}) + AbsV(DTAC_{i,t-1}) \quad (10)$$

where DTAC is the total manipulable accrued profit, deriving from the extended plate Jones model by industry by year (Dechow et al., 1995), and is calculated as follows.

$$\frac{TAC_{i,t}}{Assets_{i,t-1}} = \tau_0 \frac{1}{Assets_{i,t-1}} + \tau_1 \frac{\Delta Sales_{i,t} - \Delta REC_{i,t}}{Assets_{i,t-1}} + \tau_2 \frac{PPE_{i,t}}{Assets_{i,t-1}} + \tau_3 \frac{IA_{i,t}}{Assets_{i,t-1}} + \varepsilon_{i,t} \quad (11)$$

$$DTAC_{i,t} = \frac{TAC_{i,t}}{Assets_{i,t-1}} - \hat{\tau}_0 \frac{1}{Assets_{i,t-1}} - \tau_1 \frac{\Delta Sales_{i,t} - \Delta REC_{i,t}}{Assets_{i,t-1}} - \tau_2 \frac{PPE_{i,t}}{Assets_{i,t-1}} - \tau_3 \frac{IA_{i,t}}{Assets_{i,t-1}} \quad (12)$$

Where TAC is the total accrued profit, which manifests the difference between the annual operating profit and the net cash flow from operating activities; Assets is the total assets at the end of the year; $\Delta Sales$ is the increase in operating revenue for the year over the previous year; ΔREC is the increase in accounts receivable for the year over the previous year; PPE is the original value of fixed assets at the end of the year; IA is the total intangible assets and other long-term assets at the end of the year.

Table 11 presents the results of the mediation effect test for information transparency. The dependent variables in columns (1)–(3) and (4)–(6) are SYN1 and SYN2, respectively. The regression coefficients of POST*SBD and OPAQUE_{t+1} are significantly negative in columns (2) and (5), suggesting that the shadow banking regulation under NAMR

enhances the information transparency of firms. In columns (3) and (6), the regression coefficients of POST*SBD are significantly negative, while the regression coefficients of OPAQUE are significantly positive, verifying the partial mediation effect of information transparency. In addition, the P-value obtained by the Sobel test is 0, and the proportion of mediation effects in the total effect are 42% and 40%, respectively. This suggests that under the NAMR, shadow banking regulation reduces corporate stock price synchronicity by enhancing corporate information transparency, which is reflected in the fact that management is subject to more external supervision and chooses to disclose more idiosyncratic information. Thus, enhancing information transparency is another important mechanism of the NAMR to reduce stock price synchronicity.

8. Further tests

In order to further examine the differences in the impact of shadow banking regulation on firms' stock price synchronicity in different samples of firms, this paper chooses the nature of property rights and the degree of external supervision to conduct group tests, respectively.

8.1. Nature of property rights

The nature of property rights is a unique reflection of Chinese firms. Based on the differences like property rights, listed firms can be categorized into state-owned and private firms. Due to the existence of soft budget constraints and implicit government guarantees, SOEs, especially large SOEs, have easier access to government subsidies and credit resources (Cull & Xu, 2003; Ye et al., 2021), and are able to obtain more and longer-term credit funds at lower costs. As a result, SOEs often incorporate more funds than they need for day-to-day production and operation, and accumulates a large number of pending investments (Cull & Xu, 2003; Cull & Xu, 2003; Wang et al., 2021; Wang et al., 2021).

Table 11

Mediation effects of information transparency.

VARIABLES	(1) SYN1 _{t+1}	(2) OPAQUE _{t+1}	(3) SYN1 _{t+1}	(4) SYN2 _{t+1}	(5) OPAQUE _{t+1}	(6) SYN2 _{t+1}
POST*SBD	-0.163*** (-9.09)	-0.125*** (-6.05)	-0.152*** (-8.69)	-0.147*** (-8.92)	-0.125*** (-6.05)	-0.148*** (-8.47)
OPAQUE			0.148*** (4.13)			0.144*** (3.98)
DTURN	-0.249*** (-11.04)	-0.018 (-1.44)	-0.241*** (-10.62)	-0.248*** (-11.00)	-0.018 (-1.44)	-0.239*** (-10.57)
SIZE	-0.048*** (-5.11)	-0.011*** (-3.61)	-0.039*** (-4.74)	-0.044*** (-5.06)	-0.011*** (-3.61)	-0.037*** (-4.73)
LEV	0.065*** (7.48)	0.056*** (4.58)	0.046*** (7.06)	0.070*** (7.49)	0.056*** (4.58)	0.052*** (7.28)
ROA	-0.078*** (-3.62)	-0.024 (-1.03)	-0.068*** (-3.27)	-0.074*** (-3.53)	-0.024 (-1.03)	-0.057*** (-3.16)
BM	0.242*** (20.48)	-0.037*** (-4.05)	0.227*** (19.81)	0.240*** (20.24)	-0.037*** (-4.05)	0.223*** (19.66)
DUA	-0.006 (-1.01)	0.003 (0.28)	-0.002 (-0.79)	-0.002 (-0.87)	0.003 (0.28)	-0.001 (-0.56)
BOAR	-0.029*** (-3.62)	-0.038*** (-3.59)	-0.020*** (-3.26)	-0.017** (-2.03)	-0.038*** (-3.59)	-0.009 (-1.55)
LSSR	0.036*** (3.76)	0.038*** (2.69)	0.028*** (3.30)	0.038*** (3.89)	0.038*** (2.69)	0.023*** (3.16)
AGE	-0.011*** (-3.07)	0.070*** (8.65)	-0.005** (-2.55)	-0.015*** (-3.27)	0.070*** (8.65)	-0.008*** (-2.88)
OWN	-0.014** (-2.34)	0.016*** (3.97)	-0.007* (-1.91)	-0.019** (-2.42)	0.016*** (3.97)	-0.011** (-2.02)
Constant	0.232 (0.58)	0.296 (1.51)	0.162 (0.17)	0.246 (0.75)	0.196 (1.51)	0.173 (0.33)
Year	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES
Observations	16530	16530	16530	16530	16530	16530
R-squared	0.396	0.328	0.408	0.393	0.328	0.405

Table 11 shows the results of the test for mediating test for the information transparency. In Columns (1)–(3) and (4)–(6), the dependent variables are the SYN1 and SYN2, respectively. Appendix A provides detailed definitions of other variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Under the current environment of insufficient incentive for real investment and high return on financial assets, SOEs are more likely to invest in shadow banking based on the motive of "regulatory arbitrage", crowding out innovation and other industrial investment projects. In addition, due to the serious "insider control" problem in SOEs (Ruan & Liu, 2021; Zhang et al., 2023), investing in shadow banking makes management more indulged in financial speculation and arbitrage, and give up industrial projects, exacerbating the management's moral hazard and opportunistic behavior. Therefore, SOEs are more dependent on shadow banking investments than private firms. However, the NAMR's strict restriction on high shadow banking returns will further inhibit these SOEs from continuously investing their funds in shadow banking. Under the strengthened regulation of shadow banking by the NAMR, this paper argues that SOEs have a higher dependence on shadow banking investment than private firms and are therefore more affected, which will reduce the agency cost and enhance the transparency of corporate information and thus reduce the stock price synchronicity of the firms.

Therefore, to test the difference in stock price synchronicity of firms with different property rights under NAMR, this paper divides the sample into two groups of SOEs and private firms based on the property rights nature OWN. Table 12 shows the grouping test results based on the nature of property rights, in which columns (1) and (3) are for the state-owned firm group, and columns (2) and (4) are for the private firm group. In the private firm group, the regression coefficient of POST*SBD is significantly negative at the 10% level. In contrast, the state-owned firm group's regression coefficient is significantly negative at the 1% level.

The between-group difference test *suest* coefficients are all significant at the 5% level. This indicates that the NAMR reduces the stock price synchronicity of state-owned firms more than that of private firms. This result suggests that the NAMR can play different roles in Chinese

firms with different property rights, and it is more effective for private firms that are more inclined to participate in shadow banking, which has pronounced Chinese policy characteristics.

8.2. Degree of external oversight

Firms engaged in shadow banking investment and financing are likely to raise firms' agency costs, prompt management to conceal idiosyncratic news, and increase information asymmetry (Callen & Fang, 2015; Wu et al., 2021), which makes it challenging to release firm-level idiosyncratic information to the market and hence enhances stock price synchronicity. Especially to firms with insufficient external monitoring, a high degree of agency costs and information asymmetry can affect the truthfulness of stock price information, and it is difficult for investors to know the accurate information inside the firm (Li & Luo, 2020; Wen et al., 2019). In this case, firms' stock prices are more likely to deviate from their operating conditions, further enhancing stock price synchronicity. Therefore, under the NAMR, shadow banking regulation can act as an additional supervision for firms to further reduce stock price synchronicity of firms with insufficient external supervision.

In order to test the changes in stock price synchronicity of firms with different degrees of external supervision under NAMR, drawing on existing studies (An & Zhang, 2013; Kim & Zhang, 2014), this paper chooses analyst attention ANAL and investor shareholding INVE to measure the degree of external supervision, respectively. Because analysts have a professional educational background and focus on specific industries, they can gain an in-depth understanding of the firm's internal affairs and supervise management's malpractices through research and other means. Institutional investors, as essential shareholders of the firm, can effectively monitor the management by actively exercising their supervisory power and participating in corporate governance. Regarding analyst attention ANAL, we use the natural logarithm of the

Table 12
Grouping by ownership nature.

	(1)	(2)	(3)	(4)
	State-owned firms	Private firms	State-owned firms	Private firms
VARIABLES	SYN1 _{t+1}	SYN1 _{t+1}	SYN2 _{t+1}	SYN2 _{t+1}
POST*SBD	-0.150*** (-7.03)	-0.090* (-1.92)	-0.131*** (-6.22)	-0.076* (-1.78)
DTURN	-0.144*** (-3.45)	-0.175*** (-8.76)	-0.148*** (-3.66)	-0.184*** (-8.87)
SIZE	-0.017** (-2.35)	-0.021*** (-3.39)	-0.029** (-2.12)	-0.034*** (-3.50)
LEV	0.034*** (3.23)	0.045*** (5.79)	0.048*** (3.42)	0.054*** (5.85)
ROA	-0.030** (-2.48)	-0.053*** (-3.37)	-0.042*** (-2.67)	-0.062*** (-3.08)
BM	0.122*** (6.15)	0.162*** (13.34)	0.129*** (7.30)	0.176*** (14.16)
DUA	-0.001 (-0.17)	-0.005 (-0.96)	-0.002 (-0.65)	-0.001 (-0.24)
BOAR	-0.015** (-2.41)	-0.020*** (-3.28)	-0.006* (-1.73)	-0.012* (-1.94)
LSSR	0.018** (2.09)	0.027*** (2.69)	0.022** (2.14)	0.030*** (2.83)
AGE	-0.006** (-2.11)	-0.008*** (-2.82)	-0.007** (-2.30)	-0.013*** (-2.91)
Constant	0.276 (1.52)	0.184*** (2.85)	0.289 (1.63)	0.195*** (3.03)
Year	YES	YES	YES	YES
Firm	YES	YES	YES	YES
Observations	6698	9832	6698	9832
R-squared	0.375	0.224	0.361	0.212
Difference in coefficients (p-value)	0.038		0.041	

Table 12 shows the results of the group test based on the ownership nature of firm. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

number of analysts' attention of a firm plus one to measure it, and a more significant value indicates a higher degree of external monitoring. When ANAL is higher than the median for the sample industry year, it is categorized as a high external monitoring group; otherwise, it is categorized as a low external monitoring group. Regarding the investor shareholding INVE, the percentage of institutional investors' shareholding in the firm is taken, and a higher value indicates more external supervision. When INVE is higher than the median for the sample industry year, it is categorized as a high external monitoring group; otherwise, it is categorized as a low external monitoring group.

Table 13 shows the grouping test results based on the degree of external monitoring. Columns (1)–(4) show the grouping based on analyst attention, with columns (1) and (3) being the high analyst attention group and columns (2) and (4) being the low analyst attention group. It can be seen that none of the regression coefficients of POST*SBD are significant in the high analyst attention group. In contrast, in the low analyst attention group, their regression coefficients are all significantly negative at the 1% level. At the same time, the test of intergroup differences suest coefficients are all significant at the 1% level, suggesting that the effect of shadow banking regulation in reducing firms' stock price synchronicity in voting is more significant among firms with low analyst attention. Columns (5)–(8) are based on the institutional investor grouping, with columns (5) and (7) as the high institutional investor shareholding group, and columns (6) and (8) as the low institutional investor shareholding group. It can be seen that the regression coefficients of POST*SBD are all significant at the 10% level in the high institutional investor shareholding group. In contrast, in the low analyst focus group, their regression coefficients are all significantly negative at the 1% level, while the test of intergroup differences suest coefficients

are all significant at the 1% level. This implies that shadow banking can reduce firms' stock price synchronicity in firms with low institutional investor ownership. These results suggest that under the NAMR, shadow banking regulation can partially replace the external monitoring effect of analysts and institutional investors, reduce corporate agency costs, enhance the degree of information asymmetry, and reduce corporate stock price synchronicity.

9. Conclusion

This paper investigates the relationship between shadow banking regulation and corporate stock price synchronicity under the NAMR. Firstly, we argue the relationship between firms' participation in shadow banking and stock price synchronicity from two opposing hypotheses: From the "shadow banking promotion view", shadow banking can provide firms with more investment income, play the role of capital "reservoir", facilitate firms' main business operation, disclose more idiosyncratic information, and reduce stock price synchronicity. From the "shadow banking facilitation view", shadow banking can provide more investment income to firms, play the role of "reservoir" of capital, facilitate the main business of firms, disclose more qualitative information, and reduce stock price synchronicity. From the viewpoint of "shadow banking risk", firms investing in shadow banks is prone to make the management to be short-sighted and "crowd out" the main business, which will aggravate the agency cost and the degree of information asymmetry and lead to the management to hide more special information, and resultantly increase the stock price synchronicity. Secondly, we also argue for the relationship between shadow banking regulation and stock price synchronicity under NAMR based on the opposing hypothesis: from the "shadow banking promotion view", shadow banking regulation may exacerbate the financing constraints of firms under NAMR, which triggers the self-interested motive of management to carry out surplus management to increase the agency cost, hide more damaging information to reduce the agency cost and the information asymmetry degree. The new regulations may increase corporate financing constraints, trigger management's self-interested incentives to be engaged in surplus management to increase agency costs, hide more damaging information to reduce information transparency, and thus increase stock price synchronicity. From the perspective of the "Shadow Banking Risk View", under the NAMR, shadow banking regulation reduces the high yield of shadow banking, standardizes the main participants of shadow banking, which breaks the information advantage of management, reduces the agency cost, improves the information transparency, and ultimately reduces the stock price synchronicity.

Based on the above analysis, this paper selects Chinese Shanghai and Shenzhen A-share listed firms from 2013 to 2021 as the research sample and firstly adopts the fixed effect model to test the relationship between firms' participation in shadow banking investment and stock price synchronicity. Meanwhile, the research also adopts the generalized double-difference method based on the solicitation draft of the NAMR released in 2017 as the natural experiment to empirically test the relationship between shadow banking regulation and the relationship between corporate stock price synchronicity. It is found that firms' participation in shadow banking investments leads to higher stock price synchronicity. Shadow banking regulation reduces firms' stock price synchronicity under NAMR, which rules out the "shadow banking facilitator" hypothesis. This finding still holds after a series of endogeneity and robustness tests, which helps to analyze the significance of NAMR at the micro level of firms, as it affects not only the macro capital market but also the stock price synchronicity of micro firms.

In order to verify the hypothesis analysis, this paper conducts the mediation mechanism test of corporate information transparency and agency costs. We find that shadow banking regulation can reduce stock price synchronicity by lowering agency costs and enhancing information transparency, which fully supports the "shadow banking risk perception" hypothesis. Our study demonstrates that the risks associated with the

Table 13
Grouping of the degree of external supervision.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High analyst attention	Low analyst attention	High analyst attention	Low analyst attention	High institutional investor shareholding	Low institutional investor shareholding	High institutional investor shareholding	Low institutional investor shareholding
VARIABLES	SYN1 _{t+1}	SYN1 _{t+1}	SYN2 _{t+1}	SYN2 _{t+1}	SYN1 _{t+1}	SYN1 _{t+1}	SYN2 _{t+1}	SYN2 _{t+1}
POST*SBD	-0.078 (-0.68)	-0.189*** (-11.67)	-0.057 (-0.55)	-0.164*** (-10.39)	-0.083* (-1.82)	-0.146*** (-7.75)	-0.068* (-1.69)	-0.127*** (-6.97)
DTURN	-0.218*** (-9.10)	-0.149** (-2.44)	-0.214*** (-8.98)	-0.153** (-2.55)	-0.151*** (-8.90)	-0.106*** (-2.88)	-0.149*** (-8.52)	-0.103*** (-2.68)
SIZE	-0.040*** (-4.48)	-0.011*** (-3.04)	-0.035*** (-4.37)	-0.014*** (-3.16)	-0.033*** (-4.36)	-0.016* (-1.95)	-0.031*** (-4.21)	-0.013* (-1.88)
LEV	0.056*** (6.26)	0.022*** (2.90)	0.051*** (6.17)	0.025*** (3.03)	0.058*** (6.75)	0.027** (2.12)	0.060*** (6.57)	0.088* (1.90)
ROA	-0.066*** (-3.55)	-0.030 (-1.13)	-0.060*** (-3.46)	-0.038 (-1.28)	-0.064*** (-3.46)	-0.012* (-1.84)	-0.058*** (-3.20)	-0.010* (-1.72)
BM	0.223*** (18.33)	0.115*** (10.16)	0.219*** (18.10)	0.123*** (10.23)	0.213*** (18.24)	0.111*** (2.82)	0.208*** (18.08)	0.104*** (2.69)
DUA	-0.004 (-0.95)	-0.001 (-0.15)	-0.003 (-0.76)	-0.002 (-0.27)	-0.005 (-0.83)	-0.003 (-0.39)	-0.002 (-0.72)	-0.001 (-0.23)
BOAR	-0.024*** (-3.31)	-0.011* (-1.75)	-0.014* (-1.86)	-0.008 (-1.24)	-0.022*** (-3.19)	-0.015** (-2.37)	-0.014* (-1.86)	-0.009 (-1.10)
LSSR	0.028*** (3.40)	0.012* (1.90)	0.032*** (3.52)	0.018** (1.98)	0.030*** (3.63)	0.012 (0.17)	0.032*** (3.74)	0.014 (0.22)
AGE	-0.007*** (-2.89)	-0.004* (-1.77)	-0.012*** (-3.04)	-0.006* (-1.94)	-0.008*** (-2.80)	-0.001 (-1.15)	-0.013*** (-2.91)	-0.004 (-1.22)
OWN	-0.011** (-2.07)	-0.006 (-1.25)	-0.016** (-2.14)	-0.009 (-1.46)	-0.011** (-2.13)	-0.006* (-1.82)	-0.015** (-2.28)	-0.009* (-1.91)
Constant	0.598*** (16.60)	0.224 (0.42)	0.631*** (17.71)	0.237 (0.50)	0.187*** (2.96)	0.243 (1.52)	0.212*** (3.25)	0.257 (1.63)
Year	YES	YES	YES	YES	YES	YES	YES	YES
Firm	YES	YES	YES	YES	YES	YES	YES	YES
Observations	7178	9352	7178	9352	8042	8488	8042	8488
R-squared	0.177	0.401	0.171	0.392	0.217	0.386	0.206	0.373
Difference in coefficients (p- value)	0.001		0.002		0.020		0.027	

Table 13 shows the results of the subgroup tests based on the degree of external supervision. Columns (1)–(4) are grouped according to analyst focus, and columns (5)–(8) are grouped according to institutional investors. Appendix A provides detailed definitions of all variables. T-statistics, based on robust standard errors adjusted for heteroskedasticity and clustered at the firm level, are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

over-expansion of shadow banking in China outweigh the benefits. Although the NAMR may put more significant pressure on financial institutions to rectify the situation, it may limit the financing channels of some companies and reduce the high returns of companies investing in the financial sector. However, the NAMR does serve to regulate shadow banking and reduce corporate stock price synchronicity. In the long run, the NAMR can better help firms avoid the risks brought by shadow banking and promote the healthy development of the capital market.

In addition, this paper also conducts a test based on the nature of property rights and different degrees of external supervision grouping. We find that first, for state-owned firms and firms with a weak degree of external supervision, the more significant effect shadow banking regulation has in reducing stock price synchronicity. This result is more broadly significant, demonstrating the change in stock price synchronicity of Chinese firms with different characteristics after the release of the NAMR. Our results provide a new perspective for the study of shadow banking, i.e., the NAMR gives us a suitable event of shadow banking regulation to explore the impact on firms, as the existing literature has yet to study the economic consequences of shadow banking regulation. Our findings also illustrate China's efforts to control shadow banking, defuse virtual economy bubbles, and boost the real economy.

The results of this paper also provide some insights for other developing countries. Since 2008, on the one hand, local governments have used shadow banking to raise funds due to the large-scale investment in infrastructure and real estate development by the Chinese government. On the other hand, the lending market has developed abnormally

because China's market mechanism is not perfect enough (Lu et al., 2015). These reasons lead informal finance, such as shadow banking, to flourish quickly. The tendency of "financialization" and "maturity mismatch" of firms, driven by the profit-seeking motive, raises the agency cost and reduces information transparency, which could be more conducive to developing firms and national financial security. The NAMR is China's solid regulatory policy to deal with shadow banking, and the conclusions of this paper also manifests that the policy can reduce stock price synchronicity. Therefore, other developing countries can consider setting some thresholds for informal financial systems, establishing a stricter regulatory system for these financial institutions, and upgrading the implementation capacity of formal financial institutions, etc., to ensure the healthy development of firms and the country.

Of course, this paper has some limitations. First, this paper is based on the background of China, and the conclusions drawn are more applicable to developing countries. For developed countries, where the economic market is more complete, the applicability of this paper's conclusions is questionable. Therefore, in the future, the impact of the regulation of informal financial business on the risk of corporate stock price collapse in the context of developed countries can be investigated. Second, as the weightiest financial supervision policy in China at present, the NAMR has a lot of room for further exploring its economic consequences, such as systemic financial risk, credit resource allocation efficiency, and monetary policy effectiveness at the macro level, as well as corporate R&D investment and firm value at the micro level. Finally, there is also scope to focus on exploring the impact of the NAMR on

formal financial institutions. Under the severe impact of the NAMR pneumonia epidemic COVID-19 on the global economy, firms are experiencing increased operating difficulties, and the New NAMR Regulations have indeed reduced additional financing channels for firms. In this circumstance, banks, as formal financial institutions, are bound to bear the pressure of providing firms with sufficient financing amounts. Therefore, the NAMR can be studied in the future concerning banks' lending rate, lending scale, and lending risk.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bir.2023.11.004>.

Appendix A. Variable definition

Variable type	Variable name	Variable symbol	Variable definition
Dependent variable	Stock price synchronicity	SYN1	The calculations are shown in models (3) and (4), where the individual stock return is the individual stock return without considering cash dividends, and the higher the value, the higher the stock price synchronicity
		SYN2	The calculation is shown in models (3) and (4), where the individual stock return rate is the individual stock return rate considering the cash dividend, the larger the value, the higher the stock price synchronicity
Independent variable	Policy Variable	SBD	Shadow banking dependence is obtained by summing up entrusted loans, entrusted wealth management, private lending, and the purchase of various types of shadow credit products and then dividing them by total assets. SBD is a proxy variable for the average shadow banking dependence of firms at the end of the 4-period period prior to the release of the policy. Larger values indicate that firms are more severely affected by NAMR
Control variables	Time variable	POST	takes the value of 0 for the year before the policy and 1 for the year after the policy
	Stock excess exchange rate	DTURN	The difference between the monthly average turnover rate of stock <i>i</i> in year <i>t</i> and the monthly average turnover rate of stock <i>i</i> in year <i>t</i> -1
	Firm size	SIZE	Natural logarithm of total assets
	Gearing ratio	LEV	Total liabilities/total assets
	Return on assets	ROA	Net profit/total assets
	Book-to-market ratio	BM	Ratio of market value to book value of the firm
	Two positions in one	DUA	Takes the value of 1 if the chairman and CEO are the same person, otherwise 0
	Board size	BOAR	Logarithm of the number of board of directors
	Shareholding ratio of the first largest shareholder	LSSR	The ratio of shares held by the first largest shareholder to all stocks
	Age of the firm	AGE	Logarithm of the time the firm has been listed
	Ownership nature	OWN	Takes the value of 1 if the firm is a state-owned firm, and 0 otherwise
	Year	YEAR	Year dummy variable, takes the value of 1 if the observation falls in that year, otherwise it takes the value of 0
Robustness test	Industry	IND	Industry dummy variable, which takes the value of 1 if the observation falls in the industry and 0 otherwise
	Stock price synchronicity replacement variable	SYN3	The calculations are shown in models (3) and (4), where the individual stock return is the individual stock return without considering cash dividends, and the higher the value, the higher the stock price synchronicity
		SYN4	The calculations are shown in models (3) and (4), where the individual stock return is the individual stock return taking into account the cash dividend, and the larger the value, the higher the stock price synchronicity
	Policy variable replacement variable	SBD1	The shadow banking dependence is obtained by summing entrusted loans, entrusted finance, other receivables and purchase of various shadow credit products and dividing by total assets, and SBD1 is a proxy variable for the average shadow banking dependence of the firms at the end of the four periods before the policy was issued
Mediating variables	Agency costs	AC	Management on-the-job spending ratio, i.e., overhead/revenue, with higher values indicating higher agency costs for the firm
	Information transparency	OPAQUE	Absolute value of modified Jones model residuals
Subgroup variables	Ownership Nature	OWN	If the firm is a state-owned firm, the value of 1 is taken, otherwise 0 is taken
	Analysts' attention	ANAL	The number of analyst concerns plus 1 is taken as logarithm
	Institutional investor holdings	INVE	The number of stocks held by institutional investors as a percentage of all stocks

Appendix B. Correlation analysis

and Social Sciences (China) [19BGJ001]

Note

No conflict of interest exists in the submission of this manuscript, and manuscript is approved by all authors for publication. The manuscript does not involve studies with human participants and/or animals. I would like to declare on behalf of my co-authors that the work described was original research that has not been published previously, and not under consideration for publication elsewhere, in whole or in part. All the authors listed have approved the manuscript that is enclosed.

	SYN1	SYN2	SBD	POST	DTURN	SIZE	LEV
SYN1	1						
SYN2	0.867***	1					
SBD	0.125***	0.104***	1				
POST	-0.067***	-0.051***	-0.025***	1			
DTURN	-0.043***	-0.042***	-0.001	-0.109***	1		
SIZE	-0.036***	-0.034***	-0.003	0.061***	0.109***	1	
LEV	0.043***	0.046***	-0.005	-0.090***	0.119***	0.241***	1
ROA	-0.062***	-0.064***	-0.009	0.028***	-0.064***	-0.032***	-0.224***
BM	0.131***	0.129***	-0.017**	0.198***	-0.015*	0.210***	0.238***
DUA	-0.005	-0.002	-0.001	0.082***	-0.103***	-0.168***	-0.112***
BOAR	-0.020***	-0.013***	-0.018**	-0.081***	0.050***	0.273***	0.134***
LSSR	0.026***	0.031***	0.022***	-0.012	-0.055***	0.212***	0.010
AGE	-0.008*	-0.011***	-0.010	0.238***	0.137***	0.051***	0.107***
OWN	0.009***	0.012***	-0.005	-0.115***	0.162***	0.312***	0.217***
	ROA	BM	DUA	BOAR	LSSR	AGE	OWN
ROA	1						
BM	-0.096***	1					
DUA	0.050***	-0.108***	1				
BOAR	-0.016*	0.158***	-0.173***	1			
LSSR	0.058***	0.168***	-0.056***	0.008	1		
AGE	-0.056***	0.065***	-0.077***	0.015	-0.221***	1	
OWN	-0.111***	0.219***	-0.312***	0.227***	0.162***	0.107***	1

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奖状

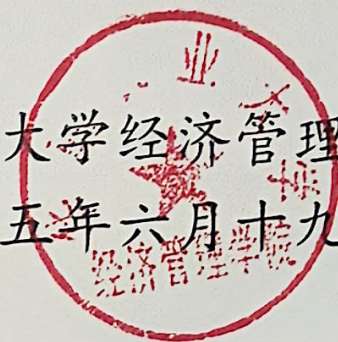
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华南农业大学经济管理学院
二零二五年六月十九日



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