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Investment screening and venture capital

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Investment Screening and Venture Capital

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ABSTRACT

INVESTMENT SCREENING AND VENTURE CAPITAL

Vera Z. Eichenauer, Stefan Köppl and Monika Köppl-Turyna

In this paper we analyze the effects of investment screening on cross-border venture capital investments in Europe between 2007 and 2022. The data we work with is originally based on PRISM data which has been extended by Eichenauer and Wang and which we combine with deal data from Preqin to assess investment activity. Our results point to unintended negative effects: while the number of actually blocked deals has remained very low, the associated uncertainty and an increase in transaction costs have led to a significant decline in cross-border deals. The effects are stronger in the case of financial (i.e. "non-strategic") investors, for late-stage venture capital deals, and for deals with investors from non-OECD countries. Moreover, we observe changes in the size of deals and their structure. This has profound policy implications for the financing of innovation in Europe.

Keywords: cross-border venture capital, investment screening, Europe, transaction costs

JEL Classification: F55, F21, G24, L14

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1 Introduction

In this work, we focus on two timely topics in international academic and policy discussions: the role of equity financing to stimulate the economy and the question of increasing protectionist policies, in our case in the form of investment screening mechanisms (ISM).[1] During the last decade, many advanced economies have adopted or tightened investment screening policies that require foreign investors to obtain approval from national authorities for investments in firms in "security-sensitive" sectors. National authorities are empowered to review and, if necessary, condition, prohibit, and unwind foreign investments on the grounds of security or public order. Although investment screening might be effective in curbing risks to national security, understanding of its unintended economic effects is still very limited (Eichenauer and Wang, 2024). The main focus of this work is to assess the effect of investment screening on cross-border venture capital investment in Europe.

There are concerns that investment screening has a chilling effect on cross-border investments which are usually welcomed as they promote company growth, innovation, and create jobs. Although investment screening aims to protect national security, it may also hinder economic growth and innovation through a reduction in competition between investors. Screening may discourage foreign investors from investing in certain sectors or countries. The lack of transparency in investment screening procedures and the lack of predictability about future screening criteria creates uncertainty about future investors in the young company and its reselling value (for foreign investors), leading to a reduction in (cross-border) investments.

One problem of ISM is that due to the complexity of the rules and in certain cases

[1] In this paper, ISM and screening refer to screening for risks to national security or public order. Other reasons for screening investments are for political and economic reasons (e.g., to protect domestic industries).

vague definitions, more firms are at times screened than would be necessary by the grounds of public order or security. Moreover, since public officials responsible for the screening in the investment-receiving countries tend to be risk averse in their decision-making, they might opt for broader interpretation of the law, further increasing the uncertainty for investors.[2]

In this research, we focus in particular on the effects of investment screening on cross-border venture capital (VC) investments. VC investments are particularly sensitive to regulatory and policy changes, and taxation, as they often involve high-risk investments. The literature review in the next section suggests that diverse sources of transaction costs play a major role in explaining that foreign VC investments are disproportionately invested in start-ups in some countries rather than in other ones. In line with this argument and findings, we expect that ISM can affect the flow of VC investments, as they complicate the ability of foreign investors to invest in certain sectors, increase the transaction costs and uncertainty, and create new risks for successfully exiting their investments.

We hypothesize that screening foreign investments reduces cross-border VC investments in the screened sectors. Following the argument in Eichenauer and Wang (2024), we suggest that ISM reduce foreign investments through up to four mechanisms: (i) government prohibition of deals, (ii) abortion of (security-threatening) deals (due to discouragement of the authorities; lengthy screening procedures with many questions; burdensome mitigation measures), (iii) intended deterrence effect on security-threatening investments, and (iv) 'lost' investments (i.e. never undertaken; diverted to other countries) due to an increase in uncertainty as well as legal and other transaction

[2]For example, the Viennese start-up company Playbrush was acquired in 2021 by Japanese Sunstar and has been subject to investment screening during the process. It is hardly understandable how a company that produces electronic toothbrushes for children should be subjected to investment screening.

costs.[3] Similarly to Eichenauer and Wang (2024), our empirical approach estimates the overall effect of the four mechanisms. The relative importance of these mechanisms cannot be disentangled. We argue that uncertainty is generally underestimated. As we explain below, anecdotal evidence suggests that an important number of nonthreatening VC transactions 'lost' due to uncertainty and transaction costs. Note that the four mechanisms will differ in importance by investor type.

We combine data on cross-border VC investments in European firms with sectoral data on the introduction of investment screening for the years 2007-2022. By applying a triple difference approach to identify the causal effect of ISM on the number of VC transaction, we differentiate out unobserved sectoral and country time-variant and invariant variation. Although there is a security case for introducing investment screening and the increase in security thanks to ISM is unknown to researchers and the broader public, our main results suggest an unintended negative effect: a significant average reduction in the number of cross-border VC transactions, in particular late-stage investments and those originating from outside the OECD countries. Our estimates suggest that without the introduction of sectoral ISM about 2,000 more cross-border VC deals would have been made in Europe in the years 2007-2022 - instead of the observed 7,200 deals in the screened sectors.

The remainder of the paper is structured as follows. In the next section, we briefly describe the context of the introduction of investment screening mechanisms. Section 3 describes the related literature, and Section 4 presents the hypotheses. Section 5 gives an overview of the different data sources, Section 6 describes the modelling technique. Section 7 contains the results and Section 8 concludes.

[3]Publicly available data on screening outcomes is limited. This is due to the intentionally aggregated reporting of national investment screening authorities and the unwillingness of private companies to publicize their subjectivity to screening and even less any failure to pass the national security review (Westbrook, 2019; Bencivelli et al., 2023).

2 The context of investment screening

Cross-border direct investment (Shen et al., 2010; Wang and Sunny Wong, 2009) has the potential to create positive spillovers of knowledge and skills (Phillips and Zhdanov, 2013; Bena and Li, 2014; Stiebale, 2016), better and higher-paying jobs (Javorcik, 2014), and access to cheaper finance in the investment receiving country (Serdar Dinc and Erel, 2013). However, openness to international capital also creates vulnerabilities. For decades, countries have paid close attention to risks stemming from foreign involvement or ownership in defense-related industries or basic infrastructures such as water or energy. To manage these risks, countries have either held (partial) public ownership in sensitive companies, prohibited foreign ownership in these sectors, or, in a small number of countries, assessed foreign investors interested in acquiring such companies. Typically, foreign investments are assessed if a foreign entity obtains a certain level of influence in companies operating in 'security-sensitive' sectors,[4] where the number of the latter has rapidly expanded over the last decade (see Figure 2). Government agencies assess the potential impact of screened foreign investment on national security, public order, or in some countries, net benefit.[5]

Over the last decade, a combination of geopolitical tensions, digitisation, and the fact that many frontier technologies such as artificial intelligence can be used for civilian or military purposes alike ('dual use') have led to a proliferation of investment screening across more and broader sectors of national economies. The sectors and thresholds of investment screening mechanisms vary widely in developed countries. Although the vast majority of investments are approved, the European governments have also prohibited

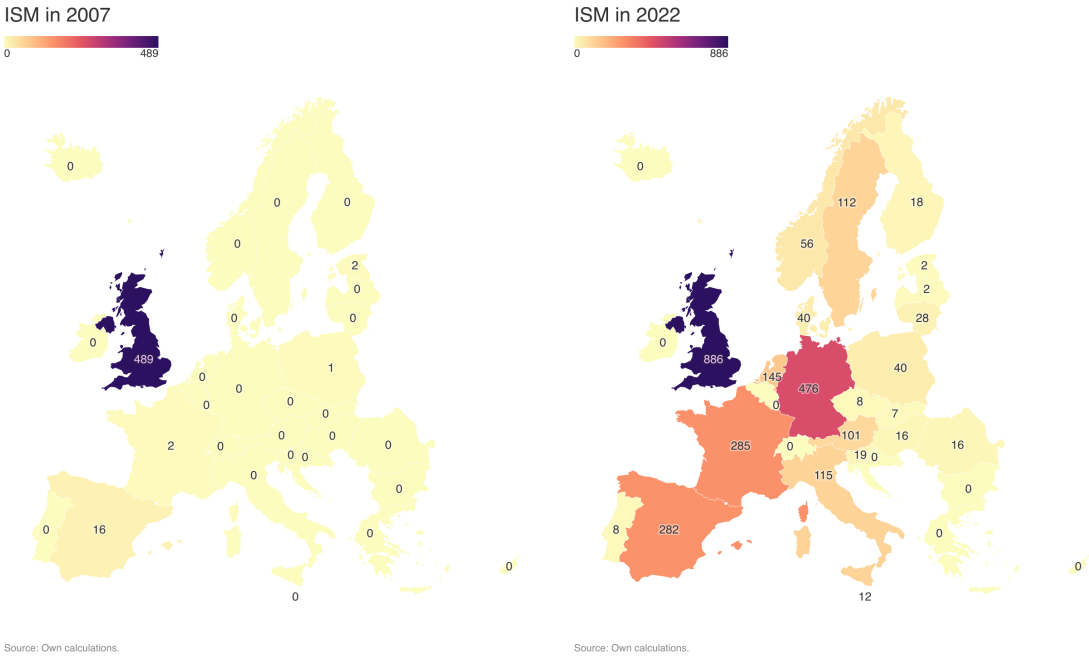
[4]In some countries, the intervention threshold is (in addition) defined by the absolute amount of investment (e.g. the UK) (Kuc, 2019).

[5]Some foreign investments into Canada have to pass the "net benefit" test. Meanwhile, Australia can block foreign acquisitions that are "against the national interest", a concept that includes national security considerations, among other aspects (Pohl and Rosselot, 2020).

some investments or imposed conditions (see Figures 5 and 6 in European Commission, 2021). Moreover, many investments are aborted before a final decision on the screening outcome is obtained due to difficulties in the screening process, explicit discouragement of the authorities, and possibly also because of the length of the screening process which might last longer than the long-stop date in the contract between investor(s) and target firm.

OECD (2009) proposed investment screening in 2009 as a less constraining alternative to completely prohibiting foreign investment in security sensitive sectors. In the last decade, public concerns about some high-technology acquisitions and the general increase in acquisitions by Chinese investors and other investors with close state connections such as sovereign wealth funds have increased. In 2017, the EU proposed guidelines for those EU member states that screened foreign investments that were adopted in 2019 and fully applies since 2020 (EU-COM Regulation 2020/1298). The EU Investment Screening Framework did not, however, require EU member states to introduce investment screening. The changing debate on the risks of openness to international investments can be considered part of broader geopolitical changes (Roberts et al., 2019; Otero-Iglesias and Weissenegger, 2020). Chan and Meunier (2021) find that public officials in countries with a higher technological level and with Chinese investments in high-tech sectors were more favorable to an EU-wide investment screening framework (see also Eichenauer et al., 2021; Bauerle Danzman and Meunier, 2023). Until the beginning of the 21st century, few countries screened investments in a limited number of sectors, such as defense or key infrastructure (Lenihan, 2018). Today, many developed countries have identified new types of risks, linked to sensitive (personal) data, food security, or dual use technology such as AI. As a consequence, the number of security-sensitive 'sectors' has expanded significantly, resembling a cascading effect (Bourles et al., 2024). Figure 1 shows the number of screened sector-country-pairs in Europe in 2007

Figure 1: The number of screened sector-country pairs in 2007 (left) and 2022 (right)



(a) 2007 (b) 2022

and 2022, indicating a strong increase.

3 Related Literature

This paper is related to the literature on the impact of VC on economic outcomes such as innovation rates, absorptive capacity, employment, and growth. The literature identifies two effects through which VC investments can lead to positive economic outcomes compared to other types of public or private investments.

VC is a form of private equity financing in which investors provide funds to early-stage, high-potential, and often technology-driven startups or small companies that are deemed to have significant growth potential. In return, these investors, known as venture capitalists, receive equity ownership in the company, allowing them to eventually profit if the company succeeds and goes public or is acquired at a higher price. Typically,

the role of venture capitalists goes beyond the financial support of young companies. The latter role of the investors is known in the literature as the 'value-added effect'. The proposition that venture capitalists can improve the value of a company beyond the provision of finance has found considerable support in the literature (Gorman and Sahlman, 1989; Lerner, 2022; Croce et al., 2013; Brander et al., 2015). Venture capitalists can play an active role in many aspects of the strategic and operational behavior of their portfolio companies, including recruiting key personnel, developing business plans, and networking with other companies, customers, and investors (Hellmann and Puri, 2000, 2002; Hsu, 2004; Sørensen, 2007). Its effects include and are not limited to: increasing the size of companies (Popov, 2014), strengthening the governance of firms (Hochberg, 2012), and improving the values of IPOs if conducted by syndicates (Tian, 2012).

Involvement of venture capitalists in firms can lead to more innovative capacity. Kortum and Lerner (2001) show, by estimating a patent production function for US data, that more VC funding leads to a higher patent-acceptance rate. Popov and Roosenboom (2012) and Faria and Barbosa (2014) confirm this positive effect in their analyses of European countries. More specifically, Faria and Barbosa (2014) find that only later stages of VC investment support innovation (defined as patenting activity). This is particularly important in the context of the present study as in Europe most later-stage financing is provided from abroad, mostly from outside the EU. Therefore, restrictions or even just additional hurdles for international investment could potentially be particularly harmful for the European economy.

Furthermore, possibly through its effect on innovation, VC financing has been found to affect economic growth. Kolmakov et al. (2015) shows, by performing a regression analysis on US data, that VC investment significantly and positively affects growth. Also Pistoresi and Venturelli (2015) find a positive effect of VC on growth by using a generalized method of moments (GMM) on data from 53 regions across Italy, Spain, and

Germany. They also conclude that the contribution of VC investments is more effective in less developed European regions. Pradhan et al. (2019) study the links between digital infrastructure, VC investment, and economic growth by using data from 25 European countries between 1989 and 2016. They similarly find evidence that VC investment affects economic growth positively through the channel of digitization: late-stage VC investment has led to an increase in internet usage, which in turn affected long-term growth. Opp (2019) find that VC-backed innovations have led to agents' consumption growth in a general equilibrium model. The results reflect the contribution of VC on three channels: the endogenous arrival rate of innovations, the quality of innovations, and the performance of the industries which were backed by VC. Also Samila and Sorenson (2011) find, by analyzing data from the metropolitan areas in the United States from 1993 to 2002, that VC investment positively affects the number of firm starts, employment, and aggregate income. The channel is drawn as follows: VC investment increases the number of new firms, which increases employment and ultimately increases growth.

There is some evidence on the effects of cross-border VC investments in particular, but this literature is still fairly scarce. However, cross-border capital investments seem to have advantages. Devigne et al. (2013) find, by tracking sales, total assets, and payroll expenses in 761 European technology companies, that companies which are backed by both foreign and domestic VC outperform those firms that are only backed by one of them. This result is also supported by the empirical findings of Chemmanur et al. (2016), who analyze 30,071 venture-backed firms from 41 countries and find that those who have been backed by both international and domestic VC had more successful exits and higher post-initial public offering (IPO) operating performances than purely international or nationally backed firms. Dai et al. (2012) supports that result by analyzing the Asian VC market. They also find that firms which had been backed by both type of VC are more likely to be successfully exited. This evidence suggests that cross-border VC investments

allow for more diverse boards and advice which leads to a better performance of the firms. On the other hand, some researchers have raised the concern that foreign VC investment increases the risk of firm relocation, which would ultimately damage domestic economic development (Bertoni and Groh, 2014). However, there is no supporting evidence for this claim. It is even contradicted, for example, by De Prijcker et al. (2019), who find the opposite. They show that firms in areas with limited access to VC were more likely to relocate to VC-rich states within the United States.

Venture capital (VC) investments are highly sensitive to regulatory and policy changes, as well as taxation, given their inherently high-risk nature. For example, Wustenhagen and Teppo (2006) highlight how regulatory risks contribute to variations in investment across different sectors. Similarly, Dimitrova and Eswar (2022) examine the effects of capital gains taxation on VC activity. Moreover, Cornelli et al. (2023) demonstrate how regulatory sandboxes can enhance access to VC financing in the fintech sector. Regulatory risks also relate to the determinants of cross-border VC investments, specifically (see, e.g., Grilli et al., 2019; Köppl-Turyna et al., 2021, for a comprehensive surveys of the determinants of VC activity). For instance, Hain et al. (2016) reports that cross-border VC activities are negatively affected by certain institutional features, such as under-developed investor and property protection (Peng, 2001), high cultural distance, diverging business ethics and practices (Ahlstrom and Bruton, 2006; Dai and Nahata, 2016), and the perception of corruption (Johan and Najar, 2010). This literature suggests that diverse types of transaction costs play a major role in explaining why foreign VC investments are disproportionately invested in start-ups in some countries rather than other ones. We thus expect that uncertainty and additional costs associated with investment screening could play a similar role in reducing the inflow of VC into screening countries.

This paper is further related to the literature studying foreign investment regulations,

in particular for security reasons. Generally, existing studies find that the stricter FDI regulations have lowered FDI growth (Mistura and Roulet, 2019; Albori et al., 2021). However, these studies use the OECD FDI regulatory restrictiveness index which does not account for FDI regulations motivated by national security reasons. Quantitative research on ISM is still scarce and often focuses on individual countries. For example, Connell and Huang (2014) study the effect of five prohibitions of foreign acquisitions in the US on the broader economy. They find an average of two percent abnormal returns for US-owned and US-domiciled competitors. Frattaroli (2020) finds a negative impact on shareholder value for a French investment screening decree. As channel, he proposes a fall in the expected present value of the takeover premium which is part of the share prices of firms affected by the decree. Eichenauer and Wang (2024) provide the first cross-country analysis using a triple difference-in-difference setting and find a negative effect of investment screening on cross-border mergers and acquisitions into OECD and EU countries from 2007 to 2022.

4 Hypotheses

We expect that investment screening reduces cross-border VC investments to sectors and countries with ISMs in place. This might be a result of direct or different types of indirect effects. The most direct channel is that foreign investments are blocked by the government. However, the number of blocked investments is low[6] Thus, we expect the indirect effects to play a more important role.

Probably the most important indirect channel is uncertainty about being subjected to the ISM and the outcome of the screening process. If there is any doubt as to whether government approval is required for an investment, a company will certainly consult

[6]See e.g., Figure 7 in European Commission (2022).

with specialized lawyers. This consultation is about the requirement and, in cases of voluntary notification, the advantages of an application, the likelihood of approval, and the application costs will determine whether an application and thus the planned investment is made at all. There is also uncertainty about the outcome of the investment screening process. This is due to the broad screening criteria and limited information about past screening for similar companies due to the sensitivity of the issue for investors, target companies, and the government. This channel implies that transaction costs increase. All in all, we expect the introduction of investment screening to negatively affect the number of cross-border VC deals.

Hypothesis 1. *The number of cross-border VC investments falls after the introduction of investment screening.*

However, we expect several heterogeneous effects, in particular regarding the **type of investors** involved and the **stage of financing**. When it comes to the types of investor, we differentiate between strategic investors as opposed to those driven by financial motives, and also consider state-owned companies separately. The two types of investors have different investment incentives and thus different sensitivity to the introduction of screening mechanisms.

On the one hand, there are strategic VC investors that have a medium-term outlook and are interested in holding or (co-)developing particular technologies. They would thus be interested only in a narrow set of firms producing or developing the particular products of interests. These investors could be corporate investors, industry associations, infrastructure and natural-resources firms, or software companies. On the other hand, financial VC investors are primarily interested in the financial returns generated by their equity investment if they improve the overall performance of their financial portfolio. These investors likely consider a broader set of start-ups in different sectors. Examples include asset managers, pension funds, hedge funds, investment banks, private equity

firms, family offices, or academic institutions.

We hypothesize that those two types of investors might react differently to the introduction of investment screening. 'Strategic' investors are likely to be more interested in one particular or a few firms headquartered in particular countries, and their demand should be more inelastic. 'Financially' motivated investors are more likely to decline to renew their investments in countries that have introduced ISM by investing in countries that do not screen investments. We call this 'the investor effect'.

Note that we do not observe the considerations of different investors but only the observed outcome, namely the number of deals by investor type. This observed result also depends on the potentially differential reaction of the screening authorities to the investor type. The government may be more concerned about investors with strategic intentions and complementary technology than profit-maximizing investors that are neutral about the technology and knowledge acquired as part of their equity investment. We, thus, conjecture that strategic investors are likely to be scrutinized more rigorously, having conditions imposed, or even seeing their investment blocked. We call this 'the regulator effect'. We expect the investor effect to dominate the regulator effect because few deals are blocked in total and because strategic investors might still accept a deal with conditions and are less likely to withdraw their application than financial investors.

Hypothesis 2. *The number of deals by strategic investors should decrease less than the number of deals by non-strategic (i.e., financial) investors following the introduction of investment screening.*

Finally, a distinctive feature of European VC markets is the fact that later stages of funding are more likely to involve foreign investors. This is generally due to the fact that European countries, with several exceptions (e.g. the United Kingdom), have fairly small equity markets compared to the market size and that the availability of VC is limited. The problem becomes more severe in later financing rounds because these

involve much higher volumes of financing. In many cases, late-stage financing rounds involve investors from the US and Asia and, most recently, from the Arabic peninsula to assemble the necessary investment volume. Moreover, late-stage rounds are a much better predictor of a consecutive exit (typically a merger or an acquisition by foreign investors), thus renewing the risk of a violation of strategic interest of a country. Since investment screening has been increasing over time, investors might expect that (more) stringent rules in the future might make it difficult to sell the company at a good price, e.g., by reducing the circle of potential buyers or by receiving conditions. For these two reasons, we expect that the late-stage, larger rounds will be more strongly affected by the screening procedures compared to early-stage rounds.

Hypothesis 3. *The number of late-stage deals will fall more than early-stage deals following the introduction of investment screening.*

Since the introduction of ISM is to protect national security interests in particular from investors with close links to authoritarian governments such as China or Russia, we further expect that there will be systematic differences in the level of screening scrutiny and outcomes between investments from countries considered more or less 'friendly' and value-aligned. This leads us to our fourth hypothesis:

Hypothesis 4. *Investments from non-OECD countries decrease more than investments from the OECD countries following the introduction of investment screening.*

Besides the effect of the regulation on the number of deals, we also expect the size of deals to change. This is related to the fact that the increase in transaction costs would be of proportionally larger financial importance for smaller deals than for larger ones. Thus, the smaller ('marginal') deals are less likely to take place if the increase in transaction costs is relevant. We will test both the mean and the median size of the deal in order to exclude that the result is outlier-driven.

Hypothesis 5. The average (median) size of the deal increases in the screened sectors.

A possible consequence of larger average deal sizes would be an increase in the average size of the syndicate. If only larger deals are conducted, a larger syndicate might be required to gather enough financing. However, an increase in syndicate size could also suggest that each syndicate partner acquires a lower share of the company, which could be used as a vehicle to 'circumvent' the regulation regarding equity thresholds. However, we cannot test this possibility directly in the current set-up due to data limitations.

Hypothesis 6. The average (median) size of the syndicate increases in the screened sectors.

Finally, one might reasonably assume that regulators will screen an investor who has already successfully passed investment screening less rigorously in the future when applying to the same authority. For example, this applies to investors who have provided financing in a previous round and participate again in follow-up rounds of financing. The transaction costs and the uncertainty about the outcome of screening would be lower because part of the investor-target couple(s) have already been screened.

Hypothesis 7. The share of repeated investors in follow-up rounds increases in screened sectors.

5 Data

5.1 Data Sources

The data on ISM is originally based on PRISM data from Bauerle Danzman and Meunier (2023) that provide annual information on sector-specific investment screening for OECD countries between 2007 and 2021. Eichenauer and Wang (2024) have extended the data in four ways: they added 2022, they re-coded investment screening mechanisms for all European Union (EU) countries, add the precise dates of adoption and entry into force

of the regulations and relevant amendments, and include information about the source countries of investments that are subject to screening. Using the introduction dates for the sectoral investment screening regulations, our analysis captures the response to the new regulations at a more fine-grained temporal level. The data includes information about 35 "sectors" or security dimensions such as artificial intelligence, water infrastructure, or sensitive personal information (see Table 9 in the Appendix).

Information about VC deals comes from the Preqin database[7]. Information on investments in start-ups is available from several commercial datasets, such as Preqin, Crunchbase, Pitchbook, VentureSource and Dealroom, each of which has advantages and disadvantages (Retterath and Braun, 2020). Preqin has the best coverage of investor data, which is a particularly important element for this research. Preqin also has the second highest coverage of deals at 95%, which is slightly worse than VentureSource. VentureSource's coverage has, however, declined over time, while the coverage of other sources has been improving - and since the question of investment screening has only recently become more relevant, Preqin offers a better coverage for the period of interest than other datasets.

The Preqin data are used to identify relevant VC investments, i.e., financing rounds of start-ups. The database covers VC deals in Europe from 1988 to the end of November 2022,[8] but it will be restricted to deals starting from 2007, to account for the time period covered by the ISM data. The focus on Europe is driven by the policy relevance of outside-EU growth financing, as mentioned in the introduction. The number of companies in the restricted sample across all industries is 21,846 and the number of investors is 19,398. Although we only look at target companies in the European Union, the EFTA, and the United Kingdom,[9] investors which participate in these deals may also come from other

[7]https://www.preqin.com/our-products/preqin-pro

[8]The dates reported in the Preqin dataset correspond to the closing date of the deal.

[9]The countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia,

countries. The Preqin data also provide information about both investors and types of deals which will be used as follows. First, we distinguish between different stages of financing. In general, Preqin provides information on rounds, which can then be logically ordered— Pre-Seed or Angel, Seed, Series A, Series B, etc., with each being assigned an integer starting with 1 in the Angel round. The ultimate round – assigned the maximum value of 14 – is one of the following events: Merger, PIPE (private investment in public equity), Pre-IPO or Secondary Stock Purchase (trade sale). This information together with the size of the deal allows us to distinguish between early- and late-stage deals.[10] Additionally, we can identify different types of investors: e.g., pension funds, asset managers, academic institutions or corporate investors, who might have different incentives.

The Preqin data classifies companies in 53 unique industries, 278 sub-industries and 68 industry verticals.[11] These classifications are then matched with the respective 'sectors' that are screened by at least one country. The matching process takes both the sub-industry and the industry vertical into account. For instance, for the investment screening sector 'Education and training' we can match both a sub-industry 'Education & Training Services' and a vertical 'EdTech'. In most cases, this assignment process results in a classification of the company into the same screening sector. However, in two cases, we need to take additional steps. First, some ISM sectors require a certain combination of a sub-industry and a vertical to be classified as falling into

Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the UK

[10]The reason for also applying the information on the size is to cross-validate and correct the rounds, which are misclassified. For instance, if a next round after Seed is coded as Series A, but the amount of financing or/and size of the syndicate decrease, we consider it a bridge round. The exact procedure for cross-validating the data is described in Köppl-Turyna et al. (2022).

[11]An industry vertical, often simply referred to as a 'vertical,' is a specific technology or niche within an economy or market that represents a distinct group of businesses, products, or services that share common characteristics or serve a similar customer base. For instance, in the technology sub-industry, cloud computing, internet of things (IoT), or software-as-a-service (SaaS) would be examples of verticals.

the screening process. For instance, the ISM sectors 'Energy infrastructure', 'Water infrastructure', 'Telecommunications infrastructure', 'Transportation infrastructure' and 'Healthcare infrastructure' are classified as such only if they consider the relevant sub-industries and at the same time they are classified as 'Infrastructure' vertical. In all other cases the 'or' operator is applied. Second, in certain cases the same sub-industry could be matched into more than one ISM sector, while this is generally not the case for the verticals. Examples include, e.g., sub-industry 'Defence' which can be matched to ISM sectors 'Defence production' and 'Defence technologies'. In most cases, this is irrelevant for the final screening, as countries who screen one of these two sectors also screen the other sector during the same period.

Finally, we combine the ISM data with the deals data, at the quarterly and yearly basis to analyze the effect of ISM on the number of cross-border deals. The advantage of aggregating the data to longer time spans is the reduction in the sensitivity of estimates to individual observations. The disadvantage is a significant reduction in the number of observations used in the regressions. Using the additional information about the deals described above, we can specify our dependent variable in diverse ways: e.g., separating early- from late-stage deals, or distinguishing between different types of investors (strategic vs. financial investors). The resulting quarterly dataset has 1.6 million observations with about 4.5 percent non-zero values. In the yearly dataset, there are around 385,000 observations, among which up to 11.5 per cent are non-zero observations. The dataset includes deals towards the sample of countries described above with VC originating in more than 100 countries. Using the matching process described above, we find that up to 23 countries screen VC from abroad in 23 sub-industries and 16 vertical industries.

5.2 Definitions of the Variables

As described in Section 4, we want to test how ISM affects VC deals overall before examining whether different groups of investors react differently to the introduction of investment screening. Thus, we construct several outcome variables.

To test Hypothesis 1, we create the main outcome variable, which is the number of cross-border VC deals (from all types of international investors) between a country-pair in a particular sector in a particular period of time. This is the main outcome variable, which is restricted to a certain subset of deals to test Hypotheses 2 to 4.

For Hypothesis 2, we need to define what we mean by 'strategic' versus 'financial' or 'non-strategic' VC investors. We identify the following categories of investors as 'strategic': Corporate Investor, Foundation, Government Agency, Industry Association, Infrastructure - Other, Infrastructure Asset, Infrastructure Firm, Natural Resources - Other, Natural Resources Firm, Software Company. Those types are likely to be interested in particular companies, particular technologies, or particular human resources in their investment decisions, rather than just trying to maximize their financial returns. On the contrary, all other types of investors are defined as 'non-strategic' investors. The full list of types is provided in Table 10 of the Appendix. As the level of observation is the deal and not the individual ticket, we consider an investment 'strategic' if at least one investor in the syndicate is a strategic one. To test Hypothesis 3, we further distinguish between investments originating in OECD and non-OECD countries.

To test Hypothesis 4, we distinguish between early- and late-stage investments. We classify as early-stage the angel and seed rounds, while anything above (starting at Series A) is considered a later-stage financing round. As described above, we cross-validate the coding of rounds using the information on the size of the deals and of the syndicates.

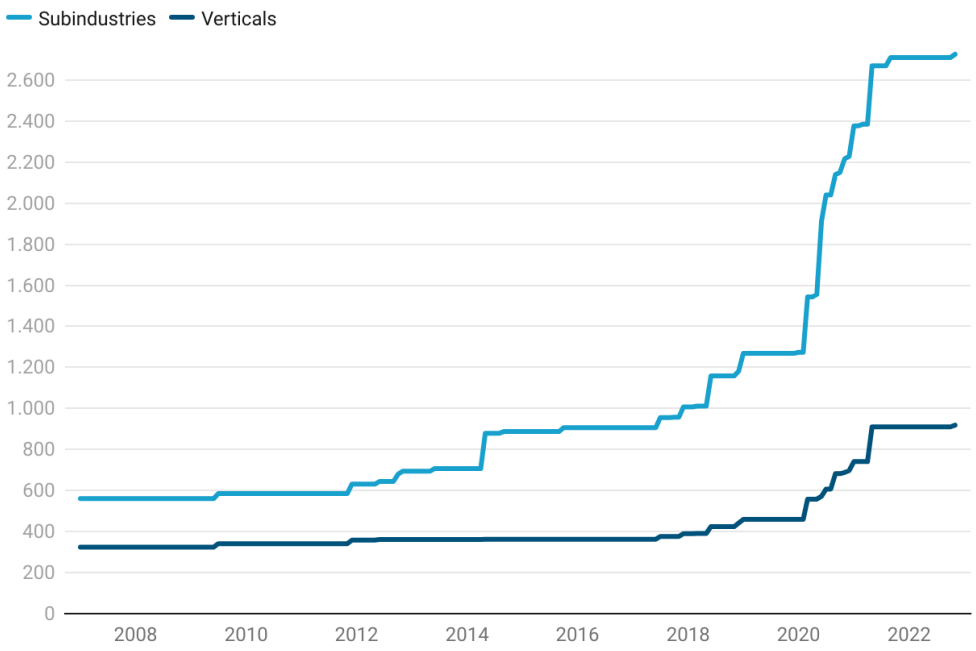
The test Hypotheses 5 and 6, we calculate the average (and median) sizes of deals (expressed in million current US Dollars) and the number of participants per syndicate.

Finally, we look at the structure of the deals in the follow-up rounds, according to our Hypothesis 7. We calculate in each follow-up round per company and use as outcome variable the percentage of investors who have invested in any of the previous rounds in this particular company.

5.3 Descriptive Statistics

The first look at the screening data shows that the number of screening at the level of sector-country-pairs has increased over time with a sharp surge in 2020 (Figure 2).

Figure 2: Number of country-dyad-sector screenings over time

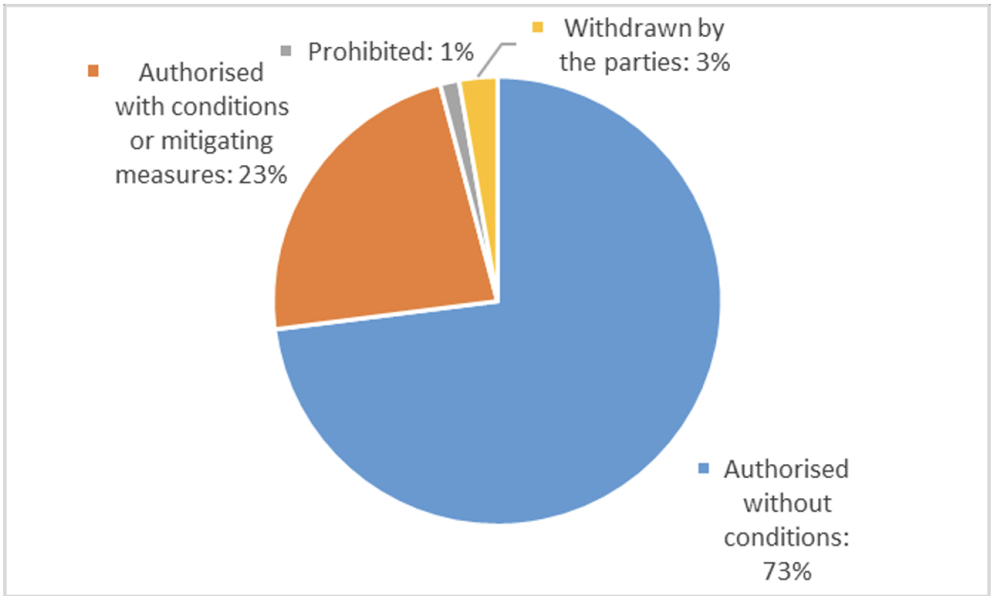


Source: own calculations.

The number of screened sector-country-pairs has hovered around 600 in the years 2007 to 2014 (according to the subindustry definition) and increased after that. It doubled until 2020, and quadrupled from 2020 to 2022 during the COVID-19 period. Nevertheless, the number of prohibitions of deals after screening has remained very low, at 1 percent in the

EU (see Figure 3).

Figure 3: Fraction of prohibited deals in 2022

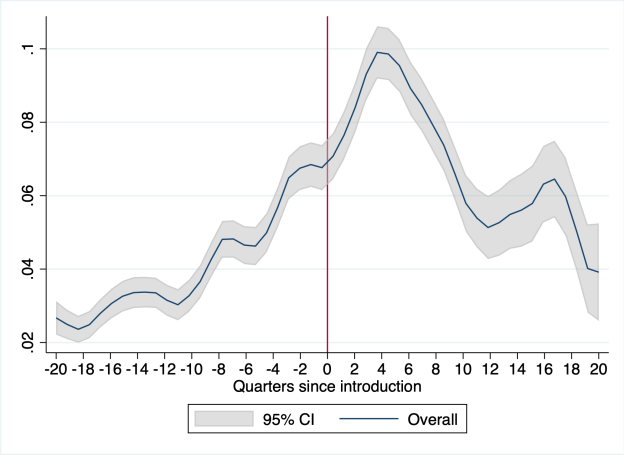


Source: European Commission, Investment Screening Report 2023

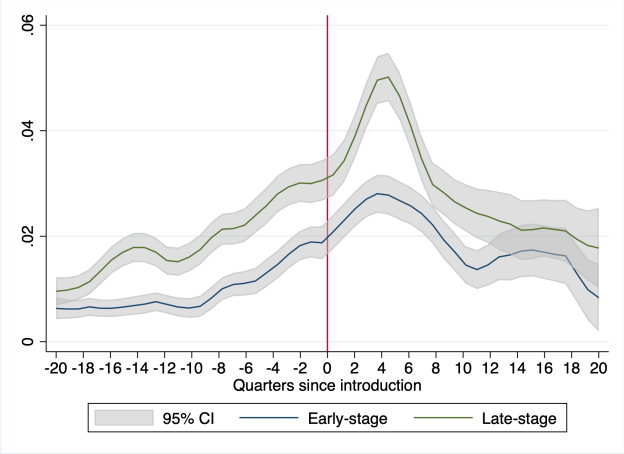
Now we turn to the deal data. Although it is not possible to visually present the staggered triple-difference model which will be estimated, we can take a look at the development of the average number of deals before and after the introduction of investment screening in each sector. The average numbers of deals by quarter (Figure 4) and by year (Figure 5) after the introduction of screening are presented below.

Looking at Figures 4 and 5, we can see that prior to the introduction of investment screening, the overall number of cross-border deals was increasing in most cases. However, there are differences between the different types of investors. First, the number of late-stage deals was increasing somewhat more strongly than the number of early-stage deals, which has primarily to do with the fact that early-stage deals less often involve international investors. Similarly, the number of deals involving strategic investors has been lower and increased more slowly over time. The introduction of ISM has been

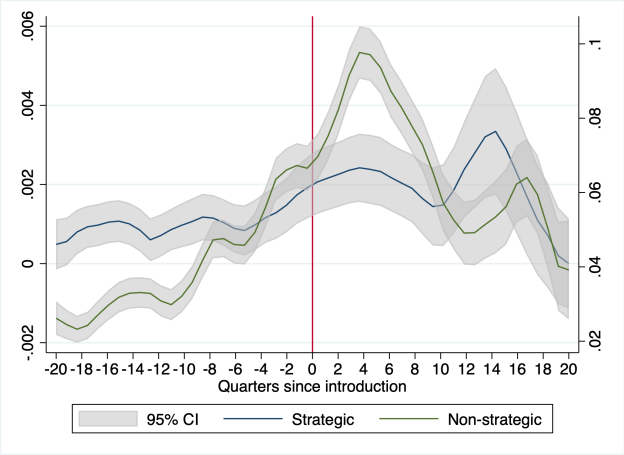
Figure 4: Number of deals (quarterly)



(a) Overall



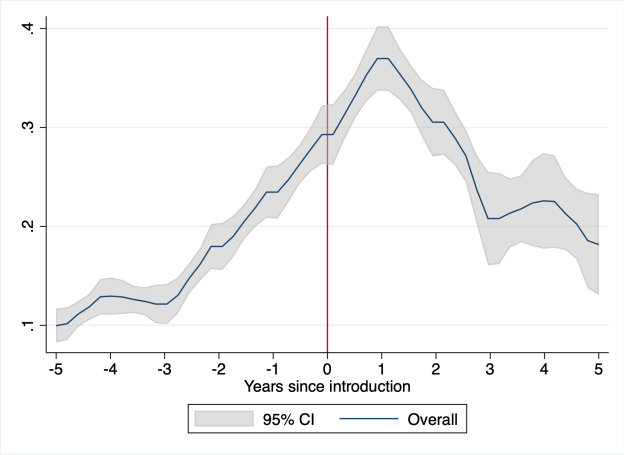
(b) Early- vs. late-stage



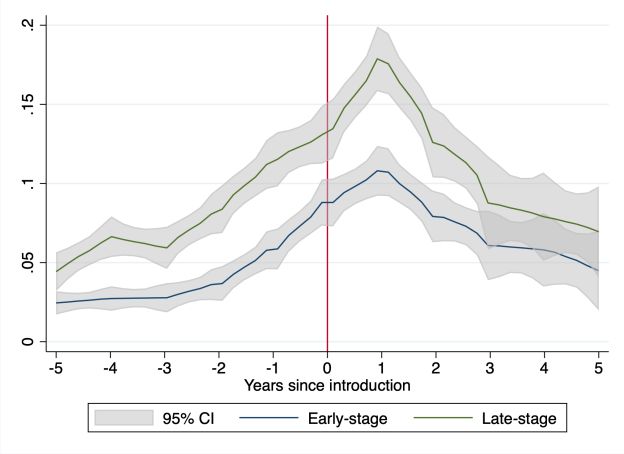
(c) Strategic vs. not strategic

Local polynomial smoothing fit of the number of deals in quarters before and after the introduction of ISM. Scaled so that 0 corresponds to the quarter of introduction.

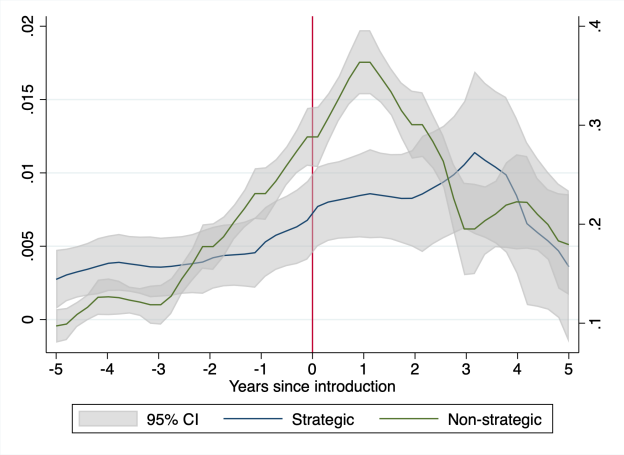
Figure 5: Number of deals (yearly)



(a) Overall



(b) Early- vs. late-stage



(c) Strategic vs. not strategic

Local polynomial smoothing fit of the number of deals in years before and after the introduction of ISM. Scaled so that 0 corresponds to the year of introduction.

followed by a lagged effect at the quarterly levels: a significant decrease in the number of cross-border deals, in particular involving later-stage rounds. A decrease seems to start after about four quarters after the introduction of screening. For the case of strategic vs. non-strategic investors, visual inspection seems to contradict the initial hypotheses, but it might have to do with the fact that the overall number of deals in these groups is lower. Similar patterns can be observed for the yearly data, which to some extent is more reliable for the categories involving fewer deals. Interestingly, Panel (c) of Figure 5 shows that strategic deals do not drop within the first three years after the introduction of screening. The drop might, e.g., be related to COVID-19 and, thus, needs to be controlled for in the subsequent regressions. There is evidence that the number of cross-border deals has been affected by the pandemic (Bellavitis et al., 2021). The decline is more pronounced for investments characterized by higher uncertainty for investors and by international investors. These changes in investment flows could potentially affect our results in non-random ways.[12] Given these findings, we restrict the sample to the observations before Q1 2020 to account for the economic changes related to the global spread of the COVID-19 pandemic and associated restrictions. All in all, a descriptive look at the data seems to confirm our hypotheses, but needs to be confirmed in a more rigorous empirical framework.

[12]The COVID-19 pandemic affected how VC investments worked: Quarantines, social distancing, business closures, and travel restrictions made it difficult for investors to carry out due diligence and close deals. This in itself would not be a problem if the effect was homogeneous across industries. The results of Bellavitis et al. (2021), however, show that industries with higher uncertainty are more affected. This is directly related to our hypotheses and could confound the results. Moreover, they show that international deals fell more strongly, which are are also those (by definition) affected by ISM. Thus, the COVID-19 period is a likely confounder in our analyses.

6 Econometric Models

In the baseline model, we use the variation in the data regarding the introduction of investment screening for particular country pairs (source-target dyad) at respective dates in respective sectors. This results, as mentioned above, in about 1.6 million observations. The unit of observation is at the level of the source-target dyad, quarter, and sector. For yearly data, the number of observations is about 385,000. The number of observations for the average size of the deal is lower still as 1) there are missing values in the data, 2) we need to take into account the average size per deal conditional on the fact that at least one deal actually takes place in the considered period, as otherwise we would also be capturing the number of deals. Thus, the sample for deal size in the quarterly data reduces to about 31,000 observations for all stages and investor types.

The main estimated equation is

$$y_{sti\tau} = exp(\mathbb{1}_{sti}\beta + \mathbb{X}'_{sti\tau}\gamma + \delta_{st} + \phi_{s\tau} + \psi_{t\tau}) \times u_{sti\tau}, \tag{1}$$

where s denotes the source country (i.e., where the investment originates), t is the target country (i.e., where the investee company is located), i refers to the sector, and τ indicates the time (quarters or years). The dependent variable is a number of cross-border VC deals taking place in a particular quarter or year τ originating from country s and targeting at a company in country t in sector i. We define the dependent variable either as the overall number of VC deals, a subset of deals, or the average deal size to test each of the hypotheses. The indicator function $\mathbb{1}$ indicates a dummy variable taking a value 1 if screening is present in country t and sector i for investments originating in country s. The variable equals zero for the quarters (years) before the introduction of the ISM policy for source-target-sectors with an ISM or remains zero for all years in the case of source-target-sectors without an ISM during the sample period. Robust error terms are clustered

at the target country-quarter level. This allows for correlation with target country-quarter level: most macroeconomic variables relevant for investments are country-specific are typically available at quarterly frequency (e.g., interest or unemployment rates, VC market reports).

The main estimation follows a triple difference design (differences-in-differences-in-differences) (see, Gruber, 1994; Olden and Møen, 2022), in which the treatment is estimated from changes in the screening rules for sectors for a country pair, and compared to the country pairs, which are never screened ('the placebo strata'). The triple difference estimator can be implemented using three-way fixed effects (Strezhnev, 2023). Since we exploit variation at the country dyad-sector-time level, we need country dyad-time, country dyad-sector and sector-time fixed effects for identification.

Because of a large number of zeros in the dependent variable, we estimate Equation 1 using Poisson Pseudo-Maximum Likelihood (PPML) which is widely used in the gravity literature and studies in other contexts when the dependent variable has many zeros (Silva and Tenreyro, 2006). It is implemented in Stata with *ppmlhdfe* allowing for a Poisson pseudo-maximum likelihood regression (ppml) with multi-way fixed effects, as described by Correia et al. (2019).[13] Because of the large number of fixed effects, some singleton observations are separated by them, and are excluded from the regressions.[14]

The identification of a causal effect of investment screening on cross-border VC investment relies on the exogenous implementation of the ISM policy. One threat to this exogeneity assumption is the non-random adoption of ISM across countries and sectors. Sectors with investment screening could be systematically different from other sectors. Several steps can be taken to account for this. First, due to the granular nature of the data, it is possible to work with a set of high-dimensional fixed effects for source and

[13] Weidner and Zylkin (2021) prove consistency of the three-way fixed effect estimator under Poisson.
[14] See this Weblink for further information about separation in Poisson models.

target countries and sectors to absorb potential confounders. We include source-time and target-time fixed effects to account for time-variant and time-invariant characteristics in the target and source country such as different business cycles. We also include country-pair fixed effects, to capture time-invariant determinants of cross-border VC, as identified in the literature (e.g., common language or geographical distance). Further, we conduct a placebo analysis by by replacing the dependent variable, the number of cross-border deals, with its lagged value by five years and 20 quarters, respectively.

7 Empirical Results

7.1 Baseline Triple Difference Design

According to the results presented in Table 1, the introduction of ISM has resulted in a reduction in the number of cross-border VC transactions, in line with Hypothesis 1. The coefficient on the ISM dummy is strongly significant in all specifications, including the full set of fixed effects needed for identification. The size of the coefficient in Column (4) indicates that compared to non-screened sectors, the number of deals dropped by about 21 percent after introduction of the ISM. The same holds if we aggregate the data to yearly levels (Table 11 in the Appendix), with a coefficient size of -0.24 reflecting a 21 percent fall of VC investment in the screened sectors.[15] For a country like Germany, this means about 400 more deals would have taken place without screening, and for the UK, about 860 more.

What should we make of the size of the estimated effect, which simply reflects a combination of prohibition and deterrence effects, as the ISM intends? There is no simple answer to this important question, as the number of prohibited or deterred transactions

[15]The triple difference approach estimates the average treatment effect on the treated (ATT) (Olden and Møen, 2022).

is unknown. We know for several countries that the annual number of blocked deals, going well beyond VC deals, is low (e.g., five deals in the United Kingdom in 2021 and four in Italy in 2022 (Bencivelli et al., 2023)). Given this, we believe that the number of security-threatening investments that is deterred is unlikely to be much larger. Thus, we hypothesize that a large share of the negative effect can be attributed to increased uncertainty and transaction costs after the introduction of investment screening.

Regarding Hypothesis 2, we can look at Panels B and C. The results of the quarterly data for the case of strategic investors need some explanation. From Panel B it is clear that the number of deals involving financial (non-strategic) investors has gone down strongly and significantly. For the case of strategic investors (Panel C), however, the number of deals is too low to identify the coefficients using the full set of fixed effects.[16] In this case, we will only interpret the coefficients for the data aggregated at the yearly level (Table 15). These show, using a reasonably high number of observations, that the number of deals involving strategic investors did not change much after the introduction of screening (Columns 1 to 3). We decided not to interpret the (significant) coefficient in Column 4 due to a low number of observations in the treated group resulting in low power. The coefficients for non-strategic investors are at -0.21 and -0.22 for the yearly data, indicating a decrease of about 19 percent.

As for Hypothesis 3, we can look at Panels D and E of Table 1 for the quarterly results and 12 and 13 for the yearly results. As reported in Panel D, the number of late-stage deals has dropped significantly in the sectors in which ISM was introduced, while it is not the case for early-stage deals (Panel E) The coefficient for the late-stage deals in the quarterly data is at -0.469 or a reduction of 37.44 percent in the screened sectors. The same is true

[16] In the case of separated observations, the maximum likelihood function would be 'minimized' for parameters equaling ∞ or $-\infty$. This would numerically resemble a very high or a very low coefficient value. This seems to be the case, e.g., in Table 15 for the full set of fixed effects in Column 4. For more information see Link.

if we aggregate the data to the yearly level (Panels D and E) , while here the coefficient is at -0.41 indicating a -33.63 percent reduction. As stated above, this is most likely due to the fact that late-stage investments involve more often investors from abroad, especially from outside of the EU.

Table 1: Quarterly data

	(1)	(2)	(3)	(4)
Panel A: All deals				
ISM=1	-0.667***	-0.360***	-0.204***	-0.236**
	[0.051]	[0.061]	[0.056]	[0.091]
Observations	722,843	722,843	486,263	484,379
Panel B: Deals by 'non-strategic investors'				
ISM = 1	-0.682***	-0.367***	-0.211***	-0.211*
	[0.035]	[0.041]	[0.041]	[0.093]
Observations	716,620	716,620	479,769	471,560
Panel C: Deals by 'strategic investors'				
ISM = 1	-0.284	-0.477*	-0.189	2.282
	[0.174]	[0.206]	[0.279]	[.]
Observations	1510272	1510272	1510272	1510272
Panel D: Late-stage deals				
ISM = 1	-0.813***	-0.519***	-0.346***	-0.469**
	[0.064]	[0.081]	[0.079]	[0.179]
Observations	541,406	536,566	274,189	190,930
Panel E: Early-stage deals				
ISM = 1	-0.667***	-0.049	-0.026	0.405
	[0.071]	[0.086]	[0.091]	[0.274]
Observations	335,120	328,800	145,356	79,868
Country-pair × Time	✓	✓	✓	✓
Sector		✓	✓	✓
Sector × Time			✓	✓
Country-pair × Sector				✓

* p <0.1, ** p <0.05, *** p <0.01. The dependent variable in Panel A is the quarterly number of cross-border VC deals for 2007-2020, in Panel B and Panel C the number of deals with participation of non-strategic and strategic investors and in Panel E and D the number of late-stage and early-stage deals respectively. Standard errors in parentheses are clustered at target country-quarter level. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded.

7.1.1 Placebo analysis

As mentioned in Section 5, we conduct a placebo analysis to further confirm the exogeneity of the introduction of ISM. The results are presented in Table 2. In all specifications, none of the estimated coefficients are significant. This suggests that there are no systematically different prior trends, reassuring us that our results are not confounded by pre-existing differences between treated and untreated sectors and countries, conditional on initial conditions and fixed effects.

Table 2: Placebo regressions

	(1)	(2)	(3)	(4)
	All deals	Early stage	Late stage	Non-strategic
Panel A: Quarterly data				
ISM = 1	0.193	-2.085	0.126	0.189
	[0.192]	[1.322]	[0.322]	[0.189]
Observations	144,773	17,409	53,419	140,885
Panel B: Yearly data				
ISM = 1	0.250	-0.178	0.491	0.232
	[0.177]	[0.679]	[0.290]	[0.175]
Observations	71,695	11,903	32,723	69,807
Country-pair × Year	✓	✓	✓	✓
Sector	✓	✓	✓	✓
Sector × Quarter	✓	✓	✓	✓
Country-pair × Sector	✓	✓	✓	✓

* p <0.1, ** p <0.05, *** p <0.01. Standard errors in parentheses are clustered at target country-quarter and target country-year level, respectively. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded and because of lagging the dependent variable.

7.2 Heterogeneity between OECD and non-OECD Source Countries

In this section, we investigate which origins of investor are most affected by the regulations. The geopolitical rationale behind investment screening in OECD countries

targets non-OECD source countries with an important role of the state in the economy - such as China. Thus, we would expect those countries to be more affected by ISM as investors from such countries could rationally expect to be screened 'with more scrutiny.' Second, as mentioned above, late-stage deals which, as we show, have been more affected by the introduction of the ISM, come primarily from outside of Europe. Thus, we divide the sample into OECD and non-OECD source countries. As we can see from Panel A of Table 3, most of the reduction is related to the decrease in the number of deals, in which at least one investor comes from a non-OECD country. However, the number of deals in the late-stage phase has decreased significantly even for the group of OECD source countries. Note that the absolute number of early-stage deals by OECD investors is lower than the absolute number of late-stage deals by OECD investors such that the net effect for OECD investors remains negative (Column 1). These results suggest that the main two channels of the total effect of ISM are the reduction of investments from non-OECD countries – as these might be expected to be screened more strictly – and for late-stage deals from OECD source countries. We find similar patterns if we look at the yearly data in Panel B of Table 3. While none of the coefficients for the OECD case is significant, the late-stage investments appear to be more affected. Investments from outside of the OECD are strongly negatively affected, further confirming our results.

Table 3: Investors from the OECD vs. non-OECD

	(1)	(2)	(3)	(4)	(5)	(6)
	OECD				non-OECD	
	All deals	Early stage	Late stage	Non-strategic	All deals	Non-strategic
Panel A: Quarterly data						
ISM = 1	-0.193*	0.450*	-0.452**	-0.168	-0.892**	-0.877**
	[0.108]	[0.262]	[0.184]	[0.109]	[0.429]	[0.429]
Observations	416,696	71,214	168,115	405,857	33,846	32,687
Panel B: Yearly data						
ISM = 1	-0.187	0.482	-0.385	-0.174	-1.280**	-1.048*
	[0.119]	[0.256]	[0.213]	[0.116]	[0.442]	[0.416]
Observations	192,028	41,706	91,315	187,416	23,763	22,912
Country-pair × Year	✓	✓	✓	✓	✓	✓
Sector	✓	✓	✓	✓	✓	✓
Sector × Quarter	✓	✓	✓	✓	✓	✓
Country-pair × Sector	✓	✓	✓	✓	✓	✓

* p <0.1, ** p <0.05, *** p <0.01. The dependent variable is the quarterly (yearly) number of cross-border VC deals for 2007-2020 if at least one investor is from an non-OECD country, otherwise the deal is classified as an OECD deal. Standard errors in parentheses are clustered at target country-quarter and target country-year level, respectively. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded. The number of observations for the strategic and early vs. late-stage deals from the non-OECD countries was too low (due to separation issues) to estimate the equations.

7.3 The Size of the Deals and the Syndicates

According to Hypothesis 5, there should be a significant increase in the value of the deal (conditional on the fact that a deal takes place in a particular period) after introduction of the screening. Descriptive statistics, in particular the mean and the median value of the deals and the number of investors per syndicate before and after the introduction of screening are presented in Table 4. All values for the size of deals are expressed in current million USD. The construction of the variables is as follows: first we calculate the average (median) size of the deal in each period (quarter or year), and later on we aggregate them in the descriptive statistics table. There seems to be an increase in the average and median size of the deal after the introduction of ISM. However, since the observation period has included a long phase of low interest rates in Europe, which has led to strongly increasing (nominal) valuations of firms, this does not necessarily reflect the impact of the ISMs. In the following regressions analysis, we therefore include, similarly to the previous regressions, a full set of fixed and time effects to capture systematic changes to the valuations of companies over time and other time-variant changes. Second, there is an increase in the average and median size of syndicates in the screened sectors. Third, the ticket size for late-stage deals increases, which would be consistent with the strong increase in the size of the deals in this group and smaller increase in the syndicate size.

Table 4: Descriptive statistics for the average size of the deal, of the syndicate, and of the ticket size per syndicate member, quarterly data

	Before ISM		After ISM		T-test	Rank sum
	Deal size (in Mio USD)					
	Average	Median	Average	Median		
All deals	34.68	8.5	47.42	9.51	-4.32***	-5.19***
Early-stage deals	3.57	2	5.40	2.99	-6.49***	-11.45***
Late-stage deals	46.51	16.61	64.49	19.34	-7.57***	-5.99***
Strategic deals	62.08	12.59	105.54	13.76	-2.53***	-0.60
Non-strategic deals	38.91	8.47	53.15	9.37	-4.54***	-5.03***
	Syndicate size (number of investors)					
	Average	Median	Average	Median		
All deals	4.54	3.5	5.42	4	-12.41***	-14.57***
Early-stage deals	3.09	3	4.12	3	-13.75***	-13.14***
Late-stage deals	4.63	4	5.09	5	-6.42***	-8.19***
Strategic deals	5.58	4	5.94	5	-0.73	-1.30
Non-strategic deals	4.56	3.5	5.44	4	-12.27***	-14.39***
	Ticket size (in Mio USD)					
	Average	Median	Average	Median		
All deals	8.32	2.51	9.13	2.38	-1.63*	0.43
Early-stage deals	1.16	0.67	1.31	0.83	-1.26	-5.58***
Late-stage deals	9.29	4.2	12.30	4.33	-4.14***	-2.58***
Strategic deals	18.68	3.48	17.52	4.05	0.16	-0.10
Non-strategic deals	8.08	2.5	8.84	2.36	-1.67**	0.57

T-Test values reported for the comparison of means. Reported significance for the alternative hypothesis that the mean before ISM is lower than after ISM. Wilcoxon rank-sum test z-values reported for the comparison of medians. The null hypothesis is equality of medians. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Financial deal value: average (Panel A) and median (Panel B) value, quarterly data

	(1)	(2)	(3)	(4)
	All deals	Early-stage	Late-stage	Non-strategic
Panel A: Average deal values				
ISM = 1	0.784*	1.444	1.055**	0.763*
	[0.426]	[1.462]	[0.436]	[0.418]
Panel B: Median deal values				
ISM = 1	0.852**	1.522	1.062**	0.815*
	[0.432]	[1.468]	[0.444]	[0.425]
Observations	31,215	3,983	18,529	30,503
Country-pair × Time	✓	✓	✓	✓
Sector	✓	✓	✓	✓
Sector × Time	✓	✓	✓	✓
Country-pair × Sector	✓	✓	✓	✓

* p <0.1, ** p <0.05, *** p <0.01. The dependent variable is the average (median) quarterly financial value of cross-border VC deals in the years 2007-2020. Standard errors in parentheses are clustered at target country-quarter level. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded.

Table 6: Size of the syndicate: average and median value, quarterly data

	(1)	(2)	(3)	(4)
	All deals	Early-stage	Late-stage	Non-strategic
Panel A: Average syndicate size				
ISM = 1	-0.005	0.923**	0.295	-0.027
	[0.131]	[0.462]	[0.237]	[0.135]
Panel B: Median syndicate size				
ISM = 1	0.012	1.047**	0.341	-0.007
	[0.130]	[0.463]	[0.241]	[0.134]
Observations	39,119	5,430	20,063	38,232
Country-pair × Time	✓	✓	✓	✓
Sector	✓	✓	✓	✓
Sector × Time	✓	✓	✓	✓
Country-pair × Sector	✓	✓	✓	✓

* p <0.1, ** p <0.05, *** p <0.01. The dependent variable is the average (median) quarterly number of syndicate members in the years 2007-2020. Standard errors in parentheses are clustered at target country-quarter level. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded.

Table 7: Size of the ticket per syndicate member: average and median, quarterly data

	(1)	(2)	(3)	(4)
	All deals	Early-stage	Late-stage	Non-strategic
Panel A: Average ticket size				
ISM = 1	0.165	-0.364	0.245*	0.124
	[0.137]	[0.244]	[0.140]	[0.137]
Panel B: Median ticket size				
ISM = 1	-0.005	0.581	-0.363	-0.038
	[0.416]	[1.339]	[0.419]	[0.391]
Observations	31,215	3,983	18,529	30,503
Country-pair × Time	✓	✓	✓	✓
Sector	✓	✓	✓	✓
Sector × Time	✓	✓	✓	✓
Country-pair × Sector	✓	✓	✓	✓

* p <0.1, ** p <0.05, *** p <0.01. The dependent variable is the average (median) quarterly ticket size per syndicate member in the years 2007-2020. Standard errors in parentheses are clustered at target country-quarter level. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded.

As indicated by the results in Table 5, the average and the median size of the deal has increased in sectors that newly became subject to screening. This is particularly the case for late-stage deals. At the same time, the size of the syndicates (Table 6) has remained unchanged except for early-stage deals for which the number of investors per deal increased. Consistently, the size of the ticket per syndicate member has increased only in the late-stage case and only slightly; in case of the median size, the change is insignificant (Table 7), suggesting that the equity stake per member of the syndicate for this group of deals might have actually gone down. However, we cannot be sure because of data limitations. This could be an indication of circumventing the screening mechanisms so that each stake bought falls under the respective sectoral thresholds, but we cannot test this hypothesis directly with the current dataset which only for a very few

cases contains information about the size of the equity stake. We do not replicate this analysis with the yearly data, as the number of observations in this case is too low to provide meaningful conclusions.

7.4 Structure of Deals

As noted in Hypothesis 6, we expect that for screened sectors, we should observe a higher percentage of investors per syndicate, who have been involved in previous rounds. We argue that previous investors are likely to be screened less stringently - the authorities already 'know' the investors, they 'know' the target companies involved and the investor-target couple. We test this hypothesis with the above-defined outcome variable and present the results in Table 8. We were only able to identify a (weak) effect in the yearly data, but not in the quarterly data. The results do not directly support our Hypothesis 6 but it suggests that some change has taken place. There is a possibility that our crude measure of deal structure, limited by the data, does not capture the changes well enough.

Table 8: Results, percentage of repeated investors

	(1)	(2)
	Quarterly data	Yearly data
Share of repeated investors (in percent)		
ISM = 1	-0.181	0.224*
	[0.125]	[0.129]
Observations	17,029	14,984
Country-pair × Time	✓	✓
Sector	✓	✓
Sector × Time	✓	✓
Country-pair × Sector	✓	✓

* p <0.1, ** p <0.05, *** p <0.01. The dependent variable is the quarterly (Column 1) or yearly (Column 2) number of investors per syndicate for 2007-2020. Standard errors in parentheses are clustered at target country-quarter and target country-year level, respectively.

8 Concluding Remarks

Although there is a security policy case for the introduction of investment screening, our results point to unintended negative effects: while the number of actually blocked deals has remained very low, the associated uncertainty and an increase in transaction costs have led to a significant decline in cross-border deals. What does this mean in actual numbers? Since 2007 a total of about 74.000 cross-border VC deals have taken place across Europe, about 7.000 of which in the screened sectors. Our estimates suggest that without ISM about 2.000 more deals would have been made in those sectors, without the ISM. Because of the more negative coefficient coefficient for these deals, the overall drop is driven by "missing" late-stage deals which turn innovation to viable businesses. This suggests that the definition of 'security-sensitive' sector might be too broad.

The effects are stronger for investments by non-strategic investors who, according to our definition, have no strategic but only financial interests, and in the case of late-stage deals. Moreover, we find a strong decline in deals from non-OECD countries. Our hypotheses are based on the increase in transaction cost and uncertainty associated with investment screening. The increase of the average size of the deals (conditional on concluding the deal) suggests that this is indeed a problem: smaller (marginal) deals decrease. We also observe a (weak) effect of Ism on the structure of the deal, which we measure as an involvement of previous-round investors in future rounds, who might expect to be screened less stringently, which reduces uncertainty and transaction costs.

There are several open questions, which we have not fully answered within the scope of this research. First, capital from outside the EU may be substituted by capital from within the EU. We are not able to look at such a substitution effect with the current data. But, as argued below, there is no reason to believe that this would be the case, since there already is a problem of financing innovation in the EU. Second, we are

not able to tell whether companies have been able to avoid screening by, for instance, remaining below the equity thresholds prescribed by the country-specific laws. This would materialize, e.g., through larger syndicate sizes and lower tickets per syndicate member in the screened sectors (which we find for the late-stage deals), but the latter result could also be a result of structural changes in the deals. A direct way to look at this question would be to analyze the density of deals above and below the legal equity thresholds. However, the data for VC deals is scarce and, regarding the ISM rules, the equity thresholds are heterogeneous and would first need to be collected in full detail. We leave this question for further research. Finally, we did not analyze the heterogeneity of effects by sector. As we argue, transaction costs increase which leads to a decrease in the number of deals. This effect is also supported by the change in the structure of the deals, but certainly requires further investigation. The importance of transaction costs should differ depending on the different half-life of technologies, which determine how strategically important certain investments are. In case of deals in technologies with long half-life and high strategic importance, the relative financial importance of transaction costs would be smaller and those deals are likely to still take place in most cases. However, this effect could potentially differ between subindustries and between verticals, or even between individual companies and products within the same industries. In this research, we were not able to look at this question in this level of detail and we leave it open for further research.

From a policy perspective, the fall in VC deals in general and in large late-stage deals in particular, could prove problematic for the European innovation landscape. A particularly important feature of VC in the European context is the fact that in most countries the size of the local VC markets is not large enough to sustain larger later-stage investment rounds required for start-up growth.[17] These investments are then typically

[17]See e.g., data from the OECD on the ratio of VC investments to GDP here.

performed by foreign investors. In 2023, 23.4 percent of all private-equity funds in Europe came from North America, followed by 19.9 percent from Australia and Asia (Invest in Europe, 2023). For the early-stage venture capital in Europe, about 12 percent originated outside of Europe. Typically, the later the funding stage, the higher the involvement of foreign investors. Unless the European Union is able to replace the reduced inflow of (late-stage) foreign capital with local sources, the innovation financing gap against the US could widen further. In this light, strengthening European capital markets has become even more important compared to a world without investment screening. Some argue that now, when the inflow of capital from outside the EU is reduced, it could pose a chance for intra-EU capital. The problem is, however, that the European market seems not large or deep enough to provide the necessary supply. So unless the European capital market is strengthened on the supply side, as for instance suggested by the recent policy report of Enrico Letta[18], there might not be enough supply to satisfy the demand for financing of European start- and scale-up companies, further reducing European innovation competitiveness.

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[18] See Link.

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Appendix

Table 9: ISM sectors

Sector ID	Sector name
1	Defense production
2	Energy infrastructure (electricity/gas/coal production and distribution)
3	Water infrastructure
4	Transportation infrastructure
5	Telecommunications infrastructure
6	Healthcare infrastructure
7	Education and training
8	Agriculture/food security
9	Finance
10	Media
11	Real estate (buying land)
12	Research Institutions
13	Sensitive Personal Data
14	Space
15	Biotechnology
16	Artificial intelligence and machine learning
17	Position, Navigation, and Timing
18	Microprocessor technology
19	Advanced computing technology
20	Data Analytics technology
21	Quantum information and sensing technology
22	Logistics technology
23	Additive Manufacturing
24	Robotics
25	Brain-computer interfaces
26	Hypersonics
27	Advanced Materials
28	Advanced surveillance technologies
29	Cybersecurity
30	Defense technologies
31	Energy storage
32	Civil Nuclear
33	Gambling
34	Mineral resources
35	Tourism
36	Critical Supplies
37	Controlled dual use

Table 10: Classification of investors according to motives

Investor Type	Strategic	Investor Type	Strategic
Academic Institution	No	Listed Fund of Funds Manager	No
Advisory	No	Loan Provider	No
Asset Manager	No	Marketing Company (Alternative Assets)	No
Asset Manager - Fund Manager	No	Natural Resources - Other	Yes
Asset Manager - Investor	No	Natural Resources Firm	Yes
Bank	No	Other	No
Consultant	No	Placement Agent	No
Corporate Finance	No	Portfolio Company	No
Corporate Investor	Yes	Press	No
Custodian	No	Prime Broker	No
Endowment Plan	No	Private Debt Firm	No
Family Office - Multi	No	Private Equity Firm	No
Family Office - Single	No	Private Equity Firm (Investor)	No
Financial Advisor	No	Private Equity Fund of Funds Manager	No
Foundation	Yes	Private Sector Pension Fund	No
Fund Administrator	No	Public Pension Fund	No
Fund Manager	No	Real Assets Firm	No
Fund of Hedge Funds Manager	No	Real Estate - Other	No
Government Agency	Yes	Real Estate Advisor	No
Hedge Fund Manager	No	Real Estate Brokerage	No
Industry Association	Yes	Real Estate Developer	No
Infrastructure - Other	Yes	Real Estate Firm	No
Infrastructure Asset	Yes	Real Estate Firm (Investor)	No
Infrastructure Firm	Yes	Real Estate Fund of Funds Manager	No
Insurance Company	No	Real Estate Investment Firm	No
Investment Bank	No	Recruitment Consultant	No
Investment Company	No	Secondary Fund of Funds Manager	No
Investment Consultant	No	Software Company	Yes
Investment Trust	No	Sovereign Wealth Fund	No
Investor	No	Superannuation Scheme	No
Law Firm	No	Wealth Manager	No

Note: An investor that is not classified as 'strategic' is considered a 'financial' investor.

Table 11: Yearly results

	(1)	(2)	(3)	(4)
ISM = 1	-0.653***	-0.344***	-0.187**	-0.240*
	[0.055]	[0.071]	[0.063]	[0.120]
Observations	259,713	259,713	226,917	225,852
Country-pair × Year	✓	✓	✓	✓
Sector		✓	✓	✓
Sector × Year			✓	✓
Country-pair × Sector				✓

* p <0.1, ** p <0.05, *** p <0.01. Standard errors in parentheses. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded. Standard errors clustered at target country-year level.

Table 12: Yearly results - early-stage deals

	(1)	(2)	(3)	(4)
ISM = 1	-0.650***	-0.024	-0.012	0.444
	[0.100]	[0.113]	[0.112]	[0.249]
Observations	152,058	149,522	101,157	47,274
Country-pair × Year	✓	✓	✓	✓
Sector		✓	✓	✓
Sector × Year			✓	✓
Country-pair × Sector				✓

* p <0.1, ** p <0.05, *** p <0.01. Standard errors in parentheses. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded. Standard errors clustered at target country-year level.

Table 13: Yearly results - late-stage deals

	(1)	(2)	(3)	(4)
ISM = 1	-0.789***	-0.491***	-0.311***	-0.415*
	[0.065]	[0.089]	[0.086]	[0.206]
Observations	217,952	216,266	162,795	104,230
Country-pair × Year	✓	✓	✓	✓
Sector		✓	✓	✓
Sector × Year			✓	✓
Country-pair × Sector				✓

* p <0.1, ** p <0.05, *** p <0.01. Standard errors in parentheses. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded. Standard errors clustered at target country-year level.

Table 14: Yearly results - non-strategic investors

	(1)	(2)	(3)	(4)
ISM = 1	-0.669***	-0.353***	-0.196**	-0.220
	[0.056]	[0.072]	[0.062]	[0.117]
Observations	258,168	258,168	224,895	220,306
Country-pair × Year	✓	✓	✓	✓
Sector		✓	✓	✓
Sector × Year			✓	✓
Country-pair × Sector				✓

* p <0.1, ** p <0.05, *** p <0.01. Standard errors in parentheses. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded. Standard errors clustered at target country-year level.

Table 15: Yearly results - strategic investors

	(1)	(2)	(3)	(4)
ISM = 1	-0.208	-0.373*	-0.206	-20.125***
	[0.139]	[0.181]	[0.178]	[2.482]
Constant	-2.862***	-2.495***	-1.751***	-0.063
	[0.003]	[0.003]	[0.003]	[0.044]
Observations	56,877	47,374	19,394	2,622
Country-pair × Year	✓	✓	✓	✓
Sector		✓	✓	✓
Sector × Year			✓	✓
Country-pair × Sector				✓

* p <0.1, ** p <0.05, *** p <0.01. Standard errors in parentheses. The number of observations is lower than the overall sample as the singleton observations separated by fixed effects have been excluded. Standard errors clustered at target country-year level.