

Foreign technology in-licensing, regulatory burden, and SME productivity

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Abstract

Extant literature highlights the importance of external knowledge sourcing strategies for small and medium-sized enterprises (SMEs) outcomes in emerging economies, yet less is known about how institutional conditions shape the productivity outcome of such strategies. This study addresses this gap by examining the interplay among foreign technology in-licensing, domestic regulatory burdens and SME productivity in emerging economies. Using a dataset of 23,939 SMEs across 24 emerging economies drawn from the World Bank Enterprise Survey (WBES) from 2006 to 2022, and applying a control function estimation approach, we find that foreign technology in-licensing significantly enhances SME productivity, while regulatory burden constrains it. Importantly, the results reveal a moderating effect: productivity gains from foreign technology in-licensing are greater in high-regulatory burden environments than in low-regulatory burden environments. Nonetheless, SMEs adopting licensed foreign technology consistently outperform non-adopters across all regulatory conditions. These findings underscore the strategic value of external knowledge acquisition for SMEs and suggest that policy efforts to streamline regulatory processes, while facilitating access to foreign technologies, can simultaneously strengthen SME productivity in emerging economies.

Keywords: Foreign technology in-licensing, regulations, productivity, emerging economies, SMEs

1. Introduction

Scholarly interest in the determinants of small and medium-sized enterprise (SME) productivity has expanded considerably in recent years (see Owalla et al., 2022, for a review). This growing attention reflects the pivotal role SMEs play in driving economic development across countries (Beck et al. 2005). For instance, SMEs constitute around 90% of all businesses in most countries and generate more than 50% of global employment (World Bank 2025), underscoring their centrality in the global business ecosystem. Despite their economic importance, they often suffer from deficiency in knowledge due to their limited internal resources (Aliasghar et al. 2023; Zhou et al. 2023). Prior research highlights that the critical role of knowledge in SME productivity (Audretsch and Belitski 2021; Ballestar et al. 2020; Hall et al. 2009). Therefore, SMEs must continuously develop their knowledge base, relying on both internal and external sources, to strengthen their capabilities to enhance their productivity. However, because they are often disadvantaged in developing knowledge internally, they are frequently compelled to seek external knowledge to compensate for these limitations.

From a capability-building perspective, SMEs can strategically mitigate internal knowledge constraints by tapping into external sources of technology beyond their organisational boundaries (Cohen and Levinthal 1990). Several mechanisms exist for accessing such external knowledge, and foreign technology in-licensing represents one of the most effective pathways. Through foreign technology in-licensing, SMEs are able to draw on advanced technological knowledge developed abroad, thereby strengthening their own technological capabilities while leveraging the competencies of firms operating outside their domestic markets (Li-Ying and Wang 2015; Smallbone et al. 2022). Foreign technology in-licensing refers to a contractual arrangement in which a firm (the licensee) obtains the right to use technology—often protected by patents, trademarks, copyrights, or other forms of intellectual property—developed by a foreign firm (the licensor). This mechanism provides SMEs with access to global technology networks, enabling them to connect them with frontier technologies that are not readily available in their local environments.

Prior research has examined how foreign technology embedded in licensing agreements influences a range of SME outcomes (Abubakar et al. 2019; Haddoud et al. 2023; Smallbone et al. 2022). Existing studies largely highlight the role of foreign technology as a strategic resource that can enhance SME innovation and export performance. Despite this growing body of literature, academic understanding of how foreign technology in-licensing shapes SME productivity specifically remains limited. Considering this limitation, there is a clear need for research that examines the productivity implication of foreign technology in-licensing within the SME context, particularly in emerging economies. Unlike developed economies, emerging economies are typically characterised by resource scarcity and institutional weaknesses (Khouri and Prasad 2016; Smallbone et al. 2022). Such conditions may constrain SMEs' ability to internalise, adapt, and deploy licensed technologies, thereby weakening the productivity-enhancing potential typically attributed to international technology transfer. At the same time, licensed foreign technologies often originate from firms in developed economies, where strong innovation-supporting institutions underpin the creation and diffusion of advanced technological capabilities (Dohse et al. 2019). Thus, understanding whether foreign technology in-licensing translates into productivity gains in emerging economies therefore represents a critical, yet insufficiently explored, avenue for inquiry in the technology transfer and SME performance literature.

Extant literature suggests that stringent regulatory environments can intensify firms' incentives to acquire licensed foreign technologies (Gentile 2020). In such contexts, compliance requirements impose substantial administrative and procedural demands, increasing the regulatory burden that SMEs must navigate. Because these burdens fall disproportionately on SMEs relative to larger firms (Mallett et al. 2019), regulatory burden can shape not only SMEs' willingness to engage in foreign technology in-licensing, but also the extent to which they are able to leverage the knowledge embodied in these technologies for productivity enhancement. Accordingly, regulatory burden operates as a critical institutional mechanism that can amplify or constrain SMEs' ability to translate in-licensed foreign technologies into effective productivity gains. Building on this insight, we examine whether and how the productivity effects of foreign technology in-licensing for SMEs are contingent on the level of regulatory burden in their domestic environment.

Relying on a dataset comprising of 23,939 SMEs across 24 emerging economies, drawn from the World Bank Enterprise Survey (WBES) spanning from 2006 to 2022. Using a control function estimation approach, our analysis shows that foreign technology in-licensing significantly enhances SME productivity whereas regulatory burden exerts an impeding effect. Moreover, the findings indicate an important moderating role of the regulatory environment: the productivity gains associated with foreign technology in-licensing are amplified in high regulatory-burden contexts. Specifically, SMEs that adopt licensed foreign technology achieve greater productivity improvements under high regulatory burden conditions than under low regulatory burden conditions. Nonetheless, SMEs utilising foreign technology in-licensing consistently outperform non-adopting firms, irrespective of whether they operate in low- or high-regulatory burden environments.

Our findings contribute to the literature in several important ways. First, we demonstrate that externally sourced technology accessed through foreign technology in-licensing enhances SME productivity. Although prior work has shown that foreign technology in-licensing improves firm productivity (Adbi et al. 2022; Lopez 2008; Yasar and Paul 2007), these effects have rarely been examined in the context of SMEs. By focusing on knowledge resources-constrained firms, we provide new insight into how SMEs in emerging economies can leverage external knowledge from foreign markets to generate productivity gains. Second, we uncover the unintended consequences of regulatory systems by showing that the regulatory burden facing SMEs in emerging economies suppresses their productivity. Existing research has largely relied on firm-level measures of regulatory compliance costs (Tomasi et al. 2025). While such measures capture the direct costs of following rules, they provide a limited view of how regulations shape SME productivity because they overlook the broader regulatory environment in which SMEs operate. Firm-level indicators do not account for structural characteristics of national regulatory systems—such as complexity, enforcement quality, or instability—that disproportionately constrain SMEs relative to larger firms. By employing a national-level measure of regulatory burden, we contribute to the literature on formal institutions and SME productivity by offering a more comprehensive understanding of how weak regulatory environments in emerging economies hinder SMEs' capacity to improve productivity. Finally, we show that the productivity benefits of foreign technology in-licensing are contingent on the regulatory environment. This moderating effect highlights that SMEs' ability to convert externally sourced knowledge into productivity gains depends critically on the regulatory burden they are exposed to in the domestic regulatory environments. We therefore extend the literature on external knowledge sourcing and SME productivity by demonstrating that the returns to foreign technology in-licensing are shaped by the institutional constraints under which SMEs operate in emerging economies.

The remainder of the paper is structured as follows. Section 2 develops the theoretical background and hypotheses. Section 3 outlines the data and empirical methodology. Section 4 presents the empirical results. Section 5 discusses the findings while Section 6 concludes this paper.

2. Theoretical background and hypotheses development

We draw on the knowledge-based view and institutional theory to underpin this research. The knowledge-based view posits that firms depend on acquiring, integrating, and deploying knowledge to enhance their performance, making foreign technology in-licensing a critical mechanism through which firms, particularly SMEs in emerging economies, access advanced external knowledge that can boost productivity. At the same time, institutional theory emphasises that firms operate within local institutional conditions, and these conditions shape the extent to which they can effectively leverage knowledge obtained from foreign markets. Consequently, examining how foreign technology in-licensing affects SME productivity under varying domestic regulatory requirements requires integrating insights from the knowledge-based view on the strategic value of external knowledge with institutional theory's focus on the enabling or constraining role of local institutional environments.

The knowledge-based view (KBV) extends the reasoning of the resource-based view by conceptualising the firm as a *knowledge-processing institution* rather than simply a portfolio of resources (Grant and Phene 2022). It posits that knowledge constitutes the most strategically important resource underpinning competitive advantage and superior performance (Grant 1996; Spender and Grant 1996). To enhance their performance, firms must acquire, integrate, and deploy knowledge both within and across their organisational boundaries (Eisenhardt and Santos 2000). Prior research shows that firms differ substantially in their ability to acquire and utilise knowledge, and such heterogeneity is a key driver of differences in performance across firms (Bergh et al. 2024; Wiklund and Shepherd 2003). Firms build knowledge not only through their existing knowledge bases and internal capabilities, but also through different forms of external knowledge acquisition (DeCarolis and Deeds 1999). Accessing external knowledge is particularly important for firms to solve complex problems and address knowledge gaps that cannot be filled internally (Caner et al. 2017).

SMEs need to possess absorptive capacity to effectively recognise, assimilate, and apply external knowledge (Cohen and Levinthal 1990). By successfully integrating such external knowledge, firms can build and expand their internal knowledge base, thereby enhancing their performance (Audretsch and Belitski 2023; Wang et al. 2013). This is particularly important for SMEs in emerging economies, which often suffer from weak internal knowledge stocks due to severe resource constraints (Aliasghar et al. 2023). As a result, sourcing external knowledge becomes a strategic response for SMEs, enabling them to overcome internal limitations and pursue improved performance outcomes (Brunswick and Vanhaverbeke 2015). Foreign markets offer rich opportunities for SMEs to access valuable external knowledge, as international engagement exposes them to knowledge that complements their limited internal knowledge bases (Stoian 2024). One effective strategy for SMEs in emerging economies to directly acquire such external knowledge is foreign technology in-licensing, which is an important inward internationalisation strategy for SMEs in emerging economies to access superior technological resources to strengthen their knowledge bases despite domestic resource constraints (Abubakar et al. 2019; Smallbone et al. 2022). Foreign technology in-licensing transfers international technology capable of facilitating firm productivity in emerging economies (Lopez 2008; Yasar and Paul 2007).

Firms including SMEs operate within a system of formal and informal rules and norms that shape their organisational structures, strategic decisions, and performance outcomes, as espoused by institutional theory (Peng et al. 2008). They are motivated not only by the pursuit of enhanced performance but also by the need to comply with the formal and informal rules that confer legitimacy (Meyer and Peng 2016; North 1990). Firms generally place greater emphasis on formal rules because they create legally binding laws and regulations enforced through coercive pressures. Failure to comply with these rules can result in penalties, sanctions, exclusion from the market, or even closure (North 1990). In contrast, informal rules influence firms through norms and shared beliefs, backed by normative and cognitive pressures (Scott 2014). These informal rules tend to be less precise, less enforceable, and slower to affect firm behaviour (Peng et al. 2008). As a result, firms often enjoy greater flexibility in adhering to informal rules, whereas formal rules impose regulations with measurable compliance costs, such as intellectual property (IP) protection law. Such regulations typically designed by formal institutions are to ensure that firms act in the public interest and to address market failures stemming from rent-seeking behaviour, information asymmetries, anti-competitive practices, and predatory pricing (Baldwin et al. 2012).

Formal institutions often exhibit significant deficiencies in emerging economies, limiting their ability to formulate and enforce regulations that support the efficient functioning of markets (Khanna and Palepu 1997). Such weaknesses produce what is referred to as formal institutional voids—gaps arising from the absence, underdevelopment, or ineffective operation of regulatory institutions (Doh et al. 2017). These voids tend to be more pervasive in emerging economies than in developed economies, reflecting long-standing challenges in legal enforcement, regulatory capacity, and market governance (Khanna and Palepu 2000; Peng et al. 2008).

Formal institutional voids can significantly undermine SMEs' internal capabilities, reducing their ability to engage in value-adding activities (Webb et al. 2020). In the presence of these voids, they face uncertainty regarding contract enforcement, intellectual property protection, and regulatory compliance (Adomako et al. 2021; Puffer et al. 2010), which collectively increase transaction costs and weaken their ability to compete effectively (Doh et al. 2017). These voids create structural disadvantages for SMEs in emerging economies, where resource scarcity already constrains their capacity to perform. Consequently, SMEs must proactively seek mechanisms to build and strengthen their internal capabilities to navigate and compensate for these institutional voids. One pathway is the strategic acquisition of external knowledge from foreign markets, which can help SMEs develop stronger internal routines, improve operational efficiency, and mitigate the risks posed by weak regulatory institutions (Smallbone et al. 2022). Thus, accessing external knowledge—such as through foreign technology in-licensing—can offer SMEs in emerging economies a vital means of enhancing their internal capabilities and improving productivity despite the constraints that arise from the regulatory burden they face due to formal institutional voids.

2.1 Foreign technology in-licensing and SME productivity

Drawing on KBV, foreign technology in-licensing represents a strategic knowledge acquisition mechanism through which SMEs can enhance and broaden their knowledge base. Prior research shows that the external knowledge acquired through foreign technology in-licensing is often superior to that sourced domestically, as it provides access to more advanced and diverse technological inputs (Li-Ying and Wang 2015). This advantage is particularly salient for SMEs in emerging economies, where domestic technological infrastructure and innovation systems are typically underdeveloped. Foreign technology in-licensing enables these SMEs to access sophisticated technological resources that are either unavailable locally or prohibitively

costly to develop internally. By leveraging such resources, SMEs can strengthen their internal capabilities without incurring the substantial expenses associated with in-house R&D (Moreira et al. 2020; Zahra et al. 2005). Moreover, unlike domestic technology in-licensing, foreign technology in-licensing provides SMEs with greater opportunities to explore novel configurations of knowledge elements and integrate frontier technological practices (Li-Ying and Wang 2015). Collectively, these factors position foreign technology in-licensing as a critical pathway through which SMEs in emerging economies can overcome their knowledge constraints and improve their technological capabilities.

There are several mechanisms through which foreign technology in-licensing is expected to facilitate SME productivity. By accessing already-developed technological resources possessed by foreign firms via foreign technology in-licensing, SMEs can bypass several stages of internal technological capability development and avoid the substantial skills and investments required to build similar technologies in-house (Abubakar et al. 2019; Wang and Li-Ying 2014). Foreign technology in-licensing also enables SMEs to acquire advanced technologies that support improvements in product quality and reductions in production costs (Tsao et al. 2023). Moreover, by reducing the need for costly in-house R&D, foreign technology in-licensing allows SMEs to allocate their limited resources more efficiently toward implementation, adaptation, and complementary capability building (Wang & Li-Ying, 2015). Lastly, SMEs not only tap into the technological capabilities of the foreign licensor but also gain access to complementary information, such as technical specifications, regulatory documentation, and production methodologies, that supports the refinement of the licensed technology and facilitates the development, manufacture, and commercialisation of the final product (Wang et al. 2013). Building on these insights, foreign technology in-licensing is likely to translate into measurable gains in SME productivity. Thus, we hypothesise that:

Hypothesis 1 (H1): Foreign technology in-licensing is positively related to SME productivity in emerging economies.

2.2 Regulatory burden and SME productivity

SMEs typically respond to regulations in their external environment. With limited resources and competing demands, they cannot realistically be expected to identify every relevant regulatory change or fully integrate it into their operations (Mallett et al. 2019). As a result, regulation becomes a significant external factor that can influence SME performance. According to Kitching et al. (2015), regulation is a dynamic factor that can generate either performance benefits or losses for SMEs by mandating and/or restricting certain activities. On the one hand, regulation can be beneficial by increasing the ability of SMEs to effectively exploit market opportunities and respond to market threats, and improving firm efficiency (De Jong and Van Witteloostuijn 2015). On the other hand, regulation can impede SME performance because it makes firms face regulatory burden often in form of substantial compliance costs—encompassing substantive, administrative, and psychological costs, which increases the overall cost of doing business (Kitching 2006; Kitching et al. 2015). Increased compliance costs often translate into higher cost of goods sold and overhead expenses, while encouraging firms to reduce capital investment, employ fewer workers, and channelling resources to more lobbying activities (Kalmenovitz 2023).

Formal institutional voids prevalent in emerging economies undermine market functioning, heighten the risk of opportunistic behaviour, discourage entrepreneurial activities, and restrict competition (Doh et al. 2017; Khanna and Palepu 2010). In such contexts, regulation tends to be fragmented, opaque, and inconsistently enforced, creating conditions that can significantly

increase regulatory burden for SMEs (Meyer and Peng 2016). The heightened regulatory burden often cause SMEs to experience unintended performance consequences of regulation, such as limited productivity (Tan and Rae 2009). Higher regulatory burden can result in lower productivity levels for SMEs (Marin and Lotti 2017; Morikawa 2023). This is because it can compels them to divert scarce resources such as managerial time and financial capital from value-adding activities toward regulatory tasks (Kitching et al. 2015). Thus, we argue that SMEs are likely to be less productive in environments characterised by formal institutional voids, where regulation can amplify regulatory burden and ultimately reduce operational efficiency. This suggests that regulation can impose significant burden on SMEs in emerging economies, where such voids are prevalent, by hindering their productivity. Therefore, we hypothesise that:

Hypothesis 2 (H2): Regulatory burden is negatively related to SME productivity in emerging economies.

2.3 Foreign technology in-licensing–SME productivity relationship and regulatory burden

Regulation constitutes an important contextual factor shaping the relationship between foreign technology in-licensing and SME productivity. Foreign technology in-licensing does not occur in isolation but is embedded within a broader legal and regulatory environment whose effectiveness depends heavily on the strength of domestic regulatory institutions. Existing scholarship, for example, highlights that strong IP protection frameworks tend to encourage greater foreign technology in-licensing by reducing the risks faced by foreign licensors (Gentile 2020; Santacreu 2026). This underscores the notion that regulatory conditions influence both the extent to which SMEs acquire external technological knowledge and the magnitude of the productivity benefits derived from such acquisitions. Specifically, regulatory burden can shape the strategic value of foreign technology in-licensing for SMEs by altering the incentives, risks, and capabilities associated with leveraging imported technologies for productive gains.

Regulatory burden may amplify the productivity effects of foreign technology in-licensing by increasing the relative value of external knowledge. SMEs often lack the internal capabilities, compliance systems, and absorptive capacity required to interpret and meet stringent regulatory requirements. As prior research shows, regulation can raise firms' knowledge thresholds and stimulate demand for external technological resources (Blind 2012). In such contexts, licensed foreign technology offers codified technical specifications, standardised processes, and quality-assurance protocols that can enable SMEs meet regulatory demands more efficiently than if they relied on internal resources alone (Wang et al. 2013). The need to comply with stricter regulation may increase firms' incentives to learn from and integrate externally sourced technologies (Dohse et al. 2019; Gentile 2020), thereby magnifying their productivity benefits.

Moreover, licensing agreements frequently include not only access to proprietary technologies but also complementary regulatory-relevant knowledge such as production documentation, certification guidelines, and quality control systems that reduce the uncertainty and costs associated with compliance. Extant research shows that technology transfer arrangements often embed tacit and codified knowledge that enables firms to adapt technologies to local regulatory environments (Zhao 2006). This bundling of technological and regulatory know-how is particularly valuable where regulatory systems are complex or inconsistently enforced—conditions prevalent in emerging economies.

In addition, formal institutional voids in emerging economies, including weak regulatory enforcement and administrative inefficiencies, can increase the transaction costs and uncertainties SMEs face when attempting to comply with regulatory requirements (Peng et al. 2008). Firms transferring technology to firms abroad, often experienced with multiple regulatory jurisdictions, can act as institutional substitutes by providing regulatory guidance and reducing uncertainty (Doh et al. 2017; Pinkham and Peng 2017). This institutional support enhances SMEs' ability to implement foreign technology effectively and translate it into productivity gains. Accordingly, when regulatory burdens are high, SMEs are more likely to extract greater value from licensed technology because it helps mitigate the institutional weaknesses and compliance challenges inherent in emerging economies (Nahar and Alam 2026). In environments where formal institutional voids are pervasive due to high regulatory burdens, SMEs are increasingly inclined to rely on foreign technology in-licensing as a strategy for acquiring frontier technological inputs that are not available domestically, enabling them to address and overcome prevailing knowledge gaps (Smallbone et al. 2022). Consequently, SMEs in high regulatory burden environments are not only more dependent on foreign technology but also more likely to leverage it intensively, resulting in higher productivity outcomes.

Taken together, these arguments suggest that regulatory burden may strengthen rather than impede the productivity effects of foreign technology in-licensing among SMEs in emerging economies. High regulatory burden creates conditions in which the knowledge embedded in foreign technologies become especially valuable. Thus, SMEs operating under more stringent regulatory conditions are expected to realise greater productivity gains from foreign technology in-licensing than those in less regulated environments. Thus, we hypothesise that:

Hypothesis 3a (H3a): The relationship between foreign technology in-licensing and SME productivity in emerging economies is moderated by regulatory burden, such that the productivity gains from foreign technology in-licensing are stronger under high-regulatory burden environments than under low-regulatory burden environments.

In emerging economies, regardless of whether regulatory burdens are low or high, SMEs that rely on licensed foreign technology tend to exhibit higher productivity than those that do not engage in foreign technology in-licensing. This productivity advantage may arise because foreign technology in-licensing provides SMEs with access to valuable external knowledge and advanced technological capabilities that are not available locally. Such knowledge access strengthens firms' capacity to upgrade their processes, gain competitive advantage, and respond more effectively to dynamic market conditions. These benefits, in turn, enable SMEs adopting licensed foreign technology to outperform their counterparts that are not relying on licensed foreign technology. Thus, even under both stringent and lenient regulatory environments, foreign technology in-licensing equips SMEs with critical inputs that support superior productivity outcomes. We therefore hypothesise that:

Hypothesis 3b (H3b): In emerging economies, SMEs that adopt licensed foreign technology exhibit higher productivity than those that do not, regardless of whether they operate in low- or high-regulatory burden environments.

3. Methodology

3.1 Data and sample

We draw on firm-level data from the World Bank Enterprise Surveys (WBES), a comprehensive cross-country dataset that provides nationally representative information on private sector firms worldwide. The WBES employs a stratified random sampling strategy based on geographic location, firm size, and industry sector, ensuring that each country's sample accurately reflects the structure of its formal private sector. Because the surveys are implemented as a repeated cross-section rather than a longitudinal panel, firms are not necessarily observed across multiple waves. To enhance cross-country comparability and reduce measurement heterogeneity, we use the harmonised global dataset accessed through the World Bank's standardised data portal.

We draw our sample with this inclusion criteria specified as follows: (i) SMEs must have less than 100 employees, following prior research (Hansen-Addy et al., 2025; Simba et al., 2024). This criterion aligns with World Bank's benchmark which accounts for the differences in economic contexts; thus, making global comparison possible. (ii) SMEs must be privately and fully domestically-owned, that is, SMEs with zero foreign or state ownership, and (iii) SMEs must be operating in emerging economies.

We restrict the sample to SMEs with non-missing observations for the country-level variables, which are sourced from multiple internationally recognised datasets and merged with the WBES at the corresponding country-year level. This ensures consistent alignment between firm-level characteristics and the broader macroeconomic environment in which SMEs operate. After filtering out incomplete observations, the final analytical sample comprises 23,939 SMEs across 24 emerging economies over the period 2006–2022 (see Table A1 in the Appendix for the full list of countries included). As reported in Table A1, India provides the largest share of firms in the sample, accounting for 19.36% of all observations, followed by Egypt with 16.85%. In contrast, Tunisia is the least-represented economy, contributing only 0.57% of the sampled firms.

3.2 Variables

3.2.1 *Dependent variable*

The dependent variable is firm productivity. Consistent with prior research (Ballestar et al. 2020; Doucet et al. 2024; Hoang et al. 2021), we capture firm productivity with labour productivity measured by the natural logarithm of annual sales per employee calculated from WBES. The WBES does not provide sufficient information to compute more sophisticated productivity measures such as total factor productivity (TFP), which require detailed data on capital stocks, intermediate inputs, and input prices—variables that WBES does not consistently collect across countries and survey waves. In contrast, firms' annual sales and total number of employees are core variables systematically captured in every WBES country-year survey. Annual sales per employee is widely used as a reliable proxy for productivity in emerging economy datasets where firms may not maintain formal capital accounts or where accounting standards vary considerably. This measure effectively captures firm-level output relative to labour input in environments where data constraints prevent the estimation of more complex production functions.

3.2.2 *Independent variables*

The focal independent variables are foreign technology in-licensing and regulatory burden. Foreign technology in-licensing is a dummy variable based on this WBES question: “*Does this establishment at present use technology licensed from a foreign-owned company, excluding office software?*”. Among the SMEs in our sample, 8.79% responded “yes” and were coded as 1, whereas the remaining 91.21% responded “no” and were coded as 0.

We measure regulatory burden using *Area 5: Regulation* from the Fraser Institute’s *Economic Freedom of the World* (EFW) index. This component captures the extent to which regulatory frameworks governing market entry, contracting, and day-to-day operations constrain economic activity. Area 5 is constructed as a composite measure that averages three subdimensions—credit market regulation, labour market regulation, and business regulation—each reflecting a distinct set of regulatory frictions encountered by firms. Area 5 is scaled from 0 to 10, with higher (lower) values denoting fewer (greater) regulatory constraints and thus a lower (higher) regulatory burden. This measure is well-suited to our analysis because its subdimensions align closely with the regulatory barriers that firms encounter when entering markets, securing financing, and managing ongoing operations. As such, it offers a comprehensive and theoretically consistent proxy for regulatory burden at the country-level.

3.2.3 Control variables

To avoid bias that may arise from omission of variables, we control for several firm-specific and country-specific characteristics likely to influence SME productivity. Regarding firm-specific characteristics, we control for firm size, firm age, manager experience, exporting, research and development (R&D) expenditure, formal training, financial constraint, regulatory compliance cost, international quality certification, and legal status, all derived from WBES. Firm size is measured as the natural logarithm of the total number of employees. Firm age is calculated as the natural logarithm of the survey year minus the firm’s year of establishment. Manager experience is defined as the natural logarithm of the total number of years of experience that the top manager has in the firm’s sector. Exporting is captured using a dummy variable coded 1 if at least 10% of the firm’s annual sales are exported directly, and 0 otherwise. R&D expenditure is measured as a dummy variable coded 1 if a firm reports having spent on formal R&D activities excluding market-research surveys and 0 otherwise. Formal training is a dummy variable indicating whether a firm provides formal training programmes to its employees, coded 1 if such programmes are offered and 0 if not. Financial constraint is also captured using a dummy variable coded 1 if the firm reports facing obstacles in accessing finance and 0 otherwise. Regulatory compliance cost, which captures the direct regulatory burden faced by firms, is measured by the percentage of senior management’s total working time spent dealing with regulatory requirements imposed by government. International quality certification is measured using a dummy variable coded 1 if a firm holds a certification that is internationally recognised, and 0 if not. Legal status is captured using a categorical variable that identifies whether a firm is publicly listed (coded 1), privately held (coded 2), a sole proprietorship (coded 3), a partnership (coded 4), a limited partnership (coded 5), or classified under another legal form (coded 6).

With respect to country-specific characteristics, we control for income level, technological development, and political stability. Income level, which reflects the level of economic development, is measured by gross domestic product (GDP) per capita (constant 2015 US dollar) sourced from World Development Indicators (WDI). Political stability is captured by an index sourced from World Governance Indicators (WGI), which estimates the perceptions of the likelihood that a government will be destabilised or removed through unconstitutional or violent means. We use total number of residents’ patent applications, sourced from WDI to

measure technological development. Following Wooldridge (2010), we use the one-year lagged values of these country-specific variables to reduce potential simultaneity and contemporaneous correlation with the error term, thereby reducing the risk of biased estimates.

We also control for time-invariant country-specific characteristics with country fixed effects. Also, we use industry fixed effects to control for time-invariant industry-specific characteristics, while year fixed effects control for common macroeconomic shocks affecting all firms in a given period. Including these fixed effects ensures that the estimates are identified from within-country, within-industry, and within-year variation, thereby mitigating omitted-variable bias that may arise from unobserved heterogeneity at country, industry, and year levels.

3.3 Estimation strategy

Endogeneity is a key concern in SME productivity research (Owalla et al. 2022). One of the prominent sources of endogeneity in the foreign technology in-licensing-SME productivity is reverse causality. This arises because productive firms have a higher likelihood to engage in foreign technology in-licensing (Lopez 2008), rather than foreign technology in-licensing independently driving SME productivity. When reverse causality is present, the estimates tend to be biased upward. To address this concern, we adopt a control function (CF) approach. Unlike two-stage least squares (2SLS) approach, which imposes strong linearity assumptions, CF approach explicitly models the endogeneity process and introduce an endogeneity correction term directly into the outcome model, whilst maintaining efficiency (Petrin and Train 2010; Wooldridge 2015). It corrects the bias arising from reverse causality by first estimating the unobserved component driving the endogenous regressor and then including this unobserved component, also referred to as correction term or estimated residual, as an additional control in the outcome model.

The CF approach is implemented in two stages. In the first stage, foreign technology in-licensing—the endogenous regressor—is instrumented using *Location*. This choice of instrument is motivated by the fact that firms’ decisions to engage in foreign technology in-licensing often depend on locational attributes such as the presence of industrial clusters and proximity to ports or international trade routes, which shape firms’ exposure to foreign technology and their access to external knowledge (Fosfuri 2006). These locational attributes therefore provide a source of exogenous variation in foreign technology in-licensing propensity. At the same time, such locational attributes are plausibly unrelated to firm productivity once country-specific characteristics are controlled for, implying that location does not directly affect firm productivity beyond its influence on foreign technology in-licensing. To operationalise this instrument, we use each SME’s city of operation in a country as recorded in the WBES and construct a full set of within-country location dummies. The first-stage regression model is:

$$Pr(FTI_{i,j,t} = 1) = \Phi \left(\alpha_i + \sum_{p=1}^{p-1} \beta_p Location_{i,p} \right) \quad (1)$$

where $FTI_{i,j,t}$ denotes foreign technology in-licensing, β_p is the fixed effect or coefficient of each location dummy within its country. We assess the exogeneity of location as an instrument by examining whether it is correlated with the first-stage residuals. Specifically, we regress the first-stage residuals on the full set of within-country location dummies. None of the location

coefficients are statistically significant, indicating no systematic association between location and the residuals. We also perform a joint F-test of all within-country location dummies, which yields an F-statistic of 0.36 (p-value = 1.000), confirming that the coefficients are jointly equal to zero. Based on these results, we conclude that the location satisfies the exclusion restriction requirement for identification of the second-stage outcome equation.

In the second stage, the first-stage residuals enter the outcome equation as an additional regressor to correct for potential reverse causality bias. The outcome equation is expressed as:

$$Prod_{i,j,t} = \alpha_i + \varphi FTI_{i,j,t} + \gamma RB_{i,j,t} + \rho X'_{i,j,t} + \omega_j + \psi_k + v_t + \mu_{i,j,t} + \varepsilon_{i,j,t} \quad (2)$$

Where $Prod_{i,j,t}$ represents firm-level productivity, $RB_{i,j,t}$ indicates regulatory burden, $X'_{i,j,t}$ is a vector of control variables including both firm-specific and country-specific characteristics, ω_j is country fixed effect, ψ_k is industry fixed effect, v_t is year fixed effect, $\mu_{i,j,t}$ is the first-stage residuals (endogeneity correction term), $\varepsilon_{i,j,t}$ is second-stage residuals, and subscripts i, j, t are indicators of firm, country, and survey year, respectively. To examine the moderating effect of regulatory burden, we include an interactive term of foreign technology in-licensing and regulatory burden in Eq. (2).

Because firms' decision to engage in foreign technology in-licensing is inherently non-random and influenced by underlying firm characteristics, this process may lead to selection bias in the outcome equation. To deal with this, we compute the inverse Mills ratio from a selection model fitted by a probit estimation and include it as an additional control variable in the outcome equation. Incorporating the inverse Mills ratio provides a standard and valid correction for selection bias (Certo et al. 2016). In the selection model, the probability that a firm engages in foreign technology in-licensing is modelled as a function of firm-specific characteristics that can explain why firms self-select into foreign technology in-licensing as a strategy to externally access knowledge to facilitate their productivity, while we control for country, industry, and year fixed effects. These characteristics include firm size, firm age, manager experience, exporting, R&D expenditure, formal training, financial constraint, and legal status.

Larger firms typically possess stronger internal capabilities to absorb and utilise knowledge from foreign technology, making them more likely to engage in foreign technology in-licensing (Dohse et al. 2019). Similarly, older firms benefit from more established routines and accumulated experiential knowledge (Coad et al. 2016), which enhances their ability to integrate foreign technology. In contrast, younger firms may also exhibit a higher propensity to in-license foreign technology to compensate for their weaker internal capabilities (Zahra et al. 2005). Managers with greater experience typically possess stronger capabilities in identifying, evaluating, acquiring, and integrating valuable knowledge, and they are more open to undertaking strategic organisational changes (Helfat and Martin 2015). This enhanced managerial judgement and adaptability make them more inclined to seek superior external knowledge through foreign technology in-licensing.

Exporting firms tend to be larger, more productive, and more intensive in skilled labour, characteristics that enhance their capability to identify and absorb external technological knowledge. Consequently, these firms are more likely to engage in foreign technology in-licensing (Bas 2012). Firms that invest in R&D typically develop stronger absorptive capacity, enabling them to more effectively recognise, assimilate, and utilise external knowledge. This enhanced capability increases their willingness to acquire external technological expertise through foreign technology in-licensing (Li-Ying and Wang 2015).

Firms often invest in formal employee training to upgrade skills, thereby enhancing workers' ability to assimilate and integrate new technologies (Boothby et al. 2010). As a result, such firms are more likely to engage in foreign technology in-licensing.

Financial constraint presents a significant barrier to firms adopting new technologies because technology acquisition typically involves substantial up-front and ongoing costs (Gomez and Vargas 2009). As a result, financially constrained firms are less likely to engage in foreign technology in-licensing. A firm's legal status, which determines the level of legal protection it can effectively claim, influences its willingness to engage in foreign technology in-licensing, as firms vary in the extent to which foreign technology a firm is licensed to use is legally protected by intellectual property rights (Gentile 2020).

To satisfy the exclusion restriction required for identifying the selection model, legal status is excluded from the outcome equation. Although legal status can influence a firm's propensity to engage in foreign technology in-licensing, it is unlikely to directly affect firm productivity. This makes legal status an appropriate exclusion variable, providing the exogenous variation necessary for identifying the inverse Mills ratio (see Table A2 for selection model regression results).

4. Results

4.1 Summary statistics

Table 1 and Table 2 reports the summary statistics and correlation matrix for the variables used in this paper, respectively. We discuss the dependent and independent variables only. Table 1 shows that the mean labour productivity is 13.45 which is slightly above the median of 13.45, indicating that, on average, majority of the SMEs within the sample exhibit moderate productivity. Also, it shows that foreign technology in-licensing has a mean of 0.088, indicating that 8.8% of SMEs in the sample rely on licensed foreign technology. The mean regulatory burden is 6.027. On a scale of 0 to 10, with higher scores indicating lower regulatory burden, this mean value indicates that, on average, most SMEs in the sample face lower regulatory constraints.

Tables 1 and 2 report the summary statistics and correlation matrix, respectively, for the variables used in this study. The discussion focuses on the dependent and independent variables. As shown in Table 1, the mean labour productivity is 13.45, which is slightly above the sample median of 13.12, suggesting that, on average, majority of SMEs in the sample exhibit higher levels of productivity. Foreign technology in-licensing has a mean value of 0.088, indicating that approximately 8.8% of SMEs rely on licensed foreign technology. The mean value of the regulatory burden variable is 6.027. Given that this variable is measured on a scale from 0 to 10, with higher scores indicating a lower regulatory burden, this suggests that most countries in the sample are low-regulatory burden environments.

Insert Table 1 about here

Turning to Table 2 which presents preliminary evidence on the linear relationships among the variables through pairwise correlation coefficients. Labour productivity is positively correlated with foreign technology in-licensing and regulatory burden. Moreover, the correlation coefficients among the explanatory variables are generally low, with none exceeding 0.7. This indicates that multicollinearity is unlikely to pose a serious concern in the regressions.

Insert Table 2 about here

4.2. Main regression results

Table 3 presents the main regression results to test the relationship between foreign technology in-licensing, regulatory burden, and SME productivity, while controlling for firm- and country-level factors. The explained variable is labour productivity. We estimated the regression results by clustering standard errors at the firm level, accounting for within-firm serial correlation. We further include year, industry, and country fixed-effects to absorb time-invariant factors, industry-specific shocks, and unobserved country effects. Column (1) presents coefficients including foreign technology in-licensing and control variables. Column (2) extends this specification by including regulatory burden. With the full specification, Column (3) reports the main OLS estimation results.

Several key results emerged from the main regression results. The estimated coefficient of foreign technology in-licensing is positive and statistically significant, indicating that foreign technology in-licensing is positively related to SME productivity in emerging economies. This result provides empirical support for H1. It suggests that SMEs that adopt licensed foreign technology exhibit higher productivity levels than their non-adopting counterparts. However, regulatory burden is negatively and statistically significant, suggesting that regulatory burden is negatively associated with SME productivity in emerging economies. This results empirically supports H2. This suggests that SMEs operating in emerging economies characterized by highly burdensome regulations tend to be less productive. The estimated coefficient of the interaction between foreign technology in-licensing and regulatory burden is negative and statistically significant, implying that regulatory burden attenuates the productivity gains of foreign technology in-licensing. However, turning to the marginal effect of foreign technology in-licensing, the results show that the marginal effect is greater in high-regulatory burden environments than low-regulatory burden environments, empirically supporting H3a. Similarly, the results shows that SMEs adopt licensed foreign technology are more productive than non-adopters in both low- and high-regulatory burden environments, and this provides empirical support for H3b.

Insert Table 3 about here

4.2. Robustness checks

4.2.1 Multilevel modelling

To ensure that the main findings are not driven by the regression model, we conduct a battery of tests to gauge the robustness of the results. First, we re-estimate our regressions using multilevel mixed-effects regression due to the data structure. Both dependent and independent variables were measured at the firm level, and control variables were measured at both firm and country levels. The choice of multilevel modelling is consistent with relevant literature (see, for example, Aulakh et al. 2013; Qian et al. 2024; Crowley & Walsh 2024). Table 4 presents multilevel regression results on the relationship between foreign technology in-licensing, regulatory burden, and SME productivity. The intra-class correlation coefficient (ICC) ranges between 90 and 94 percent, indicating that the variance in firm productivity is associated with cross-country differences. This validates the use of a multilevel modelling approach. The Likelihood tests also confirm that the specification is a good fit. The results and interpretation are qualitatively consistent with the main regression results in Table 3.

Insert Table 4 about here

4.2.2 Control function approach with entropy balancing

As an alternative to relying solely on the inverse Mills ratio to address potential selection bias, we supplement the control function approach with entropy balancing. Entropy balancing constructs unit-level weights that satisfy a rich set of balance constraints by reweighting the control group so that its covariate moments match those of the treatment group (Hainmueller 2012). In our setting, the treatment group consists of SMEs that use licensed foreign technology, while the control group includes SMEs that do not. We employ the same covariates used in estimating the selection equation for the inverse Mills ratio to generate entropy-balancing weights, ensuring comparability across methods (see Table A3 of the Appendix for entropy balancing results). The resulting weights are then applied in the second-stage outcome regression within the control function framework. This hybrid strategy strengthens the credibility of our identification by simultaneously adjusting for observable differences via entropy balancing and for unobservable selection via the control function. Table 5 reports the control function with entropy balancing-weighted regression results, and these results provide findings qualitatively similar to the main regression results

Insert Table 5 about here

4.2.3 Controlling for legal origin

To further assess the robustness of our results, we additionally control for countries' legal origins. Legal origin, defined as the historical roots of a country's legal system, shapes how governments regulate economic activity and enforce regulations (La Porta et al. 2008). Differences in legal traditions influence the extent, design, and enforcement of regulatory frameworks, thereby affecting the regulatory burden faced by firms. In particular, countries with English legal origin are generally associated with lighter regulatory regimes compared to those with French, German, or Scandinavian legal traditions (Shleifer 2005). The inclusion of legal origin in our specifications allows us to account for these systematic institutional differences and ensures that our estimated effects are not confounded by cross-country variation in regulatory environments. Additionally, it alleviates concerns that our results are driven by the uneven distribution of legal origins across countries. We present the results in Table 7, and the findings are qualitatively in alignment with the findings provided by the main regression results.

Insert Table 6 about here

5. Discussion

Our study offers new insights into how the strategic acquisition of external knowledge from foreign markets coupled with the regulatory conditions prevailing in SMEs' domestic environments shapes productivity outcomes across emerging economies. We investigate the interplay among foreign technology in-licensing, regulatory burden, and SME productivity using a dataset of 23,932 firms across 24 emerging economies. The findings indicate that access to licensed foreign technology significantly enhances SME productivity. Firms that adopt foreign technology exhibit higher productivity levels than their non-adopting counterparts, reinforcing the argument that external knowledge sourcing constitutes a vital mechanism

through which SMEs upgrade their capabilities and improve productivity (Audretsch and Belitski, 2021; Ballestar et al., 2020). In addition, our results demonstrate that regulatory burden in the domestic market reduces SME productivity. Regulatory burden impedes the resource-allocative capacity of SMEs to productive activities, thereby lowering productivity (Kitching et al., 2015). It is often reinforced by formal institutional voids predominant in emerging economies, which weaken market functioning, heighten the risk of opportunistic behaviour, and discourage entrepreneurial spirit (Khanna and Palepu, 2010; Doh et al., 2017). These findings illustrate how institutional frictions in emerging markets can erode SMEs' efficiency and inhibit performance gains.

Importantly, we find that the productivity-enhancing effect of foreign technology in-licensing is conditioned by the level of regulatory burden. SMEs derive greater productivity benefits from licensed foreign technology when operating under higher, rather than lower, regulatory constraints. This pattern supports the view that SMEs in emerging economies increasingly rely on external knowledge to build the capabilities needed to navigate institutional weaknesses and regulatory hurdles (Smallbone et al., 2022). By tapping into foreign technologies, SMEs appear better equipped to mitigate the adverse effects of burdensome regulations, thereby realising amplified productivity gains. Nevertheless, our results indicate that, irrespective of regulatory burden, SMEs adopting foreign technology maintain a consistent productivity advantage over non-adopters. This reinforces the centrality of foreign technology in-licensing as an important external knowledge acquisition strategy with broad and persistent productivity-enhancing effects.

6. Conclusion

Our findings demonstrate that SMEs in emerging economies strategically utilise external knowledge, particularly licensed foreign technology, to enhance their productivity. We show that foreign technology in-licensing serves as an effective mechanism for enriching SMEs' knowledge bases, enabling them to overcome internal resource constraints and achieve superior productivity outcomes. Importantly, our results reveal that the productivity gains from foreign technology in-licensing are not uniform but depend on the regulatory environment in which SMEs operate. In environments characterised by higher regulatory burden, SMEs derive even greater productivity benefits from foreign technology, suggesting that external knowledge accessed from foreign technology in-licensing acts as a compensatory capability that can help SMEs navigate institutional voids. Our findings extend KBV by illustrating that the value of external knowledge resources sourced from foreign technology in-licensing is contingent on the regulatory environment that shapes SMEs' ability to leverage those resources. Overall, our study highlights that external knowledge acquisition is both a strategic and context-sensitive avenue through which SMEs build and deploy competitive capabilities in emerging economies.

Our findings offer several important implications for managers of SMEs operating in emerging economies. First, the positive effect of foreign technology in-licensing on productivity suggests that SME managers should view external knowledge acquisition as a strategic investment rather than a discretionary activity. Managers who proactively identify, evaluate, and integrate relevant foreign technologies can significantly strengthen their firms' operational efficiency and competitive positioning. Because SMEs often face internal resources constraints, tapping into established foreign technologies can provide an accelerated pathway to upgrade their capability to facilitate productivity. Second, the negative effect of regulatory burden on productivity highlights the need for managers to develop robust internal processes for regulatory compliance. Streamlining compliance routines, adopting digital record-management tools, and investing in staff training can reduce the time and cost associated with fulfilling

regulatory requirements. These efforts allow SMEs to preserve managerial attention for strategic activities rather than administrative tasks. Finally, the finding that foreign technology yields even greater productivity gains under high regulatory burden implies that managers should prioritise external technology acquisition when operating in restrictive institutional environments. In such conditions, foreign technology serves as a compensatory capability, helping SMEs mitigate the operational inefficiencies caused by regulatory constraints. Managers can leverage licensed foreign technology not only to improve production processes but also to build organisational resilience by strengthening knowledge-based capabilities that are less vulnerable to institutional frictions.

Also, our findings can offer policy insights for governments. Foreign technology in-licensing is not merely a productivity tool but a strategic buffer against institutional weaknesses. Thus, governments in emerging economies should prioritize policies that expand SMEs' access to licensed foreign technologies, as these consistently raise productivity and help SMEs overcome domestic institutional weaknesses. Targeted support such as financial incentives, licensing assistance, and capability-building programmes can amplify these gains, especially in highly regulated environments where foreign technology delivers the greatest productivity payoffs. At the same time, improving regulatory quality remains essential, as excessive regulatory burden independently depresses productivity.

While the current study focuses on the interplay between foreign technology in-licensing, regulatory burden, and productivity across emerging economies, several promising avenues for future research remain. First, scholars could investigate how regulatory burden shapes the effect of foreign technology in-licensing on other key SME outcomes, such as export performance and innovation performance. Examining these performance indicators can advance understanding of how institutional environments shape the influence of external knowledge sourcing strategies on SME performance in the .A second avenue is to explore whether the relationships identified in this study hold under conditions of rare but consequential external shocks—such as geopolitical tensions, major supply-chain disruptions, war, or financial crises. During such periods, the strategic value of adopting foreign technology may shift, either by enhancing firms' resilience to domestic market turbulence or, conversely, by increasing exposure to risks associated with dependence on imported technologies. Finally, future research could incorporate the growing importance of environmental, social, and governance (ESG) initiatives. Investigating whether foreign technology in-licensing contributes not only to productivity but also to corporate sustainability would deepen understanding of its strategic relevance. A promising line of inquiry is whether foreign technology in-licensing, when combined with ESG-promoting activities, provides SMEs with a strategic buffer in environments characterised by heightened regulatory pressures.

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Table 1. Descriptive statistics

	Observations	Mean	Standard deviation	Minimum	Maximum	First quartile	Median	Third quartile
Labour productivity	23,938	13.45	2.354	-3.401	26.75	11.83	13.12	14.66
Foreign technology in-licensing	23,939	0.088	0.283	0	1	0	0	0
Regulatory burden	23,939	6.027	0.915	4.230	7.810	5.630	6.030	6.650
Firm size	23,939	2.893	0.849	0	4.595	2.197	2.890	3.555
Firm age	23,935	2.720	0.750	0	5.352	2.303	2.773	3.219
Manager experience	23,939	2.765	0.705	0	4.248	2.303	2.890	3.219
Exporting	23,939	0.099	0.299	0	1	0	0	0
R&D expenditure	23,939	1.859	0.348	1	2	2	2	2
Formal training	23,939	0.237	0.425	0	1	0	0	0
Financial constraint	23,939	0.636	0.481	0	1	0	1	1
Regulatory compliance cost	23,939	10.29	20.26	0	100	0	1	10
International quality certification	23,939	0.198	0.398	0	1	0	0	0
Legal status	23,939	2.945	1.006	1	6	2	3	3
Income level	23,939	8.456	0.805	6.957	10.12	7.799	8.216	9.177
Technological development	23,939	7.491	2.100	3.178	12.94	6.461	6.934	9.275
Political stability	23,939	-0.756	0.659	-2.088	1.054	-1.229	-0.714	-0.417

Table 2. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Labour productivity	1.000															
(2) Foreign technology in-licensing	0.0003	1.000														
(3) Regulatory burden	0.175***	0.089***	1.000													
(4) Firm size	0.077***	0.111***	-0.019***	1.000												
(5) Firm age	-0.008	-0.002	-0.032***	0.140***	1.000											
(6) Manager experience	0.002	-0.020***	-0.051***	0.055***	0.446***	1.000										
(7) Exporting	0.015**	0.096***	0.074***	0.168***	0.055***	0.073***	1.000									
(8) R&D expenditure	-0.093***	-0.128***	-0.071***	-	-0.003	-0.025***	-0.120***	1.000								
(9) Formal training	0.081***	0.116***	0.151***	0.208***	0.021***	0.037***	0.117***	-0.315***	1.000							
(10) Financial constraint	-0.041***	0.022***	-0.077***	-	-0.019***	0.003	-0.014**	-0.088***	0.046***	1.000						
(11) Regulatory compliance cost	-0.011*	0.015**	0.123***	0.007	0.043***	0.044***	0.067***	-0.059***	0.072***	0.020***	1.000					
(12) International quality certification	0.071***	0.144***	0.030***	0.289***	0.105***	0.064***	0.192***	-0.155***	0.230***	-0.029***	0.032***	1.000				
(13) Legal status	-0.067***	0.004***	-0.206***	-0.002	0.053***	-0.013**	-0.033***	0.033***	-0.056***	0.022***	-0.076***	0.031***	1.000			
(14) Income level	-0.110***	0.038***	0.362***	-	-0.094***	0.083***	0.076***	-0.040***	0.138***	-0.024***	0.086***	-0.007	-0.327***	1.000		
(15) Technological development	0.019***	-0.016**	-0.106***	0.072***	-0.011*	-0.056***	-0.018***	0.012*	0.053***	-0.089***	-0.016*	0.191***	0.073***	-0.030***	1.000	
(16) Political stability	0.045***	0.051***	0.544***	-0.012*	0.028***	0.039***	0.077***	0.041***	0.044***	-	0.061***	0.043***	-	0.520***	0.095***	1.000
										0.124***			0.114***			

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Foreign technology in-licensing, regulatory burden, and SME productivity

	(1)	(2)	(3)
Foreign technology in-licensing (FTI)	0.352*** (0.103)	0.400*** (0.103)	0.873*** (0.258)
Regulatory burden		-3.012*** (0.176)	-3.016*** (0.176)
FTI x Regulatory burden			-0.075** (0.037)
Firm size	-0.270*** (0.038)	-0.283*** (0.037)	-0.282*** (0.037)
Firm age	-0.002 (0.013)	0.001 (0.013)	0.001 (0.013)
Manager experience	0.172*** (0.016)	0.173*** (0.015)	0.173*** (0.015)
Exporting	-0.187*** (0.048)	-0.183*** (0.047)	-0.183*** (0.047)
R&D expenditure	0.532*** (0.065)	0.558*** (0.065)	0.555*** (0.065)
Formal training	-0.286*** (0.044)	-0.295*** (0.044)	-0.292*** (0.044)
Financial constraint	-0.116*** (0.019)	-0.132*** (0.019)	-0.131*** (0.019)
Regulatory compliance cost	-0.003*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
International quality certification	0.311*** (0.023)	0.296*** (0.022)	0.294*** (0.022)
Income level	1.671*** (0.307)	-0.024 (0.318)	-0.171 (0.325)
Technological development	0.271*** (0.066)	0.019 (0.063)	0.015 (0.063)
Political stability	-1.427*** (0.138)	-0.273* (0.141)	-0.237* (0.142)
Generalized residuals	-0.083 (0.055)	-0.103* (0.055)	-0.107* (0.055)
Inverse Mills ratio	-1.853*** (0.184)	-1.923*** (0.182)	-1.915*** (0.182)
Constant	1.152 (2.738)	41.153*** (3.501)	45.391*** (3.187)
Marginal effects of FTI			
FTI= 0 (at low regulatory burden)			10.68319***
FTI = 1 (at low regulatory burden)			11.03417***
FTI = 0 (at high regulatory burden)			16.0915***
FTI = 1 (at high regulatory burden)			16.57743***
Observations	23,932	23,932	23,932
R-squared	0.743	0.747	0.747
Countries	24	24	24
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes

Robust standard errors clustered at the firm level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4. Multilevel regression results

	(1)	(2)	(3)
Foreign technology in-licensing (FTI)	0.402*** (0.120)	0.507*** (0.116)	0.559 (0.512)
Regulatory burden		-1.204*** (0.436)	-1.204*** (0.436)
FTI x Regulatory burden			-0.008 (0.078)
Firm size	-0.257*** (0.037)	-0.275*** (0.037)	-0.275*** (0.037)
Firm age	-0.004 (0.012)	0.000 (0.012)	0.000 (0.012)
Manager experience	0.170*** (0.015)	0.171*** (0.015)	0.171*** (0.015)
Exporting	-0.174*** (0.047)	-0.174*** (0.047)	-0.174*** (0.047)
R&D expenditure	0.506*** (0.065)	0.538*** (0.064)	0.538*** (0.064)
Formal training	-0.274*** (0.044)	-0.280*** (0.044)	-0.280*** (0.044)
Financial constraint	-0.115*** (0.019)	-0.136*** (0.019)	-0.136*** (0.019)
Regulatory compliance cost	-0.003*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
International quality certification	0.312*** (0.022)	0.292*** (0.022)	0.292*** (0.022)
Income level	1.593*** (0.342)	0.557 (0.477)	0.553 (0.478)
Technological development	0.259*** (0.070)	-0.239 (0.148)	-0.239 (0.148)
Political stability	-1.405*** (0.129)	-0.109 (0.227)	-0.109 (0.227)
Generalized residuals	-0.102** (0.051)	-0.153*** (0.050)	-0.153*** (0.050)
Inverse Mills ratio	-1.785*** (0.183)	-1.883*** (0.181)	-1.883*** (0.181)
Constant	-0.497 (3.069)	22.373*** (5.345)	22.412*** (5.350)
Marginal effects of FTI			
FTI = 0 (at low regulatory burden)			12.50798***
FTI = 1 (at low regulatory burden)			13.01138***
FTI = 0 (at high regulatory burden)			14.66798***
FTI = 1 (at high regulatory burden)			15.18588***
Observations	23,932	23,932	23,932
Number of countries	24	24	24
LR test vs. linear model: chi2(2)	20902.86	21037.58	20941.95
Prob > chi2	0.0000	0.0000	0.0000
Log likelihood	-38277.62	-38043.98	-38043.98
AIC	76691.24	76227.97	76229.96
BIC	77240.88	76793.78	76803.85
ICC	0.900 (0.027)	0.940 (0.030)	0.940 (0.030)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes

Standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5. Control function with entropy balancing-weighted regression results

	(1)	(2)	(3)
Foreign technology in-licensing (FTI)	0.487*** (0.123)	0.524*** (0.122)	0.888*** (0.272)
Regulatory burden		-2.585*** (0.254)	-2.560*** (0.254)
FTI x Regulatory burden			-0.058 (0.039)
Firm size	0.020 (0.021)	0.021 (0.020)	0.020 (0.020)
Firm age	-0.005 (0.026)	-0.004 (0.026)	-0.004 (0.026)
Manager experience	0.111*** (0.024)	0.106*** (0.024)	0.106*** (0.024)
Exporting	0.244*** (0.045)	0.260*** (0.045)	0.258*** (0.045)
R&D expenditure	-0.105*** (0.040)	-0.098** (0.040)	-0.099** (0.040)
Formal training	0.129*** (0.037)	0.141*** (0.036)	0.142*** (0.036)
Financial constraint	-0.033 (0.035)	-0.042 (0.035)	-0.042 (0.035)
Regulatory compliance cost	-0.001* (0.001)	-0.001 (0.001)	-0.001 (0.001)
International quality certification	0.386*** (0.042)	0.365*** (0.042)	0.363*** (0.042)
Legal status	-0.000 (0.017)	0.006 (0.017)	0.008 (0.017)
Income level	2.144*** (0.426)	0.619 (0.453)	0.514 (0.461)
Technological development	0.208** (0.096)	-0.044 (0.093)	-0.046 (0.092)
Political stability	-1.532*** (0.203)	-0.515** (0.209)	-0.488** (0.210)
Generalized residuals	-0.159** (0.066)	-0.172*** (0.066)	-0.176*** (0.066)
Constant	-3.025 (2.941)	23.878*** (4.855)	33.134*** (4.487)
Marginal effects of FTI			
FTI = 0 (at low regulatory burden)			11.30998***
FTI = 1 (at low regulatory burden)			11.79319***
FTI = 0 (at high regulatory burden)			15.90049***
FTI = 1 (at high regulatory burden)			16.4883***
Observations	23,934	23,934	23,934
R-squared	0.756	0.760	0.760
Countries	24	24	24
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes

Robust standard errors clustered at the firm level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6. Controlling for legal origin

	(1)	(2)	(3)
Foreign technology in-licensing (FTI)	0.352*** (0.103)	0.400*** (0.103)	0.873*** (0.258)
Regulatory burden		-3.012*** (0.176)	-3.016*** (0.176)
FTI x Regulatory burden			-0.075** (0.037)
Firm size	-0.270*** (0.038)	-0.283*** (0.037)	-0.282*** (0.037)
Firm age	-0.002 (0.013)	0.001 (0.013)	0.001 (0.013)
Manager experience	0.172*** (0.016)	0.173*** (0.015)	0.173*** (0.015)
Exporting	-0.187*** (0.048)	-0.183*** (0.047)	-0.183*** (0.047)
R&D expenditure	0.532*** (0.065)	0.558*** (0.065)	0.555*** (0.065)
Formal training	-0.286*** (0.044)	-0.295*** (0.044)	-0.292*** (0.044)
Financial constraint	-0.116*** (0.019)	-0.132*** (0.019)	-0.131*** (0.019)
Regulatory compliance cost	-0.003*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
International quality certification	0.311*** (0.023)	0.296*** (0.022)	0.294*** (0.022)
Income level	1.671*** (0.307)	-0.024 (0.318)	-0.171 (0.325)
Technological development	0.271*** (0.066)	0.019 (0.063)	0.015 (0.063)
Political stability	-1.427*** (0.138)	-0.273* (0.141)	-0.237* (0.142)
Legal origin (Reference group=German)			
English	3.332*** (0.439)	1.676*** (0.433)	0.938*** (0.283)
French	-2.009*** (0.623)	0.758 (0.657)	7.196*** (0.624)
Generalized residuals	-0.083 (0.055)	-0.103* (0.055)	-0.107* (0.055)
Inverse Mills ratio	-1.853*** (0.184)	-1.923*** (0.182)	-1.915*** (0.182)
Constant	-5.514** (2.703)	30.900*** (3.293)	38.194*** (3.746)
Marginal effects of FTI			
FTI = 0 (at low regulatory burden)			10.68319***
FTI = 1 (at low regulatory burden)			11.03417***
FTI = 0 (at high regulatory burden)			16.0915***
FTI = 1 (at high regulatory burden)			16.0915***
Observations	23,932	23,932	23,932
R-squared	0.743	0.747	0.747
Countries	24	24	24
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes

Robust standard errors clustered at the firm level are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Supplementary Files

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