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Filtering or facilitating productive entrepreneurship?

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ABSTRACT

There is a paucity of knowledge on the conditions which enable productive entrepreneurship, particularly those which are policy-amenable like regulations. Rooted in opposing theories of public choice and public interest, we investigate the effect of several types of business regulation on productive entrepreneurship, accounting also for importance of corruption. First, we propose a composite measure of productive entrepreneurship based on three criteria: ability to capture current and potential economic gains, reflective of activities and output, and innovation-centric. Second, using a multi-source panel dataset comprising 1065 country-year observations for 118 countries during 2005–2016, we hypothesize and empirically test for the effect of three types of regulation relevant to business stages - Birth, Growth, and Exit (BSR, GSR, EXSR) - on our measure of productive entrepreneurship. Our findings advance growing insights on the highly heterogenous nature of regulation by type and even by tool (e.g. financial, procedural), and limited recent insights on drivers of productive entrepreneurship. We offer implications for research and for policy design.

1. Introduction

Interest in productive entrepreneurship is often driven by expectations that it brings value to the economy, such as gains from technological innovation, job creation, wealth creation and industry and economic expansion. Yet we know little about the drivers of productive entrepreneurship and the influence of institutional conditions (see (Chowdhury et al., 2019; Nicotra et al., 2018; Baumol, 1990). This presents a research puzzle for scholars and a knowledge gap for policymakers.

To address this gap, we ask: *how does a country's regulatory setup affect productive entrepreneurship, and what role does corruption play in this relationship?* Recent research demonstrates the importance of treating the regulatory setup as heterogeneous: the type and domain (e.g. entry regulation, trade regulation) and mode of implementation (e.g. charging fees, requiring documentation) of regulation can vary in their impacts and relevance for entrepreneurship (Audretsch et al., 2022a, 2022b; Klapper and Love, 2010). And, given substantial global variation in regulatory setup, corruption offers crucial context to understand differences in entrepreneurship outcomes (see Audretsch et al., 2022a, 2022b; Mohamadi et al., 2017; Anokhin and Schulze, 2009).

We approach our analysis of regulations based on their relevance to three stages in business life. Our intuition is that entrepreneurs may be concerned with the particular needs associated with the current stage of business life, and businesses that are just starting, growing, or exiting will have different challenges. The relevance, immediacy, and magnitude of a particular regulatory setting could vary with these stages of business life. For example, a brand new business may be concerned about property-related regulations so that it can open a facility. A growing business may be concerned about investor protections that can help secure financing to expand, or contract protections in case of disputes with new suppliers. Similarly, an exiting business may be more concerned with the exit process rather than the business registration process. We thus differentiate between regulations that are more likely to be relevant at one of three stages of business life: birth-stage regulations (BSR), growth-stage regulations (GSR), and exit-stage regulations (EXSR).

We use institutional theory (Williamson, 2000) to understand the allocation of entrepreneurship (Baumol, 1990), and public choice and public interest theory to explain how regulation and corruption can affect productive entrepreneurship. Our analysis, we analyze how regulations relevant to three stages of the entrepreneurial lifecycle (birth,

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growth, and exit) and corruption directly and jointly affect productive entrepreneurship.

We develop hypotheses on the direct effects of business regulations – birth-stage regulation (BSR), growth-stage regulation (GSR) and exit-stage regulation (EXSR) – and corruption on productive entrepreneurship, followed by a set of hypotheses on how corruption shapes the effect of these regulations on productive entrepreneurship. We test our hypotheses using a multi-source unbalanced panel dataset covering 118 countries during 2005–2016 and we also conduct a series of robustness checks. We conduct our analysis at the country level in order to maximize insights for policymakers, as many key business regulations are enacted nationally. And, the net effects of productive entrepreneurs at the national level are an important part of the overall story of a country's entrepreneurship.

Our study advances knowledge on how regulations and corruption shape productive entrepreneurship. We make three contributions to current knowledge. First, we respond to calls for clarity on the heterogeneity of institutions and particularly the role of regulations in driving entrepreneurship outcomes (Audretsch et al., 2023; Urbano et al., 2019). Second, we provide new insights on productive entrepreneurship, a growing area of research interest and a policy priority in many countries. Our findings complement recent studies on productive entrepreneurship (Nicotra et al., 2018) and its allocation (Chowdhury et al., 2019). Third, methodologically, we propose a new measure for productive entrepreneurship, which is a composite of three measures reflecting value that comes from impact or potential impact. We create this measure for 118 countries around the world and for the time period of our study.

Next, we discuss the relevant literature and present our hypotheses. In our third section, we present our data and describe our method. We report results in section four, followed by a discussion of the implications, contributions and limitations of our study.

2. Theoretical framework

2.1. Productive entrepreneurship

The allocation of entrepreneurial talent to different activities is theorized as being driven by the institutional context and reward structures in which entrepreneurs operate (Murphy et al., 1992; Baumol, 1990; Autio et al., 2014; Boudreaux et al., 2019). In a conceptual overview, Baumol proposed that entrepreneurship can be productive, unproductive, and destructive. He defined productive entrepreneurship as adding (directly or indirectly) to the net economic output or the capacity for future and additional output in the economy (Baumol, 1993: 30). These types of entrepreneurial activities actively pursue opportunities and tend to be growth-oriented (Baumol, 2002). And, unproductive entrepreneurship can be associated with 'rent-seeking activity' (Baumol, 1990) or even mafia-like activities (Bureau and Fendt, 2011), with destructive entrepreneurship exerting negative effects and destroying wealth (Desai et al., 2013). Our concern in this analysis is with productive entrepreneurship, as it is the explicit or assumed target of many related direct and indirect policy efforts around the world (see Nicotra et al., 2018).

2.2. Measuring productive entrepreneurship

Productive entrepreneurship is not empirically well established in the literature, and there is a lack of consensus on measurement (Nicotra et al., 2018). We propose a measure of productive entrepreneurship in the spirit of Baumol's conception of the term – that it adds to current or additional and future economic output (1993: 30). We apply this to mean that productive entrepreneurship is value creation as a result of the impact or potential future impact of entrepreneurial activity.

Thus, this serves as our first requirement to measure productive entrepreneurship – consideration of both the current and future dimensions. We impose two additional requirements when creating our measure. The second requirement is that a measure of productive entrepreneurship should capture *activities* as well as *output.* This is related to the first requirement, as some activities may yield future gains but have not yet become measurable output. As an example of the relevance of the first two requirements, innovating a product may not immediately yield job gains as it takes time to develop a new product, but new innovations can lead to future jobs, wealth creation, and industry expansion. While we want our PEI to consider activities and output, we explicitly do not consider *motivation.* This resolves concerns around necessity and opportunity entrepreneurship. While these concepts are useful because they conceptually capture distinctions in why people start a new business, they are neither empirically clean nor easily matched to specific activities or outcomes (see Nicotra et al., 2018). For example, the net entrepreneurial productivity approach used by Chowdhury et al. (2019) is an index which includes productive and unproductive measures. Necessity entrepreneurship is part of their unproductive entrepreneurship measure but we do not want to assume that necessity entrepreneurs are unproductive. Isenberg (2010) considers opportunity-driven entrepreneurs (not necessity) as enablers of productive entrepreneurship. However, we point out that this kind of focus can muddy the impact and potential impact of entrepreneurship (gains for the economy) with the motivation for entrepreneurship (necessity or opportunity). Necessity-driven entrepreneurship is often assumed to yield poorer effects than opportunity-driven entrepreneurship (Nicotra et al. (2018) and to be less desirable (see Audretsch et al., 2021). This is problematic both conceptually and empirically, as the findings of Block and Sandner (2009), Caliendo and Kritikos (2010) show that some outcomes like survival of opportunity-driven entrepreneurship are not better than those of necessity-driven entrepreneurship (see Nicotra et al., 2018 for a discussion). Our approach aligns with the arguments of Sauka (2008) and Sauka and Welter (2007) on the importance of keeping questions about impact and motivation separate.

Third, we imposed a requirement that a measure of productive entrepreneurship be *innovation-centric,* because innovation has been shown to drive industry expansion and economic advancement. Nicotra et al. (2018) point out that innovation as part of measurement for productive entrepreneurship is based on the assumption that innovation is associated with better post-entry performance of a new business. Productive entrepreneurship generates innovation, as described by Nicotra et al. (2018), and innovation itself enables new businesses to produce productive gains. Thus, we consider an innovation-centric approach to be useful.

We acknowledge that there are tradeoffs in measuring complex economic concepts, and that one measure cannot capture everything. However, we feel that imposing these three criteria – capturing current and future dimensions, reflecting activities as well as outputs, and being innovation-centric – provides an appropriate and reasonable approach to measure productive entrepreneurship. Our measurement approach builds on important recent efforts to measure productive entrepreneurship, either independently or as relates to unproductive entrepreneurship (e.g. Chowdhury et al., 2019; Nicotra et al., 2018; Mohamadi et al., 2017, and Sobel, 2008).

2.3. Regulatory environment

Entrepreneurial activity and types of entrepreneurial activity vary by country (Stenholm et al., 2013), regions, and cities (Audretsch et al., 2015). Institutions establish the basic operating "rules and frameworks" for entrepreneurs (Williamson, 2000, 1994; North, 1990, 1991), and the institutional landscape of a country includes both the formal structures, like regulations, and informal norms and processes, like corruption. Recent research shows that the institutional context is not an "either/or" where one type of regulatory condition, like entry regulation, dominates and is more important than other types, such as export regulations or contract-related regulations (see Stenholm et al., 2013; Klapper and

Love, 2010; Uriarte et al., 2023). Similarly, the institutional context is highly heterogeneous (see Scott, 2001: 57), not strictly formal or informal, and often reflects a delicate interaction between formal and informal dimensions (Audretsch et al., 2022a, 2022b). For example, a country's institutional environment for entrepreneurs can include not only licensing, permitting fees, tax policy, business incorporation procedures, property registration, policies for closing a business, bankruptcy laws, labor market laws, other economic and political conditions, judiciary procedures, and environmental regulations (see Uriarte et al., 2023). The regulatory environment, which varies by country, can have a profound effect on the direction of entrepreneurship (Baumol, 1990; Stenholm et al., 2013; Chowdhury et al., 2019; Audretsch et al., 2022a, 2022b).

The origins of regulation are often characterized as being public choice, set up by self-interested bureaucrats with personal goals (Peltzman, 1976; Stigler, 1971), or in the public interest, set up by benevolent bureaucrats to protect the greater social interest (Hantke-Domas, 2003; Horpedahl, 2018). Regulation from a public choice view examines rationality and self-interest of both the market participants (e.g., entrepreneurs) as well as the bureaucrats (see Lucas and Boudreaux, 2020). Regulation can play a type of "tollbooth" role (Djankov et al., 2002) where the rules themselves can be commodities supplied by regulators and demanded by market actors with political connections and knowledge, and which can generate income. This can allow bureaucrats to enhance personal wealth and resources, which can include e.g. political support, campaign contributions (Holcombe, 2003; Holcombe and Boudreaux, 2015). Regulation in the public interest approach can work to correct market inefficiencies, such as to counter monopolies and even out information asymmetries; it can deter economic activities which create negative social consequences, such as causing environmental damage (e.g. overmining, polluting).

Substantial research on regulation and entrepreneurship suggests that a conducive regulatory environment can stimulate productive entrepreneurs and growth aspirations (Lucas and Boudreaux, 2020; Estrin et al., 2013; Baumol, 1990), whereas a more difficult regulatory environment can deter market entry and subsequent entrepreneurial growth (see Aidis et al., 2008, 2012; Stenholm et al., 2013). Engaging in entrepreneurship by nature is accompanied by risk and uncertainty (McMullen and Shepherd, 2006), and regulations can play a key role in decision-making at various stages of the entrepreneurial process (Audretsch et al., 2022b).

In order to better understand how regulations matter, we approach our analysis first by considering the most relevant stage for which a regulation matters to a business. We therefore create three groups of regulations based on when we expect a regulation will be most directly impactful for an entrepreneur (Audretsch et al., 2024). Some regulations will matter more when a new business is just being born. For example, entry regulations govern the process of formally registering a new business, and this can (depending on the country) involve a national social security agency, tax agency, a name check, filing incorporation forms, and other steps. Similarly, if a new business is going to produce goods and is investing in a factory, the process to register property will be very important during this birth stage. On the other end of a business perspective, however, is that exit-related regulations will be relevant when the business is leaving the market. When an entrepreneur is intensely dealing with birth-related regulations, it is unlikely that they are also considering how to leave the market.

We thus examine regulations based on whether they are *birth-stage regulations, growth-stage regulations,* and *exit-stage regulations* (BSR, GSR, EXSR). We acknowledge that these are not perfect groupings, as some entrepreneurs may be interested in growth and suddenly realize they are not going to survive, and may want to exit the market. Similarly, some entrepreneurs may enter the market and achieve rapid success and grow at almost the same time they are born. However, we argue that our approach of consider birth, growth, and exit as relevant broad situations for entrepreneurs is useful conceptually as it allows us to hypothesize and consider how specific regulations can matter for entrepreneurs, and it provides a framework for policymakers to consider when approaching how their regulations can affect some entrepreneurship activities and not others.

2.4. Regulatory environment and productive entrepreneurship

Potential productive entrepreneurs considering entering the market must weigh the opportunity costs tied to the allocation of their talent. Regulations can influence an entrepreneur's decision to take action: to enter the market, to invest, partake in the activity, operate in the gray economy, or choose not to enter (Audretsch et al., 2022b). Birth-stage regulations (BSR) are thus pivotal for productive entrepreneurs, as the early life of the business is the first set of opportunities that the entrepreneur will encounter. It is also the first time that an entrepreneur will interact with the bureaucratic process on behalf of the new business, which means that the costs and complexity of regulations at this time should be highly impactful for decision-making. In particular, higher costs around BSR are likely to cut further into the financial resources available to the productive entrepreneur, which is a constraint they face around the world (Ross and Levine). It is possible that even with the public interest in mind, higher costs of BSR could discourage aspiring productive entrepreneurs by cutting into their already limited financial resources. In addition, since this is the first time the business will be visible, a rent-seeking bureaucrat in the public choice view would be able to extract rents. We thus hypothesize:

H1. An increase in Birth-stage regulations (BSR) discourages productive entrepreneurship.

Liao and Chen (2011) examined the sudden abolition of entry regulation in China, which had previously generated substantial rents, arguing that the benefits supporting this regulation eroded as a new technology promoted illegal entries, thereby amplifying enforcement costs.

When it comes to growth-stage regulation (GSR), we consider how the quality of entrepreneurship activity and products commercialized in the market can match up with a country's standards and safety for customers (Audretsch et al., 2019). During the growth stage of a business, the productive entrepreneur can be considering how to expand in the market, gain customers, deliver new products to the public, and maintain an innovative orientation in order to maintain business competitiveness and market share. Regulation can foster innovation (Kunapatarawong and Martínez-Ros, 2016) by protecting the ability of entrepreneurs to commercialize and maintain rights to their innovations, and curb anti-competitive practices (Vogelsang, 2002). Recent research, including Blind et al. (2017), suggests that regulation might play a role in in innovation in markets characterized by uncertainty, e.g. where there are competing technological standards. This perspective – leaning on a public interest interpretation – treats regulation as being able to reduce market uncertainties, thereby boosting consumption and production, which in turn can lead to higher entrepreneurial aspirations and intentions for job creation and innovation. In this line of thinking, regulation is seen as a potential conduit for productive entrepreneurship. As entrepreneurs want protections for their investments and opportunities (see Bowen and De Clerq, 2008; Johnson et al., 2002), GSR is necessary to encourage productive entrepreneurship. In particular, regulations related to protecting property and enforcing contracts (Johnson et al., 1999, 2002) can enable productive entrepreneurs by allowing them to secure their investments and have recourse in the market when dealing with other actors (customers, suppliers, etc.).

However, at some point, too much GSR can make it increasingly difficult to achieve these same needs for protection and encouraging innovation. This could occur if more regulatory requirements or needs could result from self-interested bargaining, if there is a self-interest bureaucrat. If this were the case, more GSR could reduce

entrepreneurial aspirations to create jobs, invest in R&D and grow (see Bailey and Thomas, 2017) by increasing regulatory compliance and operational costs. This could mean diverting resources away from growth-oriented activities, like exploring new markets including foreign markets, financing new production facilities and investing in technology for more efficient production, and acquiring human capital – and this could lead to less lower productive entrepreneurship. Thus, we hypothesize on a nonlinear relationship between GSR and productive entrepreneurs, which is initially positive and then negative:

H2. Growth-stage regulations (GSR) will have an inverted U-shaped relationship with productive entrepreneurship.

Exit-stage regulations (EXSR) can reflect a "later" consideration for the business as they are relevant for entrepreneurs leaving the market or considering leaving the market, as it affects their ability to reallocate their efforts and resources tied up in the business towards other activities (see Sobel, 2008; Bae and Goyal, 2009; Lee et al., 2011; Armour and Cumming, 2006). Exit regulations could therefore be important as entrepreneurs consider if they will be "stuck" or be able to move on, either to a new productive venture or as employees elsewhere. If this reallocation is easy, they can seek other productive entrepreneurial opportunities. However, if this reallocation is difficult, this means their resources will remain tied up in the existing business, which can limit their ability to invest into a new productive business. Low barriers related to exit can mitigate losses resulting from entrepreneurial failures first for least productive entrepreneurs. In a study of 29 countries from 1990 to 2008, Lee et al. (2011) discovered that nations adopting entrepreneur-friendly bankruptcy laws witnessed a surge in entrepreneurship rates, with little is known about entrepreneurship quality. Thus, we expect that EXSR will help productive entrepreneurship if it enables more rapid movement out of the current business, thereby meaning faster flow of productive resources to more promising ventures. However, *too much* or *too difficult* exit regulation can start to burden entrepreneurs, which could have the opposite result. We thus hypothesize on a nonlinear relationship between EXSR and productive entrepreneurship, which is initially positive and then negative:

H3. Exit-stage regulations (EXSR) will have an inverted U-shape effect on productive entrepreneurship.

Low barriers related to exiting the market can mitigate losses resulting from entrepreneurial failures, which can free up the resources and human capital needed for productive entrepreneurship. For example, Lee et al. (2011) studied 29 countries from 1990 to 2008 and discovered that a country adopting entrepreneur-friendly bankruptcy laws witnessed a surge in entrepreneurship rates – however, little is known about entrepreneurial productivity.

2.5. Corruption, regulation and productive entrepreneurship

Corruption is prevalent in many countries (Belitski et al., 2016) and is an important consideration when understanding regulations and entrepreneurship. Rose-Ackerman (1997) described corruption as a transaction between a public bureaucrat and a private entity, where both parties may benefit personally and illegally. The public bureaucrat exploits their public office for personal gain while the private entity obtains benefits through illicit payment. Shleifer and Vishny (1993) similarly viewed corruption as the sale of public assets for personal benefits by bureaucrats.

Corruption is especially embedded in countries where the rule of law is weak (Baumol, 1990), and very relevant when the regulatory environment is inefficient (Aidis et al., 2008). The existing literature regards corruption as a double-edged sword that can either *grease* or *sand* the wheels of business needs for entrepreneurs (see Méon and Sekkat, 2005; Das and Parry, 2011; Belitski et al., 2016; Bardhan, 2017). For entrepreneurs, more corruption can mean more costs (Belitski et al., 2016) but it can also mean a way around a difficult regulatory environment (Chowdhury et al., 2015; Das and Parry, 2011). Complex regulations can provide greater opportunities to extract rents via bribes (Martin and Thomas, 2013; Belitski et al., 2016). On the other hand, corruption can be used by some to help circumvent regulations, deal with bureaucratic delays and expedite transactions (Kaufmann and Wei, 1999; Méon and Weill, 2010; Audretsch et al., 2022b). More complicated regulations can increase the need for entrepreneurs to interact with bureaucrats, and if they happen to be corrupt, this can increase vulnerability of the entrepreneurs. This could affect productive entrepreneurship in two ways. First, if they have to pay bribes or invest significant time in dealing with corruption, this cuts into their resources for productivity (e.g. a "second tax") (see Ebben and Jognson, 2006; Braunerhjelm and Eklund, 2014). Second, if they try to avoid bribes, they may not be able to complete their transactions (e.g. obtaining export permits) and this can reduce productivity. Thus, we expect that more corruption should lower productive entrepreneurship.

H4. Corruption discourages productive entrepreneurship.

While findings point to both effects being possible in the short-term, there has been substantially more evidence of a negative effect of corruption on many economic activities (Galang, 2012), and Belitski et al. (2016) caution about the danger of embedded corruption in the long-term.

When it comes to BSR, we expect corruption to pose an additional burden for productive entrepreneurs because it imposes costs, which can be both financial as well as the time / resources of entrepreneurs to learn and navigate relationships. The birth stage of a productive entrepreneur is vulnerable to these types of costs because of financing and resource constraints. For example, they might lean on personal and informal financial sources (Davidsson and Honig, 2003; Berger and Udell, 2003), which are limited for many people. In addition, as it is the birth stage, new productive entrepreneurs may not have familiarity with how things are done – and who to engage with – and therefore face greater uncertainty when knowing when and how they might encounter corruption. Thus, we hypothesize that:

H5. Corruption will further increase the negative effect of birth-stage regulation (BSR) on productive entrepreneurship.

We expect that entrepreneurs whose business is growing will face a different calculation than those who are just entering the market, and that this can depend to some extent on how much corruption they face. When entrepreneurs are ready and in the process of growth, they have already moved beyond the initial birth stage, and they have acquired knowledge about the market and the institutional environment (Boudreaux et al., 2023). This means that they may know more about the expectations for bribing, the bureaucrats to avoid or to seek out, and the regulatory processes that may be more or less affected by corruption. In addition, some entrepreneurs may be able to seek growth because they had early success in the market, and could face less dire financial constraints than in the initial birth stages (though we point out, significant barriers to scale a young business likely still remain).

In countries with high levels of corruption, the cost of bribing and the cost of dealing with corruption may be very cumbersome, even if the entrepreneur has accumulated knowledge about how to navigate the institutional environment. For example, even if an entrepreneur knows that the "true" cost of an export permit will include regulatory fees, the cost of manager hours to complete the process, and an informal payment, the business still loses both money and manager time. If corruption is extensive, these losses could also be extensive. Corruption is often arbitrary (Rodriguez et al., 2006; Cuervo-Cazurra, 2006) yet also often frequent (Audretsch et al., 2021) so it adds to uncertainty associated with productive entrepreneurship. When GSR discourages productive entrepreneurship, corruption should further discourage it by increasing uncertainty and raising costs related to regulatory compliance. This aligns with a *sanding* role of corruption for productive entrepreneurship.

However, if corruption is lower, this could mean lower financial

costs and fewer nonfinancial resources devoted to the process, reducing the uncertainty and the tangible resource depletion caused by corruption. For example, if corruption is arbitrary but not frequent, it could mean that while there is uncertainty, it is less costly. In addition, entrepreneurs with growing businesses may have been able to learn where and when corruption is likely to occur, and be able to avoid or seek it based on what their needs are. It is unlikely that a country which has very clean property registration requirements will have extremely high corruption in other areas, so if corruption is relatively low, even if it is not clear which regulatory domains will be corrupted, it is likely that productive entrepreneurs will not be extensively affected. In addition, whereas BSR and EXSR regulations in theory apply to all productive entrepreneurs (they have to enter and exit the market), not all GSR regulations will apply to all productive entrepreneurs. This could depend on the type of business. For example, some ICT businesses will produce components and hardware, requiring a factory, whereas others will produce software and may require an office but not a large production facility (Belitski and Desai, 2016).

When GSR encourages productive entrepreneurship, low levels of corruption may further encourage it if entrepreneurs can use it to their advantage (or easily avoid it). This aligns with a *greasing* role of corruption for productive entrepreneurship. We thus hypothesize that corruption amplifies the non-linear relationship between GSR and productive entrepreneurship:

H6. Corruption will intensify the inverted U-shape relationship of growth-stage regulations on productive entrepreneurship, such that both the initial positive and then negative effects are increased.

Finally, when it comes to exit-stage regulations (EXSR), corruption can increase costs of closing down the business. For businesses that are exiting because they have failed in the market, costs are a crucial consideration and can be a limiting factor in the ability to comply with a regulatory requirement. And unlike GSR, where we expected that high corruption can affect productive entrepreneurs differently than lower corruption, any kind of corruption in the exit stage represents a cost and thus is likely to harm the entrepreneurs. This should be the case even if the entrepreneurs have learned how the system works quite well by the time they need to close down. Thus, we expect that corruption actually will change the nature of the relationship between EXSR and productive entrepreneurship (which we predicted to be nonlinear in H3). We thus hypothesize as follows:

H7. Corruption will linearize the U-shaped of exit-stage regulations on productive entrepreneurship, such that it will decrease productive entrepreneurship.

3. Data and methodology

3.1. Data and sample

We put together our sample by matching data from the following sources at the country level: World Development Indicators (World Bank, 2017), Doing Business Statistics (World Bank, 2016), Global Entrepreneurship Monitor (GEM, 2017), Index of Economic Freedom (Heritage Foundation, 2017), World Economic Forum (2017), and World Intellectual Property Statistics (WIPO, 2017) for the period 2005–2016.

Our dataset is an unbalanced panel that covers 118 countries over the period from 2005 to 2016. Of the countries included in the study, 22 have data for <10 years and 3 have data for <3 years of data. Our final

Table 1
Summary statistics and sources of data.

Variables	Description	Mean	S.D.	Min	Max
Productive entrepreneurship	Cronbach alpha standardized calculated as using the measures of number of patent applications per residents and non-residents, in logarithms, percentage of firms involved in total entrepreneurial activity (TEA) aiming to create 6+ jobs in 5 years; firms involved in TEA that introduce new to market product	−0.08	0.71	−2.30	2.03
Unemployment	Unemployment, share of the labor force that is without work but available for and seeking employment (% of total labor force).	8.35	5.43	0.10	37.60
Tertiary	Tertiary education enrolment, gross percentage	39.57	25.90	0.49	98.09
Government consumption	General government final consumption expenditure (% of GDP). General government final consumption expenditure includes all government current expenditures for purchases of goods and services (including compensation of employees).	15.66	4.98	2.05	28.06
Controlled corruption	corruption measure that captures perceptions of the extent to which public power is exercised for private gain index reversed from – 2.5.- no corruption to 2.5 – high corruption	−0.13	1.02	−2.56	1.41
Cost to register property	Cost to register property (to secure rights to property) (% property value)	5.12	4.41	0.00	28.30
Procedures to register property	Number of procedures to register property is the number of procedures required for a business to secure rights to property.	6.02	2.29	1.00	14.00
Cost to start a business	Cost of business start-up procedures (% of GNI per capita) including interactions to obtain necessary permits and licenses and to complete all inscriptions, verifications, and notifications to start operations	26.97	47.27	0.00	676.10
Procedures to start business	Start-up procedures are those required to start a business (number), including interactions to obtain necessary permits and licenses and to complete all inscriptions, verifications, and notifications to start operations. Data are for businesses with specific characteristics of ownership, size, and type of production.	8.19	3.41	1.00	19.00
Disclosure	Business extent of disclosure index (0 = less disclosure to 10 = more disclosure). It measures the extent to which investors are protected through disclosure of ownership and financial information. The index ranges from 0 to 10, with higher values indicating more disclosure.	5.51	2.58	0.00	10.00
Customs procedures	Burden of Customs Procedure (reversed) measures business executives' perceptions of their country's efficiency of customs procedures. The lowest score (−7) rates the customs procedure as extremely efficient, and the highest score (−1) as extremely inefficient. Data is collected conducted for 30 years in collaboration with 150 partner institutes.	−4.05	0.89	−6.45	−1.80
Enforcing contracts (cost)	Enforcing contracts cost (% of claim)	66.44	18.54	0.00	91.45
Enforcing contracts (procedures)	Number of procedures required to enforce contract	53.19	18.00	0.00	100.00
Tax rate	Total tax and contributions as percentage of firm profit (%)	42.87	15.71	14.10	137.40
Tax payments	Tax payments (number)	28.56	21.62	4.00	147.00
Time to pay tax	Tax payments (time in days)	310.00	280.62	12.00	2600.00
Insolvency cost	Resolving Insolvency Cost (% of estate)	14.70	9.00	1.00	50.00
Insolvency time	Number of years required to resolve insolvency	2.55	1.24	0.40	9.20

Notes: The number of observations over 2005–15 is 1065 with 118 countries.
Source: WDI= World Bank (2017); DB=World Bank Doing Business Statistics (World Bank, 2017); GEM = Global Entrepreneurship Monitor (GEM, 2017), WEF=World Economic Forum (2017), WIPO=World Intellectual Property Statistics (WIPO, 2017).

sample comprises 1065 observations. The sample description and summary statistics are presented in Table 1, correlation matrix in Table 2, and list of countries in the study in Table 3.

3.2. Dependent variable

Our measure is a *productive entrepreneurship index (PEI)* which relies on a Cronbach alpha (β = 0.71) combining three key themes: (1) *innovation output,* (2) *product innovation,* and (3) *growth aspirations.* These measures are operationalized as follows: (1) innovation output: patent applications in the country per residents and non-residents, in logarithm from World Intellectual Property Organization (2) product innovation: the percentage of total entrepreneurial activity (TEA) where the firms are introducing a new product to the market from Global Entrepreneurship Monitor, (3) growth aspirations: the share of TEA where the firms aim to create at least 6 jobs over the next 5 years from Global Entrepreneurship Monitor.

The PEI is standardized around the mean zero. A positive value of the index indicates that a country is characterized by greater productive entrepreneurship and negative values indicate otherwise. Detailed values for the PEI for countries in our study are provided in Table 3. Theory and operationalization of productive entrepreneurship are described in Section 2.2.

3.3. Independent variables

Our explanatory variables for regulation are grouped based on the stage of business life to which they are most directly relevant. They are drawn from the World Bank Doing Business Project, which compiled cross-national comparative data on the business environment around the world.

Birth-stage regulation (BSR) pertains mainly to the early stage of business. We include two relevant domains of regulation – entry regulation to register a new business, and property registration regulation – which have been used widely in previous research on regulations (Belitski et al., 2016; Lawless, 2013; Becker et al., 2012; Bruhn, 2011; van Stel et al., 2007; Claessens and Laeven, 2003; Johnson et al., 2002). We use both the financial costs and the procedures for each, resulting in four measures under the BSR umbrella: entry regulation costs, entry regulation procedures, property regulation costs, property regulation procedures.

Growth-stage regulation (GSR) pertains to regulations that are most likely to be directly relevant to new businesses that are actively pursuing growth. We use measures that reflect the protection of investors, as raising capital is necessary to scale; the ability of an entrepreneur to enforce contracts as signing contracts with employees, buyers, and suppliers enables business growth; tax regulations, as these are highly relevant for profitable and growing businesses; and trade requirements, as these reflect connectedness to larger foreign markets (Bae and Goyal, 2009; Johnson et al., 1999; Djankov et al., 2009; Baliamoune-Lutz and Garello, 2014; Audretsch et al., 2019). Thus, we have seven measures under the umbrella of GSR: an index capturing investor protection; an index capturing the difficulty of customs procedures; the financial costs and the procedures related to enforcing contracts; and the financial costs, procedures (payments), and the time needed to file taxes.

Exit-stage regulation (EXSR) is related to the process for a business to leave the market, reflecting how entrepreneurs can resolve insolvency (see McMullen et al., 2007). Our two EXSR measures here are the cost and the time required to resolve insolvency.

Our explanatory variable for corruption (used to our H4–H7), is measured by individual perceptions about corruption in their country. This perceptive measure broadly captures both minor and major forms of corruption (see Belitski et al., 2016) which is important as we recognize that corruption can affect transparency of transactions (see Uhlenbruck et al., 2006) in several ways. Our measure lets us understand the "capture" of the state by elites and private interests (Rose-Ackerman,

Table 2
Correlation matrix.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Productive entrepreneurship	1																
2. Unemployment	0.03*	1															
3. Tertiary	0.57*	0.04*	1														
4. Government consumption	0.24*	0.28*	0.47*	1													
5. Controlled corruption	−0.49*	0.05*	−0.58*	−0.50*	1												
6. Cost to register property	−0.29*	0.05*	−0.33*	−0.03*	0.17*	1											
7. Procedures to register property	−0.13*	0.05*	−0.25*	−0.19*	0.39*	0.17*	1										
8. Cost to start a business	−0.39*	−0.18*	−0.43*	−0.34*	0.37*	0.37*	0.12*	1									
9. Procedures to start business	−0.23*	0.03*	−0.39*	−0.33*	0.53*	0.07*	0.43*	0.32*	1								
10. Disclosure	0.23*	−0.03*	0.19*	0.09*	−0.24*	−0.08*	−0.21*	−0.17*	−0.43*	1							
11. Customs procedures	−0.44*	0.10*	−0.47*	−0.37*	0.61*	0.19*	0.44*	0.34*	0.58*	−0.29*	1						
12. Enforcing contract (cost)	0.29*	−0.05*	0.47*	0.18*	−0.35*	−0.21*	−0.14*	−0.36*	−0.16*	0.05*	−0.27*	1					
13. Enforcing contract (procedures)	0.28*	−0.02	0.41*	0.37*	−0.49*	−0.20*	−0.21*	−0.24*	−0.36*	0.24*	−0.47*	0.07*	1				
14. Tax rate	0.05*	−0.02	0.11*	0.03*	0.14*	0.05*	0.21*	0.05*	0.24*	−0.08*	0.23*	0.12*	−0.05*	1			
15. Tax payments	−0.35*	0.05	−0.33*	−0.22*	0.50*	0.16*	0.30*	0.25*	0.32*	−0.27*	0.51*	−0.27*	−0.20*	0.12*	1		
16. Time to pay tax	−0.08*	−0.01	−0.12*	−0.14*	0.34*	0.06*	0.37*	0.05*	0.34*	−0.19*	0.40*	−0.07*	−0.21*	0.26*	0.27*	1	
17. Insolvency cost	−0.25*	−0.07*	−0.38*	−0.25*	0.48*	0.18*	0.22*	0.29*	0.36*	−0.24*	0.37*	−0.43*	−0.13*	−0.03*	0.35*	0.19*	1
18. Insolvency time	−0.15*	−0.06*	−0.33*	−0.34*	0.47*	−0.07*	0.19*	0.26*	0.40*	−0.30*	0.38*	−0.26*	−0.30*	−0.08*	0.23*	0.26*	0.38*

Note: Level of statistical significance is * 0.05 %.
Sources: See Table 1.

Table 3
Country included in this study and productive entrepreneurship average score.

Country	Productive entrepreneurship	Country	Productive entrepreneurship	Country	Productive entrepreneurship
Chile	1.55	Ecuador	0.20	Malaysia	−0.32
United States	1.39	Mexico	0.17	Malawi	−0.33
United Arab Emirates	1.14	Croatia	0.15	Azerbaijan	−0.34
Colombia	1.13	India	0.14	Botswana	−0.35
Denmark	1.03	Hungary	0.13	Brazil	−0.35
Puerto Rico	1.03	Italy	0.13	Honduras	−0.36
United Kingdom	1.01	Dominican Republic	0.10	Morocco	−0.41
Japan	0.88	Lithuania	0.08	Mongolia	−0.44
Ukraine	0.88	Kazakhstan	0.06	Costa Rica	−0.46
Australia	0.79	Norway	0.06	Nicaragua	−0.47
France	0.77	Finland	0.04	Moldova	−0.48
South Africa	0.75	Spain	0.03	Kenya	−0.52
Canada	0.73	Uruguay	0.03	Armenia	−0.55
Turkey	0.72	Slovak Republic	−0.01	Indonesia	−0.57
Israel	0.69	El Salvador	−0.07	Kyrgyz Republic	−0.58
China	0.68	Iceland	−0.08	Bosnia and Herzegovina	−0.66
Luxembourg	0.61	Total	−0.08	Trinidad and Tobago	−0.71
Germany	0.59	Portugal	−0.09	Cameroon	−0.76
Poland	0.58	Thailand	−0.09	Burkina Faso	−0.83
Korea, Rep.	0.54	Nigeria	−0.10	Ethiopia	−0.84
Singapore	0.54	Pakistan	−0.10	Jamaica	−0.84
Czech Republic	0.53	Egypt, Arab Rep.	−0.12	Brunei Darussalam	−0.92
Ireland	0.53	Vietnam	−0.12	Bangladesh	−0.95
Namibia	0.52	Sri Lanka	−0.13	Rwanda	−0.95
Argentina	0.50	Jordan	−0.14	Bulgaria	−0.97
New Zealand	0.48	Venezuela, RB	−0.14	Ghana	−0.99
Latvia	0.43	Iran, Islamic Rep.	−0.15	Suriname	−1.00
Montenegro	0.43	Belgium	−0.17	Madagascar	−1.01
Romania	0.43	Philippines	−0.17	Albania	−1.06
Slovenia	0.38	Tunisia	−0.18	Senegal	−1.10
Peru	0.37	Guatemala	−0.19	Zambia	−1.15
Switzerland	0.37	Belize	−0.21	Cambodia	−1.19
Austria	0.36	Bolivia	−0.21	Mozambique	−1.22
Lebanon	0.32	Greece	−0.21	Zimbabwe	−1.24
Sweden	0.29	Panama	−0.22	Cote d'Ivoire	−1.25
Syrian Arab Republic	0.29	Georgia	−0.23	Nepal	−1.32
Russian Federation	0.28	Paraguay	−0.24	Mauritius	−1.34
Estonia	0.26	Algeria	−0.26	Uganda	−1.37
Netherlands	0.21	Serbia	−0.27	Tajikistan	−1.55
				Tanzania	−2.07

Source: WDI= World Bank (2017); DB=World Bank Doing Business Statistics (World Bank, 2017); GEM = Global Entrepreneurship Monitor (GEM, 2017), WEF=World Economic Forum (2017), WIPO=World Intellectual Property Statistics (WIPO, 2017).

2007). To gauge corruption, we utilized data from The World Bank Group, which compiles and summarizes information from over 30 sources. For a country, this data reflects the experiences and views of citizens, private firms, information providers, experts in different positions in public, private, and nonprofits sectors. Based on surveys, each country in the World Bank data receives a corruption control score ranging from −2.50 (most corrupt) to 2.5 (least corrupt). For more intuitive interpretation in our study, we reversed the index: this means that a higher value of the index signifies more corruption.

3.4. Control variables

We included several control variables in our study. Since governments can provide infrastructure and financial resources to support entrepreneurial endeavors (Estrin et al., 2013), we account for *government spending*. This is measured using general government final consumption expenditure, expressed as a percentage of GDP, sourced from the Heritage Foundation's Index of Economic Freedom. As employment status reflects state of the labor market (Thurik et al., 2008), including potential entrepreneurs and their future employees, we control for *unemployment rate* in a country. This is measured as the proportion of the labor force that is jobless, yet available for and actively seeking employment taken from World Development Indicators. Related to this, controlling for human capital is important (Mincer, 1974; Korosteleva and Belitski, 2017), and we use gross enrolment ratio in tertiary education, irrespective of age and shown as a percentage of the total eligible population. This comes from the World Bank. Note that as gross domestic product (GDP) per capita is highly correlated with the level of corruption, it has been omitted due to multicollinearity (Audretsch et al., 2015). We control for country and year fixed effects.

4. Method

We began by estimating the model using two different panel estimation techniques: Fixed Effects (FE) and Random Effects (RE). The FE estimator focuses on differences that, over time, characterize a single country. This estimator is often termed the 'within' estimator. It determines how a change in a variable of interest within a specific country affects its entrepreneurial productivity. We perform the Hausman test to decide on the choice of the FE vs. RE model. Our test does not reject the null, with p-values 0.09, making the choice for RE estimation as the baseline regression. In addition, the use of FE estimator does not account for potential differences that exist across countries at a specific point in time. The RE estimator takes both the 'within' and 'between' effects into account. This approach allows us to identify factors that explain differences between the countries in the panel. However, concerns about potential simultaneity bias caused by unobservable factors often suggest a preference for FE estimates.

To adjust for endogeneity concerns between regulation, corruption and productive entrepreneurship, we used difference in difference (DiD) estimation instead of lagged independent variables, which does not allow to adjust for endogeneity. First, we estimated the following model:

$$y_{it} = f\left(\beta x_{it-1}, \psi \varphi_{it-1} \Theta z_{it}, \alpha, \mu_{it}\right) \quad (1)$$

$$\text{uit} = \text{vi} + \text{eit}, i = 1, \ldots, \text{N}; t = 1, \ldots, \text{T} \quad (2)$$

where y*it* is the productive entrepreneurship measure in a country *i* at time *t*. β and Θ are parameters to be estimated, x*it* is a vector of independent explanatory variables (birth-stage regulation - BSR, growth-stage regulation - GSR, exit-stage regulation - EXSR), φ_{it} is a vector of corruption and z*it* is a vector of exogenous control variables; α presents time fixed effects to capture for potential changes over time for all countries (such as world financial crises, economic development, etc.). In the panel estimation, the error term *uit* consists of unobserved country-specific effects, *vi* and the observation-specific errors, *eit*. To incorporate the potential non-linear relationship between regulation and productive entrepreneurship, we used squared terms for GSR and EXSR for the direct effects and interactions (Thurik et al., 2008). In addition, we used logarithmic transformation of variables where distribution was power law.

We used RE panel data estimation to test our hypotheses on the effect of regulations on productive entrepreneurship. Note that variance inflation factors (VIFs) in the models are <5, suggesting that multicollinearity is not a major concern in the regressions.

To allow for possible curvilinear relationship between different regulations and productive entrepreneurship drawing on Lind and Mehlum (2010), we performed the post-estimated predictive margins (Figs. 1–5). Predictive margins are the most reliable approach to test a potential curvilinear relationship for interaction terms with coefficients in Table 4 (specification 8).

5. Results

Regression results for eight estimations are reported in Table 4. Specifications 1, 2 and 3 show the direct effects of birth-stage regulation (BSR), growth-stage regulation (GSR), and exit-stage regulation (EXSR), respectively. Specification 4 tests all three groups of regulation together as well as control variables.

We find that the level of tertiary education ($\beta = 0.001$, $p < 0.05$), unemployment ($\beta = 0.005$–0.008, $p < 0.05$), and government consumption ($\beta = 0.002$–0.005 $p < 0.01$) in a country have a positive and significant impact on productive entrepreneurship.

In H1, (specs 1 and 4 in Table 4), we predicted that birth-stage regulation (BSR) discourages productive entrepreneurship. We find mixed support using four measures of BSR: (a) a one unit increase in *entry procedures* to register a new business is associated with a decline of productive entrepreneurship by 0.005 standard deviation ($\beta = -0.005$, $p < 0.05$) – but this effect disappears when we run our model with all regulations (spec 4); (b) a one-unit increase in *entry costs* is associated with a reduction of productive entrepreneurship by 0.001 standard deviation ($\beta = -0.001$, $p < 0.05$); (c) *property registration procedures* have a negative but not significant relationship to productive entrepreneurship (spec 1), which becomes positive and not significant when all regulations are included (spec 4); (d) *property registration costs* have a positive but not significant effect for productive entrepreneurship (spec 1), which becomes negative and not significant when all regulations are included (spec 4).

In H2 (specs 2 and 4 in Table 4), we predicted that growth-stage regulation (GSR) will have an inverted U-shaped effect on productive entrepreneurship. We obtain mixed findings for seven GSR measures: an inverted U-shaped effect for two, a U-shaped effect for three, and no significant finding for two. We find an inverted U-shaped effect for: (a) *customs procedures* (first $\beta = 0.023$ to 0.031, $p < 0.05$, then $\beta = -0.023$ to 0.003, $p < 0.01$); (b) *contract enforcement costs* (first $\beta = 0.006$ to 0.007, $p < 0.01$, then $\beta = -0.001$, $p < 0.01$). In contrast, we find a U-shaped effect, where the regulation first discourages and then increases productive entrepreneurship for: (c) *investor disclosure* (first $\beta = -0.094$ to -0.096, $p < 0.01$, then $\beta = 0.005$, $p < 0.01$); (d) *contract enforcement procedures* (first $\beta = -0.003$, $p < 0.05$, then $\beta = 0.002$, $p < 0.01$); (e) *tax payments* (first $\beta = -0.006$, $p < 0.01$, then $\beta = 0.001$, $p < 0.01$). We also find that the direct effect of *tax rate* and *time to pay taxes* are not statistically significant.

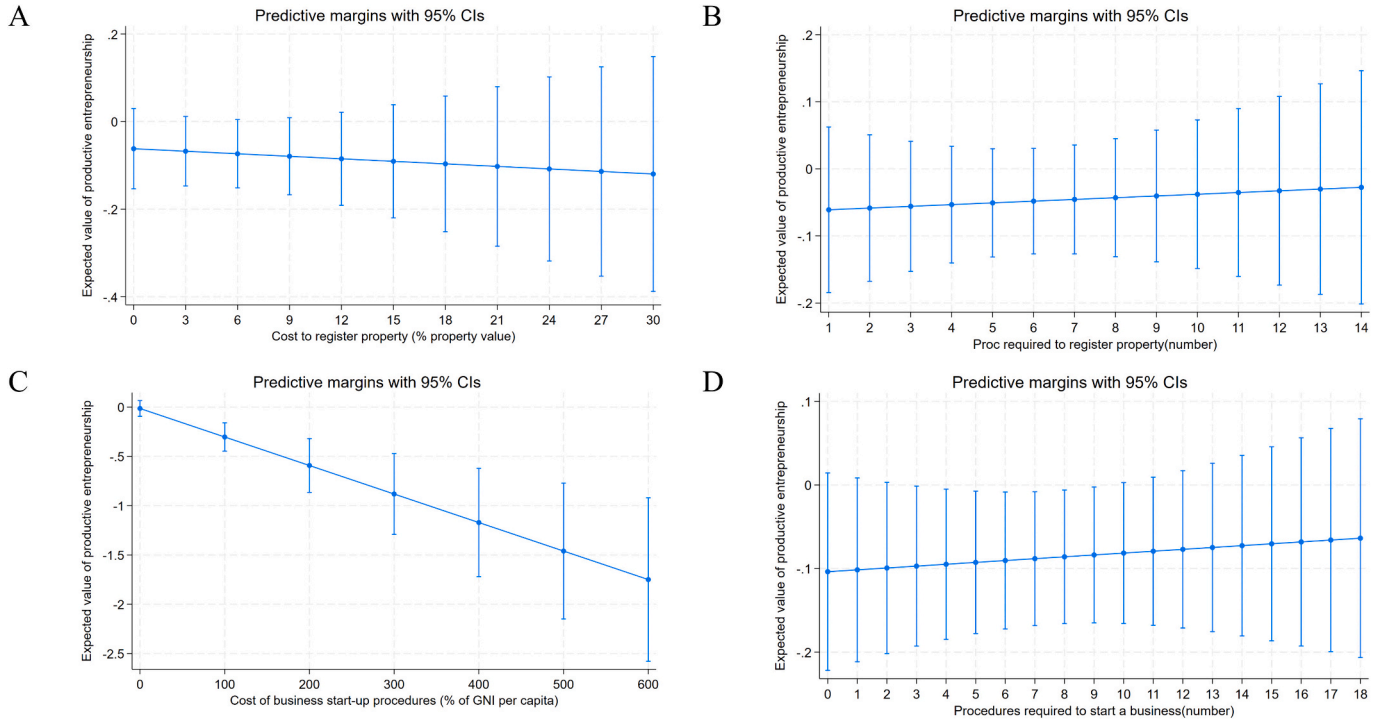

Fig. 1. Entry regulation and productive entrepreneurship.
Note: Margins fit using mixed effects panel data estimation with 118 countries and 1065 obs. with the predictive margins at 95 % confidence intervals.
Source: Authors calculation.

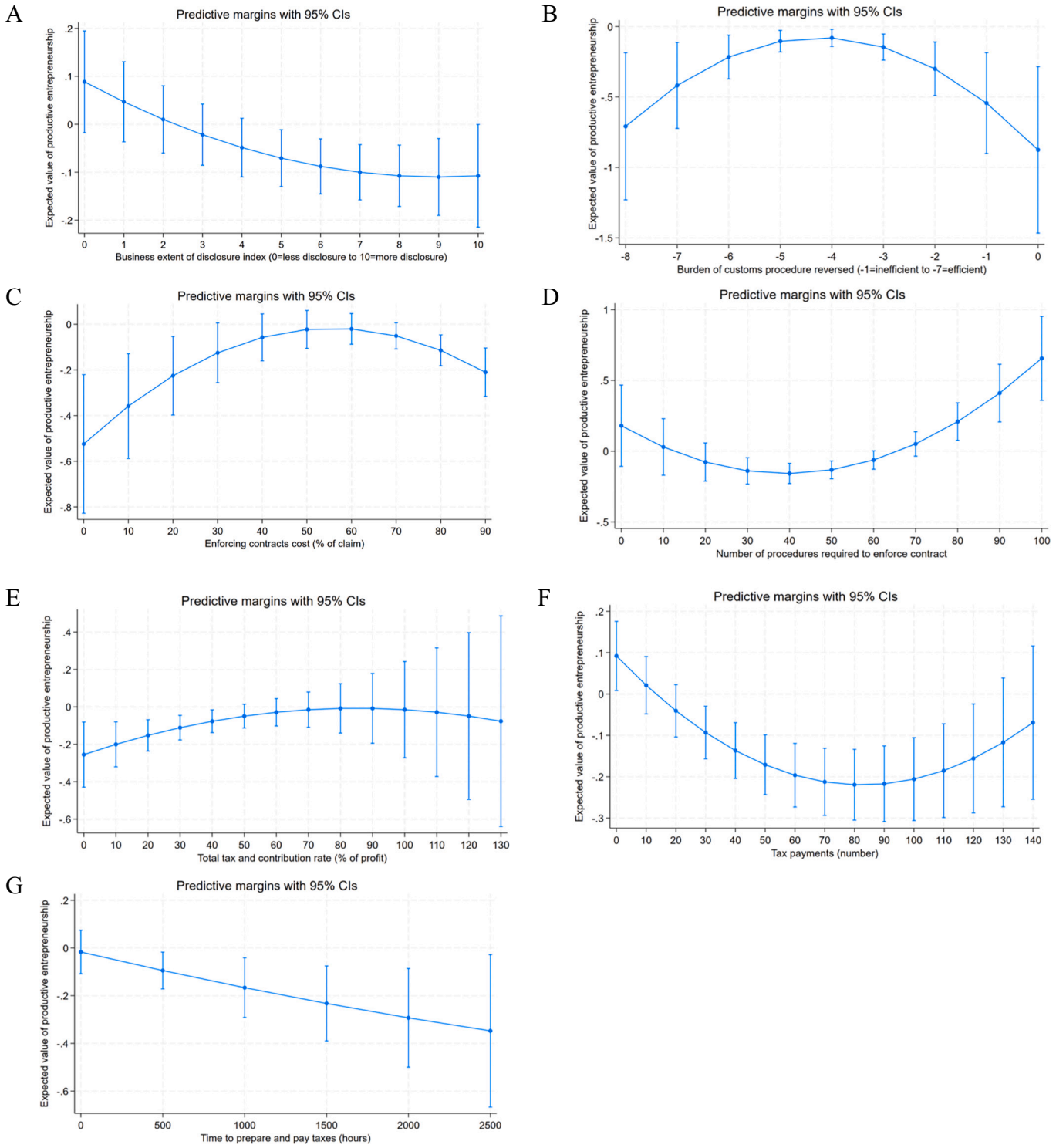

Fig. 2. Growth regulation and productive entrepreneurship.
Note: Margins fit using mixed effects panel data estimation with 118 countries and 1065 obs. with the predictive margins at 95 % confidence intervals.
Source: Authors calculation.

In H3, (specs 3 and 4 in Table 4), we predicted that exit-stage regulations (EXSR) would have an inverted U-shaped effect on productive entrepreneurship. We found the opposite of our predicted relationship: (a) resolving *insolvency costs* has a U-shaped effect, first reducing and then increasing productive entrepreneurship (first $\beta = -0.011$, $p < 0.05$, then $\beta = 0.001$, $p < 0.05$) (specification 4); (b) resolving *insolvency time* also has a U-shaped effect (first $\beta = -0.069$, $p < 0.05$, then $\beta = 0.006$, $p < 0.01$) but it became not significant once we included all regulations (specification 4).

To visualize the effect of different stages of regulation on productive entrepreneurship we calculate and plot the predictive margins for Figs. 1, 2 and 3, (Table 4). This provides further support to our discussion from Table 4.

In H4, we predicted that corruption negatively affects productive entrepreneurship, which is supported ($\beta = -0.11$–0.12, $p < 0.05$, specifications 1–4). Our findings mean that an increase in one unit of

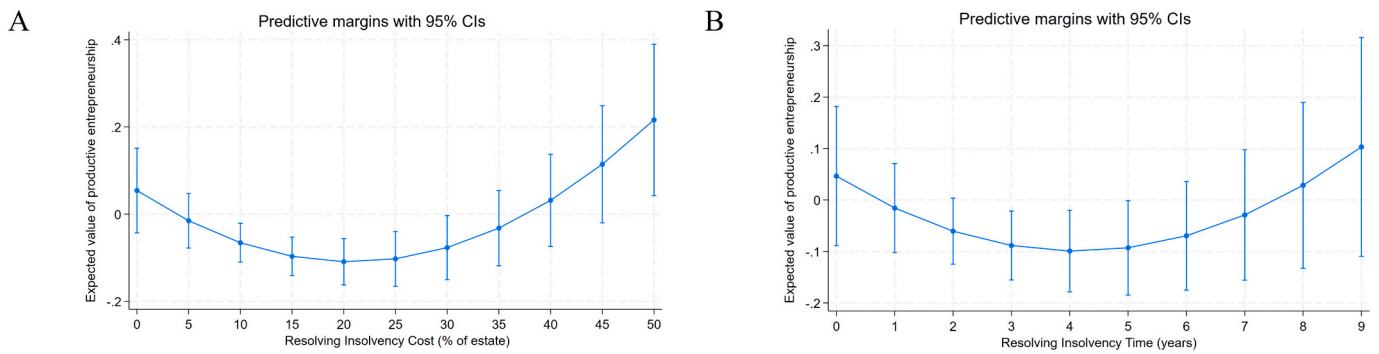

Fig. 3. Exit regulation and productive entrepreneurship.
Note: Margins fit using mixed effects panel data estimation with 118 countries and 1065 obs. with the predictive margins at 95 % confidence intervals.
Source: Authors calculation.

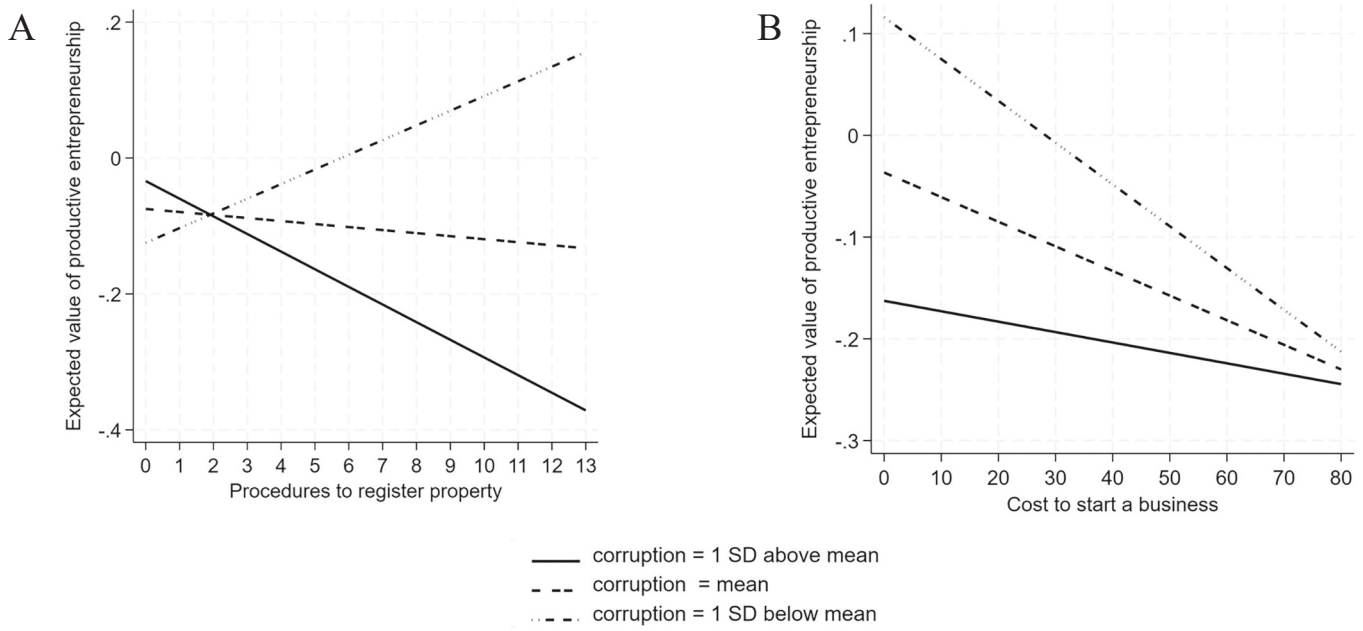

Fig. 4. Predictive margins of entry regulation and corruption level on productive entrepreneurship.
Note: Margins fit using mixed effects panel data estimation with 118 countries and 1065 obs. with the predictive margins at 95 % confidence intervals.
Source: Authors calculation.

corruption reduces productive entrepreneurship by between 0.11 and 0.12 standard deviation. While corruption has a negative effect, this disappears once we interact corruption with different regulations. An increase in corruption by one unit is associated with a reduction in productive entrepreneurship from 0.103 to 0.121 (specs 1, 2, 3, and 4 in Table 4). This finding is in line with studies on other types of entrepreneurship which find adverse effects of corruption (Belitski et al., 2016; Audretsch et al., 2021).

Specifications 5, 6 and 7 in Table 4 report the interaction of corruption and different groups of regulation one at a time, and specification 8 tests all direct effects of regulation on productive entrepreneurship and the interactions of regulation and corruption. Next, we turn to the effect of BSR, GSR, and EXSR regulations on productive entrepreneurial in countries with varying levels of corruption, testing. To test H5, H6, and H7 on the role of corruption in the relationship between regulation and productive entrepreneurship, we use triple interactions between non-linear effects of GSR and EXSR and corruption on productive entrepreneurship. Our results are presented in specifications 5–8 (Table 4). In addition, we plotted predictive margins effects in Figs. 4 and 5, which correspond to specification 8 (Table 4), in order to test H5, H6, and H7.

In H5, we predicted that corruption would worsen the negative effect of BSR on productive entrepreneurship. We find mixed support with four measures for BSR: (a) the relationship between *property registration procedures* and productive entrepreneurship in countries with a level of corruption one standard deviation point below the mean is negative ($\beta = -0.021$, $p < 0.05$, spec 8 and Fig. 4A), meaning that an increase in corruption with more property registration procedures reduces productive entrepreneurship by 0.021 standard deviation; (b) an increase in corruption with *entry costs* to register a business increases productive entrepreneurship by 0.001 standard deviation ($\beta = 0.001$, $p < 0.05$, spec 8 and Fig. 4B).

In H6, we predicted that corruption would intensify the inverted U-shaped effect of GSR on productive entrepreneurship. We find mixed support. As shown in specification 8, when corruption is high, an inverted U-shaped relationship becomes U-shaped for (a) the effect of investor disclosure on productive entrepreneurship (Fig. 5A) and (b) contract enforcement procedures on productive entrepreneurship (Fig. 5B). However, GSR becomes less daunting for productive entrepreneurship if corruption further increases, and if there is greater (c)

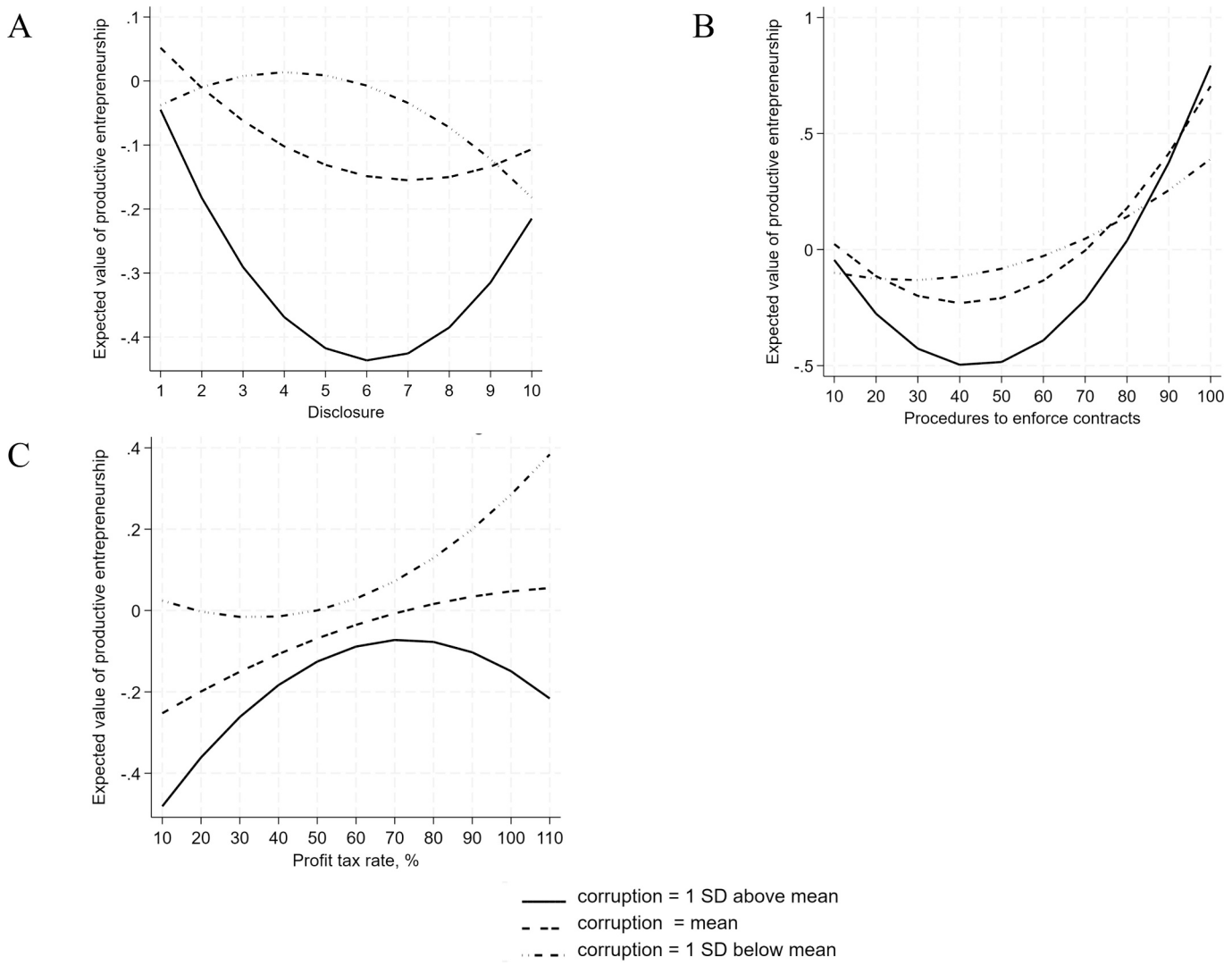

Fig. 5. Predictive margins of growth regulation and corruption level on productive entrepreneurship.
Note: Margins fit using mixed effects panel data estimation with 118 countries and 1065 obs. with the predictive margins at 95 % confidence intervals.
Source: Authors calculation.

investor disclosures and (b) procedures to enforce contracts increase. On the one hand, under a high level of corruption, an increase in tax payments first increases productive entrepreneurship, but under high level of tax it decreases it (Fig. 5C). On the other hand, in less corrupt countries, tax rate is positively associated with productive entrepreneurship.

Finally, in H7, we predicted that corruption would linearize the non-linear effect of EXSR on productive entrepreneurship. We find that the effect of insolvency costs and time becomes insignificant.

5.1. Post-hoc analysis

We conducted a series of additional robustness tests. First, we implemented a cross-sectional OLS regression. While OLS regression can pose challenges in making inferences and determining causal relationships, we used cross-sectional data that was averaged around the year 2010. Standard errors were clustered by country. Predictive margins derived from the OLS estimation are consistent with the results of the predictive margins of the RE.

A concern when analyzing corruption is endogeneity, and simply lagging independent variables is insufficient to adjust for this. We apply difference in difference (DiD) estimation to provide further causal inferences and validate our estimation. Results are presented in Table 5.

The main changes between using RE and DiD estimation are as follows. First, we confirm that an increase entry regulation cost to start a business discourages productive entrepreneurship, confirming H1. Second, our H2 is partly supported as we only find the negative effect of GSR on productive entrepreneurship. We did not confirm the positive slope of the inverted U-shaped relationship. We find the negative effects wears off, and becomes insignificant, while it does not turn positive. Third, our H4 now is not supported, which means that changes in corruption do not result in changes in productive entrepreneurship, while the high level of corruption is negatively associated with productive entrepreneurship. Fourth, the effect of EXSR on productive entrepreneurship is no longer significant, which means independent of changes in insolvency practices, productive entrepreneurial activity is unlikely to change.

Finally, our H5, H6, and H7 on the role of corruption in the relationship between regulation and productive entrepreneurship are supported using DiD analysis. For example, we find that higher corruption further discourages productive entrepreneurship if entry procedures to start a business increase, or contract enforcement procedures increase, and disclosure of investors as well as higher tax rate discourages productive entrepreneurship (growth regulation). The effect of changes in EXSR do not change productive entrepreneurship in countries with low and high corruption, while level of corruption and EXSR continue to

Table 4
Random-effect estimation of the effect of regulations on productive entrepreneurship.

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method	RE	RE	RE	RE	RE	RE	RE	RE
Unemployment	0.008**	0.009***	0.006*	0.008**	0.008**	0.005**	0.005*	0.005**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tertiary education	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Government consumption	0.003**	0.001**	0.004**	0.001**	0.005**	0.003**	0.004**	0.002**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Controlled corruption (H4)	−0.121***	−0.103***	−0.108**	−0.110*	0.008	0.473	0.074	0.478
	(0.04)	(0.03)	(0.03)	(0.05)	(0.06)	(0.51)	(0.11)	(0.58)
Birth-stage regulation (BSR)								
Cost to register property (H1)	0.002			−0.001	0.001			−0.003
	(0.01)			(0.01)	(0.01)			(0.01)
Procedures to register property (H1)	−0.001			0.002	−0.004			−0.001
	(0.01)			(0.01)	(0.01)			(0.01)
Cost to start a business (H1)	−0.001***			−0.001**	−0.002**			−0.002**
	(0.00)			(0.00)	(0.00)			(0.00)
Procedures to start a business (H1)	−0.005***			0.001	−0.004*			0.001
	(0.00)			(0.01)	(0.00)			(0.01)
Growth-stage regulation (GSR)								
Disclosure (H2)		−0.094***		−0.096***		−0.057*		−0.055*
		(0.03)		(0.03)		(0.03)		(0.03)
Disclosure squared (H2)		0.005**		0.005**		0.003**		0.003**
		(0.00)		(0.00)		(0.00)		(0.00)
Customs procedures (H2)		0.023***		0.031*		0.552**		0.294**
		(0.00)		(0.01)		(0.12)		(0.05)
Customs procedures squared (H2)		−0.023**		−0.003**		−0.056**		−0.037**
		(0.01)		(0.00)		(0.02)		(0.01)
Cost enforcing contracts (H2)		0.006**		0.007**		0.012**		0.009**
		(0.00)		(0.00)		(0.01)		(0.01)
Cost enforcing contracts squared (H2)		−0.001**		−0.001*		−0.001**		−0.001*
		(0.00)		(0.00)		(0.00)		(0.00)
Procedures enforcing contracts (H2)		−0.003**		−0.003**		−0.009**		−0.012**
		(0.01)		(0.01)		(0.00)		(0.00)
Procedures enforcing contracts squared (H2)		0.002**		0.002**		0.001*		0.001*
		(0.00)		(0.00)		(0.00)		(0.00)
Tax rate (H2)		0.004		0.006*		−0.003		−0.001
		(0.00)		(0.00)		(0.01)		(0.01)
Tax rate squared (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Tax payments (H2)		−0.006***		−0.006***		−0.004*		−0.005**
		(0.00)		(0.00)		(0.00)		(0.00)
Tax payments squared (H2)		0.001**		0.001**		0.001**		0.001**
		(0.00)		(0.00)		(0.00)		(0.00)
Time to pay taxes (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Time to pay taxes squared (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Exit-stage regulation (EXSR)								
Resolving Insolvency time (H3)			−0.059**	−0.043			−0.063**	−0.012
			(0.02)	(0.05)			(0.02)	(0.06)
Resolving Insolvency time squared (H3)			0.006**	0.005			0.003**	0.001
			(0.00)	(0.01)			(0.00)	(0.01)
Resolving Insolvency cost (H3)			−0.017*	−0.011*			−0.021*	−0.011**
			(0.01)	(0.00)			(0.01)	(0.00)
Resolving Insolvency cost squared (H3)			0.001**	0.001*			0.001**	0.001**
			(0.00)	(0.00)			(0.00)	(0.00)
BSR interactions with corruption								
Cost to register property × controlled corruption (H5)					0.003			0.007
					(0.01)			(0.01)
Procedures to register property × controlled corruption (H5)					−0.010**			−0.021*
					(0.00)			(0.01)
Cost to start a business × controlled corruption (H5)					0.001**			0.001**
					(0.00)			(0.00)
Procedures to start business × controlled corruption (H5)					0.001			0.011
					(0.00)			(0.01)
GSR interactions with corruption								

(*continued on next page*)

Table 4 (*continued*)

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disclosure × controlled corruption (H6)						−0.118***		−0.099***
						(0.03)		(0.04)
Disclosure squared × controlled corruption (H6)						0.009***		0.008**
						(0.00)		(0.00)
Customs procedures × controlled corruption (H6)						−0.091		0.045
						(0.16)		(0.18)
Customs procedures squared × controlled corruption (H6)						−0.020		−0.001
						(0.02)		(0.02)
Cost enforcing contracts × controlled corruption (H6)						−0.006		−0.003
						(0.00)		(0.01)
Cost enforcing contracts squared × controlled corruption (H6)						0.001		0.001
						(0.00)		(0.00)
Procedures enforcing contracts × controlled corruption (H6)						−0.015**		−0.013**
						(0.01)		(0.01)
Procedures enforcing contracts squared × controlled corruption (H6)						0.001**		0.001*
						(0.00)		(0.00)
Tax rate x controlled corruption (H6)						0.014**		0.016**
						(0.01)		(0.01)
Tax rate squared × controlled corruption (H6)						−0.001**		−0.001**
						(0.00)		(0.00)
Tax payments × controlled corruption (H6)						−0.001		−0.001
						(0.00)		(0.00)
Tax payments squared × controlled corruption (H6)						0.001		0.001
						(0.00)		(0.00)
Time to pay taxes × controlled corruption (H6)						−0.001		−0.001
						(0.00)		(0.00)
Time to pay taxes squared × controlled corruption (H6)						0.001		0.001
						(0.00)		(0.00)
EXSR interactions with corruption								
Resolving Insolvency time × controlled corruption (H7)							−0.004	0.051
							(0.06)	(0.07)
Resolving Insolvency time squared × controlled corruption (H7)							−0.008	−0.014
							(0.01)	(0.01)
Resolving Insolvency cost × controlled corruption (H7)							0.001	−0.001
							(0.01)	(0.01)
Resolving Insolvency cost squared × controlled corruption (H7)							−0.001	0.001
							(0.00)	(0.00)
Constant	−2.501***	−2.884***	−2.144***	−2.155***	−2.299***	−3.376***	−2.054***	−2.289***
	(0.38)	(0.51)	(0.39)	(0.57)	(0.39)	(0.64)	(0.40)	(0.73)
Number of obs.	1065	1065	1065	1065	1065	1065	1065	1065
RMSE	0.227	0.228	0.229	0.226	0.226	0.228	0.228	0.224
R2 within	0.046	0.063	0.053	0.076	0.058	0.086	0.063	0.115
R2 overall	0.328	0.415	0.290	0.397	0.326	0.464	0.285	0.451
R2 between	0.317	0.377	0.272	0.348	0.304	0.421	0.264	0.385
chi-squared	125.81	160.11	125.04	158.19	133.23	206.30	134.88	213.91
Sigma u	0.489	0.469	0.476	0.469	0.496	0.442	0.472	0.448
Sigma e	0.220	0.221	0.221	0.218	0.219	0.219	0.220	0.215
Rho	0.831	0.818	0.821	0.821	0.836	0.803	0.820	0.812

Note: Significance *0.05 %, **0.01 %, ***0.001 % do not include zero; Given the nonlinear model, significance may vary within an interval. Standard errors are clustered by country. Number of observations: 1065; number of countries in a sample: 118; average number of obs. per country/year = 9.1 out of 10. Country and year dummies were included to capture unobserved heterogeneity across countries and time, oppressed to save space.
Source: World Bank national accounts data and OECD National Accounts, Transparency International, World Bank Doing Business Project, International Monetary Fund, Government Finance Statistics; World Bank World Development Indicators; World Economic Forum, Global Competitiveness Report.

predict productive entrepreneurship.

Our robustness check which used DiD demonstrated the differences between level and change in regulation and level and change in productive entrepreneurship. While the level of productive entrepreneurship is strongly affected by the level (cost, time and procedures) of regulatory dimension, change in regulation and corruption may not lead to a subsequent change in productive entrepreneurship.

6. Discussion

Taken together, we offer four narratives to interpret our findings. First, our intuition was that we might see distinct patterns in the effect of regulations on productive entrepreneurship based on their relevance to the birth, growth, and exit stages of a business, based on recent research highlighting the heterogeneity of regulation and entrepreneurship (Audretsch et al., 2021). However, we did not find such clear patterns. In fact, we obtained mixed findings particularly for our BSR and GSR variables. This could mean that entrepreneurs consider more than only the regulations directly relevant to their current stage of business. For example, some entrepreneurs in the startup phase might be considering exit regulations if their business model is to sell the business. Or, it could mean that our breakdown of regulations by stage requires greater nuance. For example, effects could vary by industry as some entrepreneurs will need factories and thus prioritize property registration whereas others will not.

Second, our results lend support to both a public choice and a public view of regulation. These two views of regulation (see Holcombe and Boudreaux, 2015; Lucas and Boudreaux, 2020) are not necessarily mutually exclusive: regulation is often incremental in nature, and the process by which regulations are enacted involve many people whose

Table 5
Difference in difference estimation - dependent variable difference in productive entrepreneurship.

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method	DiD	DiD	DiD	DiD	DiD	DiD	DiD	DiD
Unemployment	−0.003*	−0.003*	−0.003*	−0.003*	−0.003*	−0.004*	−0.004*	−0.004*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tertiary education	−0.001	−0.002	−0.001	−0.002	−0.002	−0.001	−0.001	−0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Government consumption	0.005	0.004	0.005	0.002	0.005	0.006	0.005	0.004
	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
Controlled corruption (H4)	0.025	0.042	0.030	0.039	0.039	0.089	0.029	0.075
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.07)	(0.05)	(0.08)
BSR regulation								
Cost to register property (H1)	0.006			0.005	0.006			0.006
	(0.01)			(0.01)	(0.01)			(0.01)
Procedures to register property (H1)	0.003			0.002	0.002			0.006
	(0.01)			(0.02)	(0.01)			(0.02)
Cost to start a business (H1)	−0.002**			−0.003**	−0.002**			−0.004*
	(0.00)			(0.00)	(0.00)			(0.00)
Procedures to start a business (H1)	0.001			0.007	0.003			0.017
	(0.00)			(0.01)	(0.00)			(0.01)
GSR regulation								
Disclosure (H2)		−0.042		−0.050*		−0.105***		−0.110***
		(0.03)		(0.03)		(0.04)		(0.04)
Disclosure squared (H2)		0.008		0.011**		0.029***		0.030***
		(0.01)		(0.00)		(0.01)		(0.01)
Customs procedures (H2)		−0.009		0.003		−0.022		−0.011
		(0.04)		(0.04)		(0.04)		(0.04)
Customs procedures squared (H2)		0.011		0.017		−0.028		−0.011
		(0.09)		(0.09)		(0.09)		(0.09)
Cost enforcing contracts (H2)		−0.007**		−0.007*		−0.008*		−0.008*
		(0.00)		(0.00)		(0.00)		(0.00)
Cost enforcing contracts squared (H2)		0.001**		0.001**		0.001**		0.001**
		(0.00)		(0.00)		(0.00)		(0.00)
Procedures enforcing contracts (H2)		0.004		0.004		0.006		0.006
		(0.01)		(0.01)		(0.01)		(0.01)
Procedures enforcing contracts squared (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Tax rate (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Tax rate squared (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Tax payments (H2)		−0.003**		−0.003**		−0.003**		−0.003**
		(0.00)		(0.00)		(0.00)		(0.00)
Tax payments squared (H2)		0.001**		0.001**		0.001**		0.001**
		(0.00)		(0.00)		(0.00)		(0.00)
Time to pay taxes (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
Time to pay taxes squared (H2)		0.001		0.001		0.001		0.001
		(0.00)		(0.00)		(0.00)		(0.00)
EXSR regulation								
Resolving Insolvency time (H3)			−0.018	−0.021			−0.008	−0.007
			(0.05)	(0.05)			(0.07)	(0.07)
Resolving Insolvency time squared (H3)			−0.004	−0.005			0.001	0.002
			(0.02)	(0.02)			(0.03)	(0.03)
Resolving Insolvency cost (H3)			−0.001	−0.001			−0.001	−0.001
			(0.00)	(0.00)			(0.00)	(0.00)
Resolving Insolvency cost squared (H3)			−0.001	−0.001			0.001	−0.001
			(0.00)	(0.00)			(0.00)	(0.00)
BSR interactions with corruption								
Cost to register property × controlled corruption (H5)					−0.006			−0.008
					(0.08)			(0.09)
Procedures to register property × controlled corruption (H5)					−0.011			−0.026
					(0.11)			(0.21)
Cost to start a business × controlled corruption (H5)					0.003			0.002
					(0.00)			(0.00)
Procedures to start business × controlled corruption (H5)					−0.035**			−0.202**
					(0.01)			(0.09)
GSR interactions with corruption								

(*continued on next page*)

Table 5 (*continued*)

Specifications	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disclosure × controlled corruption (H6)						−1.519***		−1.464***
						(0.34)		(0.35)
Disclosure squared × controlled corruption (H6)						0.333***		0.312***
						(0.09)		(0.09)
Customs procedures × controlled corruption (H6)						0.532		0.463
						(0.40)		(0.41)
Customs procedures squared × controlled corruption (H6)						0.542		0.364
						(1.11)		(1.12)
Cost enforcing contracts × controlled corruption (H6)						0.001		0.001
						(0.03)		(0.03)
Cost enforcing contracts squared × controlled corruption (H6)						0.002		0.002
						(0.00)		(0.00)
Procedures enforcing contracts × controlled corruption (H6)						−0.006**		−0.003**
						(0.00)		(0.00)
Procedures enforcing contracts squared × controlled corruption (H6)						0.001*		0.001*
						(0.00)		(0.00)
Tax rate × controlled corruption (H6)						0.045*		0.051**
						(0.02)		(0.02)
Tax rate squared × controlled corruption (H6)						−0.001*		−0.001*
						(0.00)		(0.00)
Tax payments × controlled corruption (H6)						0.001		−0.004
						(0.03)		(0.03)
Tax payments squared × controlled corruption (H6)						0.001		0.001
						(0.00)		(0.00)
Time to pay taxes × controlled corruption (H6)						−0.002		−0.002
						(0.00)		(0.00)
Time to pay taxes squared × controlled corruption (H6)						−0.001		−0.001
						(0.00)		(0.00)
EXSR interactions with corruption								
Resolving Insolvency time × controlled corruption (H7)							−0.050	−0.209
							(0.40)	(0.43)
Resolving Insolvency time squared × controlled corruption (H7)							−0.034	−0.085
							(0.21)	(0.23)
Resolving Insolvency cost × controlled corruption (H7)							0.099	0.157
							(0.12)	(0.13)
Resolving Insolvency cost squared × controlled corruption (H7)							0.013	0.005
							(0.01)	(0.02)
Constant	0.010	0.005	0.006	0.002	0.010	0.003	0.006	−0.001
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Number of obs.	1065	1065	1065	1065	1065	1065	1065	1065
RMSE	0.202	0.206	0.195	0.204	0.203	0.205	0.196	0.203
R2 within	0.018	0.027	0.018	0.029	0.021	0.056	0.019	0.063
R2 overall	0.016	0.027	0.016	0.029	0.020	0.051	0.017	0.061
R2 between	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.003
chi-squared	18.63	26.29	19.95	27.64	21.57	50.68	20.76	58.45
Sigma e	0.207	0.212	0.199	0.209	0.207	0.210	0.198	0.208

Note: Significance *0.05 %, **0.01 %, ***0.001 % do not include zero; Given the nonlinear model, significance may vary within an interval. Standard errors are clustered by country. Number of observations: 1065; number of countries in a sample: 118; average number of obs. per country/year = 9.1 out of 10. Country and year dummies were included to capture unobserved heterogeneity across countries and time, oppressed to save space.
Source: World Bank national accounts data and OECD National Accounts, Transparency International, World Bank Doing Business Project, International Monetary Fund, Government Finance Statistics; World Bank World Development Indicators; World Economic Forum, Global Competitiveness Report.

motivations can differ. Broadly, out findings support Galang's (2012: 431) discussion that "not all firms suffer by being embedded in an institutional environment with entrenched corruption because some of them have the capability and the motivation to make these political deficiencies work in their favour".

Third, our findings demonstrate that how regulatory policy is designed matters, adding to relatively newer insights on the under-examined question of which tools regulators use (Audretsch et al., 2019), expanding on the relatively more well-established findings that the type of regulation matters (Stenholm et al., 2013; Klapper and Love, 2010). Our empirical analysis considered two types of regulatory tools (financial and administrative / procedural). With few exceptions – namely, entry costs and procedures, and insolvency costs and time – most regulations do not exert consistently negative or positive effects on productive entrepreneurship. Entry regulation often offers the first point of contact between an entrepreneur and the regulatory system, providing strong reasoning for policy attention to the entry process and its effects (Bruhn and McKenzie, 2014), particularly because our findings are in line with previous research on its dampening effect on entrepreneurship more broadly (see Klapper et al., 2006). In contrast, our findings on contract enforcement costs and procedures are both nonlinear – and they contradict each other. This suggests that policymakers have an opportunity to holistically examine how regulations – even within the same domain – might actually be in conflict, redundant, or potentially even cancel out the intended effects.

Fourth, our findings that corruption dampens the adverse effects of some regulations – or a portion of the effects which are adverse, in the case of non-linear relationships - on productive entrepreneurship suggest caution for policymakers debating how to best target this type of entrepreneurship. For example, although insolvency costs have U-shaped nonlinear relationships with productive entrepreneurship, corruption renders it not significant. This does not mean that corruption should

be interpreted as a positive force. One interpretation could be that smaller-scale or less financially lucrative yet still productive entrepreneurs may face difficulty complying with exit regulations, whereas the more profitable productive entrepreneurs may have less difficulty. Corruption may offer an easier way to manage exit regulations when they are costly – but this bypasses the regulatory system, so policymakers should consider if lowering insolvency costs could affect the nonlinear relationship with productive entrepreneurship.

7. Conclusion

Since regulatory context is an important concern for entrepreneurs and an important function of policymakers, it is important to understand how it affects productive entrepreneurship.

This study brings together an institutional perspective (North, 1990; Williamson, 2000) with theory on the allocation of entrepreneurship (Baumol, 1990) to examine the effects of various regulatory frameworks on three entrepreneurial stages: early, growth, and exit. We investigated: a) how different regulation types influence productive entrepreneurship (Baumol, 1990, 1993); and b) how this relationship is modified by corruption in a country (Kaufmann and Wei, 1999; Méon and Weill, 2010; Galang, 2012; Audretsch et al., 2022a). Our study calls into question existing frameworks that paint regulation as “too much and too bad” or “not enough to be good”.

We provided new insights on the heterogeneity of institutions and especially regulation in shaping entrepreneurship outcomes (Audretsch et al., 2023; Urbano et al., 2019). Our overarching finding was that although regulations are highly heterogenous and sometimes nonlinear in their influence on entrepreneurship, there is no consistent pattern based on the relevance of regulations to business stage. This offers a point for consideration in the regulatory uncertainty research, as our results suggest that uncertainty is not uniform for entrepreneurs (Yang et al., 2004).

Although in some cases one type of regulation seems to have a consistent effect on productive entrepreneurship (*entry* costs and procedures; *insolvency* costs and procedures), this is not the case for most regulations. In fact, in most cases the impact of regulation is not necessarily linked to the domain it governs (for example, taxes) but can often be the result of how compliance is achieved: by completing procedures, paying fees, or even spending time.

Our focus on productive entrepreneurship adds to its growing literature (Nicotra et al., 2018; Chowdhury et al., 2019; Sobel, 2008). To this end, our introduction of a new measure for productive entrepreneurship offers a path for future research to test and validate. In particular, the three conditions upon which our measure rests offer a novel way to operationalize a nebulous concept. As we created this measure for 118 countries around the world and for the time period of our study, future research can undertake a comparative approach.

7.1. Limitations and future research

Several limitations of this study should be noted, and some also provide interesting questions for future research on productive entrepreneurship. Firstly, our findings are limited with 72 countries at different level of economic development and unbalanced data with unequal number of observations during 2005–2016 which we leveraged by running the cross-sectional estimation and post-estimation predictive margins on both panel and cross-sectional data. We acknowledge the possible existence of estimation bias related to the poolability of data (Wooldridge, 2002) for 72 countries (analyzed within the same framework) which needs to be addressed in future research. Second, as such, despite empirical research has made an attempt to recognize the contextual and environmental elements that predict productive entrepreneurship, empirical findings are still limited (Sobel, 2008; Nicotra et al., 2018; Chowdhury et al., 2019; Audretsch et al., 2022b). The World Bank's Doing Business Project has been discontinued due to concerns about the process and stakeholder issues, and new measures of regulation should be selected in the future to test longitudinal effects of regulation type on productive entrepreneurship (Wang, 2021). Future work is needed both on the theoretical and measurement development of the concept of productive entrepreneurship. Related to this, future research should go beyond regulation to understand how, for example, individual cognitive factors play a role in productive entrepreneurship. This calls for multi-level research. One stream of argument that could be tested argues that the entrepreneurs are affected by regulation, but they are also affected by the ability to identify an opportunity which is down to individuals' cognitive skills. A multi-level nested model could be further applied to test the interrelationship across different levels of interactions and incentives: individual, regional and country level. In addition, having large time-variation, scholars will be able to experiment with longer lags minimizing potential endogeneity between regulation level, country's economic development and the quality and quantity of entrepreneurship. Finally, although we examined productive entrepreneurship, we did not examine further breakdowns within productive entrepreneurs which can reflect important questions for policymakers. For example, access to opportunity to start a productive business can vary based on demographic, regional, and other characteristics. This is an important potential line of investigation or future research with large economic development and social welfare implications.

CRediT authorship contribution statement

Maksim Belitski: Conceptualization, Data curation, Methodology, Resources, Software, Validation, Writing – review & editing. **Sameeksha Desai:** Conceptualization, Investigation, Resources, Validation, Writing – original draft.

Declaration of competing interest

Authors have no competing and conflicting interests.

Data availability

The authors do not have permission to share data.

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