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Productive entrepreneurship and the effectiveness of insolvency legislation: a cross-country study

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Abstract This paper studies the association between the effectiveness of insolvency regulations and entrepreneurship using multilevel modeling of about 300,000 individuals in 27 countries over the 2005–2010 period. We investigate the relationship between three different measures of "resolving insolvency" (time, cost, and recovery rate) from the World Bank and four different measures of entrepreneurship from the Global Entrepreneurship Monitor, controlling for relevant individual- and country-level facets. We find that opportunity-driven and innovation-oriented entrepreneurs are more severely affected by onerous insolvency regulations than necessity-motivated entrepreneurs. However, entrepreneurs envisioning rapid employment growth are not affected by onerous insolvency regulations. We discuss contributions to comparative entrepreneurship research and public policy.

Keywords Entrepreneurship · Bankruptcy · Effectiveness of insolvency laws · Cross-country

JEL classification L26 · L51 · P37 · O57

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1 Introduction

A sizable literature in political economics and law has focused on the importance of a "fresh start" for entrepreneurs who find themselves in financial insolvency (Hallinan 1986). Encouraging personal risk taking and entrepreneurship are imperative requirements for modern economic systems since the most productive types of entrepreneurship often involve joint ownership and labor input from founder entrepreneurs (Gennaioli et al. 2013; Kihlstrom and Laffont 1979).

According to Michelle White, international authority in the fields of insolvency law and political economies, "research shows that potential entrepreneurs are strongly affected by changes in the risk of bankruptcy" (White 2001, pp. 19–20). Further, addressing public policy attempts to promote entrepreneurship and economic growth in the midst of the global financial crisis, The Economist (2010) reported the following:

> Making it easier to close a business may not sound as inviting as announcing yet another "enterprise fund" or "innovation initiative," but it is more vital to reviving the world's moribund economy. In the short run, enlightened bankruptcy laws reduce unemployment by keeping viable companies alive. In the long run they boost rates of entrepreneurship. The best way to get more people

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> to start businesses is to make it easier to wind them up. (The Economist 2010, p. 68).

However, more lenient insolvency laws making it easier to close down a business may not be solely advantageous to societies. Insolvency laws that are too lenient could lead creditors to react negatively by raising the costs of interest and/or access to financing for small firms, which may negatively affect small firms' access to credit. Consequently, growth-friendly insolvency legislation often tries to strike a balance between not exclusively favoring the small firm creditors (Gratzer and Sjögren 1999) and not encouraging "excess entry" among unproductive entrepreneurs (Camerer and Lovallo 1999).

The overall goals of insolvency legislation are multifold: on the one hand, insolvency rules and legislation are meant to protect asset owners' claims to assets produced or controlled by the firm (e.g., firm shareholders, suppliers, debtholders, tax authorities). Recent reforms to insolvency rules, such as the U.S. Chapter 11 legislation, the comprehensive Japanese bankruptcy reform in 2003, and the Swedish 2010 bankruptcy legislation, are often designed to weed out bankrupt firms deemed unproductive when re-organization is not likely to result in increased project; however, these reform do encourage the re-organization and re-initiation of firms deemed likely to become profitable in the near future. The potential to "recycle" resources from bankruptcies—be it fixed assets in the firm or entrepreneurs' and employees' human capital—is imperative for society to recoup investments (Lee et al. 2007; Peng et al. 2010; White 2001) and for entrepreneurs to learn from their mistakes (Jenkins et al. 2014; Wennberg et al. 2010).

Not all bankrupt firms are necessarily declared insolvent. A substantial number of bankruptcies are initiated by entrepreneurs themselves, whereas other entrepreneurs choose to sell off remaining assets, pay their debts, and liquidate their firm when facing insolvency perhaps to avoid the "stigma" of insolvency (Thorburn 2000). Calls for a firm to be declared bankrupt may also be initiated by other asset claimants, such as suppliers or debtholders.

Even if entrepreneurs in young firms strive to pursue profitability, erratic performance is common: initial high performance can quickly turn into losses or insolvency because young firms generally have few reserves to withstand sudden environmental shifts (Cooper et al. 1994). Further, growing firms create many beneficial societal spillovers in terms of new products and services, job creation, and tax payments. Small firms that remain unprofitable, however, often do not create these beneficial spillovers, instead leading to low earnings for the entrepreneur, limited job creation, and reduced tax payments. Thus, from a theoretical perspective, policymakers should balance encouraging unprofitable firms to exit with encouraging profitable businesses to grow.

Whether insolvency laws and regulations are too lenient or too harsh is an empirical question. A number of cross-country studies have investigated correlations between bankruptcy procedures and aggregate-level entrepreneurship, often measured as self-employment or firm-formation rates (e.g., Armour and Cumming 2008; Lee et al. 2011). Some single-country studies have shown that specific changes in bankruptcy laws may impact entrepreneurs' entry decisions (Dewaelheyns and Van Hulle 2008). In particular, a recent quasi-natural experimental study by Eberhart et al. (2016) investigated a reform in Japan to change insolvency laws to reduce the consequences of closing a firm. The authors found that the proportion of firms declaring bankruptcy increased following the reform, especially for firms founded by "elite entrepreneurs." Further and importantly, Eberhart et al. (2016) also found that the average performance of new firms increased after the reform as these elite entrepreneurs were more likely to found higher-performing firms.

To date, however, there is a scarcity of research investigating the relationship between insolvency legislation and the various types of entrepreneurship despite the theoretically salient distinction between self-employment and other forms of entrepreneurship. One exception is the recent study by Estrin et al. (2016), which distinguished between entrepreneurs in general and entrepreneurs with aspirations to create more than 5, 10, or 20 jobs within 5 years. They investigated different dimensions of both personal and corporate bankruptcy law and found that the latter does not have any impact on low-aspiration entrepreneurs. For corporate bankruptcy law, limitations in bankruptcy proceedings regarding entrepreneurs' control over their firm, such as an automatic stay on secured assets and mandatory removal of management, reduced the likelihood of individuals' entering high-aspiration entrepreneurship.

In this paper, we provide a new comparative study on the association between insolvency regulations and

entrepreneurship using recent high-quality data on about 300,000 individuals in 27 countries over a 7-year period. It is worth noting that we focus on the effectiveness of insolvency regulations rather than the legislation per se as the actual impact of these regulations can be affected by the rule of law—that is, how they will be enforced in a country. Specifically, we use multilevel modeling to investigate the relationship between three different measures of "resolving insolvency" (time, cost, and recovery rate) from the World Bank (2004–2009) and four different measures of entrepreneurship from the Global Entrepreneurship Monitor (GEM), controlling for relevant individual- and country-level facets. These measures allow us to categorize individuals' entrepreneurial activities as either "productive entrepreneurship"—measured as opportunity-, innovation-, or growth-driven entrepreneurship—and "unproductive entrepreneurship"—measured as necessity-driven entrepreneurship. Distinguishing between necessity entrepreneurship, which mostly leads to self-employment, and entrepreneurship based on innovative ideas, perceived attractive business opportunities, and a growth orientation is important since necessity entrepreneurship has been found to be negatively correlated with economic growth (e.g., Henrekson and Sanandaji 2014). Rather, there is a positive relationship between entrepreneurship and economic growth only for a subset of firms, specifically those that are innovative and growth oriented (Henrekson and Sanandaji 2014; Shane 2009).

We find that entrepreneurial entry is affected by corporate insolvency regulations but that the exact impact differs depending on the measures of insolvency regulations chosen and the type of entrepreneurship considered. Specifically, insolvency time and insolvency cost (percentage of estate) are, as expected, negatively related to individuals' likelihood of engaging in opportunity-driven, necessity-driven, and innovative entrepreneurship. Conversely, but again as expected, insolvency recovery rate has a positive effect on the same types of individual-level entrepreneurial activities. Further, we find that opportunity-driven and innovation-oriented entrepreneurs are more severely affected by onerous insolvency regulations than necessity-motivated entrepreneurs. However, entrepreneurs envisioning rapid employment growth are not negatively affected by onerous insolvency regulations, a puzzle that we speculate on in the discussion section. Overall, our analyses show that less stringent insolvency legislation may indeed stimulate entrepreneurship but to a different extent depending on the type of entrepreneurship. We discuss implications for comparative entrepreneurship research and public policy.

2 Theory and hypotheses

The theoretical framework of our paper is inspired by an Austrian economic model of entrepreneurship that identifies the historically and culturally determined framework conditions affecting entrepreneurship and the idiosyncratic prior experience of enterprising—and potentially enterprising—individuals (Shane and Venkataraman 2000).

By framework conditions, we mean the general conditions defining the context in which entrepreneurship occurs. Examples of such conditions are the stock of knowledge, financial and human capital in the economy, institutions, history, and prevailing culture. Such conditions determine what opportunities entrepreneurs will identify and how they will exploit them (Baumol and Strom 2007). Opportunity exploitation is defined by three characteristics: (1) the ability to discover versus the ability to exploit; (2) the entrepreneur's opportunity cost; and (3) the uncertainty of the outcome, risk, and information asymmetry (Shane and Eckhardt 2003).

On the individual level, entrepreneurial actions are regulated by individuals' evaluation of first-person feasibility and desirability considerations (e.g., McMullen and Shepherd 2006). That is, an entrepreneur does not know in advance whether exploiting an opportunity will be profitable or not. The accuracy of his or her confidence regarding the value of an opportunity can only be tested on the market. Since opportunity exploitation is characterized by uncertainty (Knight 1921), those that become entrepreneurs have to handle this uncertainty. Feasibility denotes individuals' perceived ability to execute a target behavior—namely, the degree to which they feel capable of becoming an entrepreneur (Krueger et al. 2000). Desirability refers the degree to which one finds the prospect of becoming an entrepreneur to be attractive; "it reflects one's affect toward entrepreneurship" (Krueger 1993, p. 8) and depends on an individual's values, which in turn stem from her or his institutional environment (Shapero and Sokol 1982).

Theoretically, variation in the cost of insolvency procedures will likely influence a given individual's reaction toward entrepreneurial entry, success, and failure. By regulating the economic and social tradeoffs

associated with alternative courses of action, as observed by the entrepreneur, institutions influence the first-person feasibility and desirability considerations of potential entrepreneurs (McMullen and Shepherd 2006). Specifically, efficient insolvency procedures, such as well-functioning bankruptcy laws, provide entrepreneurs with "insurance," enabling them to clear their debts instead of being liable until they are paid off. Such procedures limit the downside risk of failure if the entrepreneurs' business is incorporated (Posner 1973). However, the relative risk of entering entrepreneurship can never be insured against but comes in the form of genuine uncertainty.

Acs and Audretsch provided an economic explanation for the relationship between entrepreneurship, societal institutions, and uncertainty based on an agency cost perspective (e.g., Acs 2002; Acs and Audretsch 1987; Audretsch and Acs 2003; Audretsch et al. 2001). They argued that in the absence of perfect markets with perfect information, markets are characterized by uncertainty and substantial information asymmetries, both of which make the creation of new independent firms the best way to process the information needed to determine the value of new opportunities. Because of incumbent firms' bureaucratic organization and decision making, information asymmetry leads to different agency problems, for example, problems related to creating incentive structures, monitoring employees, and handling transaction costs (Wiggins 1991). These agency problems, in combination with information asymmetries, often incentivize entrepreneurs to pursue their own opportunity by starting a new independent firm.

The degree to which incumbent firms face such agency problems with respect to new knowledge and potentially valuable opportunities varies across industries and regions because the underlying knowledge conditions differ in these contexts. In some industries, new knowledge-generating and innovative activities are relatively more frequent and can be processed within incumbent firms' context and structure. In other industries, innovations and new opportunities often originate from knowledge that is not routine in nature and is thus discarded more often by incumbent firms. Nelson and Winter (1982) called these industry differences the "technological regime" of the industry. They argued that the choice of exploitation mode in an industry is based on (1) the nature of benefits and costs weighted by the incumbent firms that will decide to exploit or not exploit a new opportunity, (2) the manner in which consumers or regulatory preferences and rules influence what is profitable, and (3) the relationship between profit and the ways incumbent firms learn what is and what is not a valuable opportunity.

Our paper incorporates both an individual-level component (as the level of analysis is individual entrepreneurs' entry decisions) and a national-level component (variation in expected costs of insolvency procedures at the national level) (Kim et al. 2016). Insolvency laws represent one of several institutional mechanisms affecting the likelihood that individuals will act on perceived opportunities. Research has shown that individuals' propensity to start new ventures is affected by specific features of economic policy, such as taxes, interest rates, judicial efficiency, or insolvency laws (Armour and Cumming 2008; Braunerhjelm and Eklund 2014). While taxes and interest rates mainly affect the profitability of entrepreneurship, insolvency laws represent a crucial aspect of the tradeoffs for individuals considering starting a business or not. From a societal perspective, the goal of insolvency regimes is to maximize the value of assets subject to the insolvency regime (Cepec et al. 2016; Hart 2000). However, insolvency laws can be regarded as a barrier to both entry and exit (Lee et al. 2007, 2011). For example, insolvency laws that reduce the cost of entrepreneurial exit may increase the level of entrepreneurship in a country (Lee et al. 2007; Wennberg et al. 2010). The reason behind this increase is that possible future losses, or the downside, are more likely to be a prominent factor in individuals' start-up decisions than the possible future upside because losses may come sooner and are easier to calculate (Dew et al. 2009). Losing personal assets can be a major factor when assessing the degree of risk associated with entrepreneurial-entry decisions (Estrin et al. 2016).

To date, empirical studies on this topic remain scarce and have largely been limited to cross-sectional studies of country-level rates of entrepreneurship. A few of these studies have shown a positive relationship between more lenient bankruptcy or insolvency procedures and different measures of entrepreneurship. For example, Armour and Cummings (2008) dealt with the impact of personal insolvency laws on self-employment, while Lee et al. (2011) focused on the impact of corporate insolvency laws on new firm entry rates. Further, Estrin et al. (2016) found that both personal and corporate bankruptcy laws affect entrepreneurs. While personal bankruptcy laws influence a broad range of entrepreneurs, corporate bankruptcy laws is likely to

impact ambitious entrepreneurs more directly since they tend to form limited liability corporations (Astebro and Tåg 2015). Insolvency regulations relaxing constraints on the supply of funds will enhance entrepreneurial activity (Parker 2005). Thus, dimensions of corporate insolvency regulations that enhance the return of debt if failure occurs, such as time, cost, and recovery rate, will have an impact on the likelihood of entrepreneurial entry. Since insolvency laws are intimately tied to downside risk of starting and potentially failing with a new enterprise, we derive an overall prediction followed by three specific hypotheses related to the three different types of entrepreneurship investigated:

H1: Onerous (lenient) corporate insolvency relegations are negatively (positively) associated with individuals' likelihood of engaging in entrepreneurship.

H1a: Insolvency time is negatively associated with individuals' likelihood of engaging in entrepreneurship such that the more the time, the lower the likelihood individuals will engage in entrepreneurial activity.

H1b: Insolvency cost is negatively associated with individuals' likelihood of engaging in entrepreneurship such that the higher the cost, the lower the likelihood individuals will engage in entrepreneurial activity.

H1c: Insolvency recovery rate is positively associated with individuals' likelihood of engaging in entrepreneurship such that the higher the recovery rate, the higher the likelihood individuals will engage in entrepreneurial activity.

2.1 Insolvency legislation, risk, and productive entrepreneurship

The benefits of entrepreneurship to society depend on whether the entrepreneurial efforts initiated generate positive spillovers (Acs et al. 2009). Innovation-oriented and opportunity-driven entrepreneurship are initiated by entrepreneurs seeking to turn new ideas into marketable products and services (Low and Weiler 2012). Such innovative entrepreneurs are often distinguishable from other entrepreneurs by their willingness to search and create new economic opportunities in the face of uncertainty and risk (Koellinger 2008; Wennekers and Thurik 1999). Our second string of arguments posits that for such innovation- and opportunity-driven entrepreneurship, the negative effects of onerous insolvency regulations will be stronger than they are for entrepreneurship in general.

Prior studies have indicated that potential entrepreneurs are strongly affected by changes in the risk of bankruptcy (White 2001), and studies of US state practices have indicated that more lenient insolvency laws affect perceptions of risk (Fan and White 2003). We build on the contribution from Eberhart et al. (2016), who recognized the heterogeneity of entrepreneurs, and distinguish between elite individuals and non-elite individuals.[1] Elite individuals have higher bankruptcy costs since they are likely to have more personal assets. Similarly, elites have higher opportunity costs and are likely to have more attractive career options, such as employment in established firms or opportunities to start other firms (Eesley and Roberts 2012). Thus, it can be argued that elite, or opportunity-driven entrepreneurs, will more accurately assess perceived risk and weigh it against the potential returns of starting a firm. Eberhart et al. (2016) also showed that lenient insolvency laws disproportionately affect firm formation by elite individuals compared with non-elites. The former individuals are more likely to form high-growth ventures (i.e., they are productive entrepreneurs), and while the potential returns and profitability from entrepreneurship will increase with firm growth, growing a firm also increases the risk of firm failure (Delmar et al. 2013). Elite entrepreneurs are also more likely to rely on debt to achieve growth and to form limited liability companies to obtain greater protection from bankruptcy (Vanacker and Manigart 2010). Innovation- and opportunity-driven entrepreneurs thus face increased exposure to onerous insolvency regulations since such regulations will directly affect the risk involved with introducing novel market offerings (York and Venkataraman 2010). Since corporate insolvency laws disproportionately affect innovation- and opportunity-driven entrepreneurship by increasing the downside risk of starting and potentially failing with a new enterprise, we formulate a second prediction followed by three specific hypotheses related to the three different types of entrepreneurship investigated:

H2: These negative (positive) effects of insolvency legislation are stronger for productive entrepreneurship than for unproductive entrepreneurship.

[1] The authors define "elite entrepreneurs" as individuals who are particularly likely to succeed since they have better access to resources via superior human and social capital compared to non-elites.

H2a: The negative effect of insolvency time is stronger for opportunity-, innovation-, and growth-driven entrepreneurship than it is for necessity-driven entrepreneurship.
H2b: The negative effect of insolvency cost is stronger for opportunity-, innovation-, and growth-driven entrepreneurship than it is for necessity-driven entrepreneurship.
H2c: The positive effect of insolvency recovery rate is stronger for opportunity-, innovation-, and growth-driven entrepreneurship than it is for necessity-driven entrepreneurship.

3 Methods and data

Using our theoretical framework, we seek to study the relationship between country-level measures of resolving insolvency and individuals' likelihood of undertaking the four types of entrepreneurial activity outlined above. The World Bank started collecting data on resolving insolvency in 2004, and we have access to the GEM data up to 2010. Thus, we analyzed survey data from a total of 27 countries that were included in the World Bank's insolvency data and the GEM's micro-level entrepreneurship data. Since not all countries participated in the GEM survey in all years, we included all countries that had participated at least once during this period. Including all countries also ensured that the number of country-level observations was adequate for a multilevel study with three country-level predictors and two country-level controls. Overall, the total sample includes 291,424 observations and 23,597 individual-year observations from 27 countries.

3.1 Dependent variables

Consistent with our theoretical focus, our dependent variable measured individuals' entry. We followed similar studies identifying four types of entrepreneurship in the GEM data (Acs et al. 2008; Autio et al. 2013): (1) opportunity-driven entrepreneurship, characterized by individuals who take advantage of a business opportunity; (2) necessity-driven entrepreneurship, characterized by individuals who have no better options for work other than starting their own business; (3) innovation-oriented entrepreneurship, characterized by individuals who introduce new products to the market; and (4) growth-oriented entrepreneurship, characterized by individuals who aspire to grow their business. Following standard procedures, all outcomes were defined as the percentage of the working-age population (18–64 years old) who has claimed a business mentioned above in the current year of the GEM survey (i.e., number of certain types of entrepreneurship per 100 working-age individuals in the population (see, e.g., Reynolds et al. 2003).

3.2 Independent variables

Our *resolving insolvency measures* come from the World Bank (2004–2010) and are described in detail by Hart et al. (2008). We used three different proxies to measure resolving insolvency. The data describing resolving insolvency for all 27 countries in our study are detailed in Table 1.

Insolvency time refers to the average time (in years) it takes to complete a bankruptcy procedure within a given country. We expect that a shorter time for the bankruptcy procedure will be associated with a higher rate of bankruptcy filings as well as higher rates of entrepreneurship.

Insolvency cost (percentage of estate) represents the cost of bankruptcy proceedings, including court fees and government levies; the fees of insolvency administrators, auctioneers, assessors, and lawyers; and all other fees and costs. This measure is recorded as a percentage of the value of the debtor's estate. We expect a less costly insolvency procedure will lead to more bankruptcy filings as well as higher rates of entrepreneurship (Hall 1992).

Recovery rate calculates how many cents on the dollar claimants (i.e., creditors, tax authorities, and employees) can recover from an insolvent firm (Berkowitz and White 2004). We expect a higher rate of recovery from insolvent firms will increase investors' confidence level, which will in turn lead to higher rates of entrepreneurship. We included three key explanatory variables with a one-year time lag in all regression models to avoid simultaneity bias.

3.3 Control variables

3.3.1 Control variables: individual level

We controlled for a set of individual-level variables related to one's propensity to participate in entrepreneurial activities. The *age* of an individual was measured in

Table 1 Descriptive data on country-level insolvency measures (2004–2009)

Country	Insolvency time (year)	Insolvency cost (% of estate)	Insolvency recovery rate (cents on the dollar)
USA	1.5	7	77.5
Greece	2	9	44.9
Netherlands	1.1	4	85.9
Belgium	0.9	4	86.3
France	1.9	9	46.5
Spain	1.5	15	71.6
Hungary	2	15	37.9
Italy	1.8	22	59.9
Switzerland	3	4	46.8
UK	1	6	85.0
Denmark	2.5	4	73.7
Sweden	2	9	74.6
Norway	0.9	1	89.4
Germany	1.2	6.1	81.2
Mexico	1.8	18	64.8
Chile	3.4	15.3	28.6
Australia	1	8	80.1
New Zealand	1.3	4	79.4
Japan	0.6	4	92.6
Korea	1.5	4	80.5
Turkey	3.3	15	19.3
Canada	0.8	4	90.1
Ireland	0.4	9	87.7
Iceland	1	4	78.9
Finland	0.9	4	88.1
Slovenia	2	8	44.7
Israel	3	23	51.5

Please note that our analyses of individual-level entrepreneurship are based on the GEM data from 2005 to 2010. A 1-year time lag is applied to the country-level variables from the World Bank data

years. *Gender* took the value 1 for females and 0 for males. *Education* took the values 1, 2, 3, 4, and 5 for individuals who received no education, primary education, secondary education, post-secondary education, and graduate education, respectively. *Household income* took values of 1, 2, and 3 for the lowest, middle, and highest income tiers in the population, respectively. *Fear of failure* indicated whether fear of failure would prevent the individual from setting up a business (1 = yes). *Familiarity ties with entrepreneurs* indicated whether the individual knew other people who had started a business in the past 2 years (1 = yes). *Entrepreneurial knowledge and skills* indicated whether the individual perceived that he or she had the required skills and knowledge to start a new business (1 = yes).

3.3.2 Control variables: country level

We introduced several macro-economic factors associated with entrepreneurial activities into the models as control variables as research has shown that these factors significantly impact the nature of entrepreneurial activity (Van Stel et al. 2005). Because a country's wealth has been shown to influence the prevalence of entrepreneurial activity, we controlled for the country's GDP per capita (USD) adjusted for purchasing power parity (PPP), as well as the annual GDP growth rate (Levie and Autio 2011). We controlled for population size in the model as it captures the size of the potential domestic market (Autio et al. 2013). Ease of doing business in a country was accounted for in the model as it captures legal and bureaucratic barriers in terms of time, cost, and procedures that entrepreneurs have to bear when starting a business (Van Stel et al. 2007). These data were taken from the World Bank datasets. We included all country-level control variables with a 1-year time lag in all regression models to establish a clear causality inference.

4 Analyses

All 27 countries are included for each of the years in the 2004–2010 period. The descriptive data and correlations for all years in the study are provided in Tables 2 and 3. We noted low to moderately high correlations between the three insolvency measures, so we introduced these measures separately in all regressions.

The data feature a hierarchical structure at multiple levels, meaning that individual-level data are nested within country-level data. With this data structure, individual-level data are likely to be correlated within country over time. Ignoring the multilevel structure can result in violating the assumption of data independence in traditional multiple regressions, which gives rise to unreliable estimates (Hofmann et al. 2000). Therefore, we adopted a multilevel modeling approach to test our hypotheses and to account for interdependence by capturing residuals at different levels (Bliese et al. 2007).

Table 2 Descriptive statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
Necessity-driven entrepreneurs (yes = 1)	291,424	0.01	0.12	0	1
Opportunity-driven entrepreneurs (yes = 1)	291,424	0.06	0.24	0	1
Innovative entrepreneurs (yes = 1)	23,597	0.47	0.50	0	1
Growth-oriented entrepreneurs (yes = 1)	23,597	0.10	0.30	0	1
Insolvency time (year)	291,424	1.56	0.78	0.4	5.6
Insolvency cost (% of estate)	291,424	10.14	5.27	1	23
Insolvency recovery rate (cents on the dollar)	291,424	75.85	18.18	11.96	100
Age	291,424	42.28	12.32	18	64
Gender	291,424	1.50	0.50	1	2
Education	291,424	3.36	1.11	1	5
Income	291,424	2	0.82	1	3
Fear of failure (yes = 1)	291,424	0.40	0.49	0	1
Familiarity ties with entrepreneurs (yes = 1)	291,424	0.38	0.49	0	1
Entrepreneurial knowledge and skills (yes = 1)	291,424	0.51	0.50	0	1
GDP per capita, ppp ($)	291,424	31,589.87	6929.08	12,191.06	61,342
GDP growth	291,424	1.62	3.00	− 8.35	7.23
Size of population (million)	291,424	47.50	50.5	0.30	307
Ease of starting a business	291,424	78.57	11.24	56.21	97.56

Moreover, we are interested in assessing to what extent country-level insolvency regulations influence individuals' likelihood of engaging in entrepreneurship. Multilevel modeling provides ways to simultaneously evaluate the impact of factors from different levels and makes testing cross-level effects possible.

To understand how much variance in the different types of entrepreneurial activities resided in the country level, we calculated the intra-class correlation coefficient (ICC) and carried out likelihood ratio tests to compare single-level and multilevel model specifications, respectively. The results indicate that there are significant country differences in necessity-driven, opportunity-driven, innovation-oriented, and growth-oriented entrepreneurship (11.5, 7, 7, and 6%, respectively). In unreported graphs (available upon request), we plotted "caterpillar" graphs, which showed significant country-level variance for each type of entrepreneurial activity between the countries studied. Statistical comparison of our multilevel models to nested single-level studies showed that the multilevel models provide a better fit to the data (LR test: Chi^2 with 1 $df, p < 0.001$). We adopted multilevel logit regressions with random intercepts in the empirical model to determine the influence of insolvency measures on opportunity- and necessity-driven entrepreneurship (with nascent entrepreneurship as the baseline model). This provided an estimate of individuals' *likelihood* of engaging in either necessity- or opportunity-driven entrepreneurship given specific levels of insolvency procedures in a given country. The models are specified below, and the regression results are shown in Tables 4 and 5.

Level 1 equation: $Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + e_{ij.}$

The level 1 equation predicts the direct effects (or betas) of level 1 predictors on level 1 outcomes, where Y_{ij} is the dependent variable for an individual observation at level 1 (subscript i refers to an individual, subscript j refers to the country to which the individual belongs in the current study). X_{ij} is an individual-level (level 1) predictor. β_{0j} is the intercept of the dependent variable in country j (level 2). β_{1j} is the slope for the relationship in country j between the individual-level predictor and the dependent variable. e_{ij} is the individual-level residual.

Level 2 equations: $\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + u_{0j}$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

The level 2 equations predict the effects (or gammas) of level 2 predictors on level 1 betas as well as on the

Table 3 Correlations of all variables in models

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Necessity- and opportunity-driven entrepreneurship[a]															
1. Necessity-driven entrepreneurs															
2. Opportunity-driven entrepreneurs	−0.03														
3. Insolvency time	0.04	0.01													
4. Insolvency cost	0.01	−0.02	0.39												
5. Insolvency recovery rate	−0.04	−0.01	−0.83	−0.51											
6. Age	−0.01	−0.06	−0.06	−0.04	0.08										
7. Gender	−0.02	−0.07	−0.01	−0.03	0.01	0.01									
8. Education	−0.01	0.06	0.02	−0.13	0.07	−0.12	−0.01								
9. Income	−0.01	0.05	0.02	0.05	−0.06	−0.01	−0.10	0.19							
10. Fear of failure	−0.02	−0.09	0.002	0.09	−0.01	−0.02	0.07	−0.04	−0.04						
11. Familiarity ties with entrepreneurs	0.04	0.14	0.07	0.004	−0.06	−0.14	−0.11	0.10	0.11	−0.04					
12. Entrepreneurial knowledge and skills	0.08	0.20	0.03	0.04	−0.03	0.01	−0.15	0.10	0.11	−0.15	0.23				
13. GDP per capita, ppp	−0.05	−0.02	−0.64	−0.51	0.77	0.10	0.01	0.10	0.03	0.01	−0.04	−0.03			
14. GDP growth	0.003	0.04	0.11	0.10	−0.02	−0.05	0.00	0.08	−0.16	−0.01	0.05	0.03	−0.20		
15. Size of population	0.01	−0.02	−0.22	0.20	0.23	0.04	0.004	−0.01	−0.06	0.04	−0.11	0.01	0.07	−0.08	
16. Ease of starting a business	−0.01	0.02	−0.09	−0.59	0.21	0.02	0.04	0.16	−0.02	−0.10	−0.001	−0.02	0.35	−0.19	−0.18
Innovation- and growth-oriented entrepreneurship[b]															
1. Innovation-oriented entrepreneurs product															
2. Growth-oriented entrepreneurs	0.08														
3. Insolvency time	0.16	0.04													
4. Insolvency cost	0.10	−0.04	0.52												
5. Insolvency recovery rate	−0.17	−0.03	−0.87	−0.59											
6. Age	−0.04	−0.01	−0.07	−0.09	0.09										
7. Gender	0.02	−0.09	0.02	0.01	−0.01	0.02									
8. Education	0.04	0.07	−0.03	−0.10	0.08	−0.03	0.00								
9. Income	0.01	0.09	0.04	0.04	−0.09	0.02	−0.10	0.13							
10. Fear of failure	−0.02	−0.05	0.01	0.09	−0.02	−0.01	0.07	−0.03	−0.05						
11. Entrepreneurial knowledge and skills	0.03	0.03	0.00	0.04	0.00	0.02	−0.07	0.04	0.06	−0.15					
12. GDP per capita, ppp	−0.18	−0.02	−0.77	−0.59	0.85	0.10	−0.02	0.11	−0.01	−0.01	0.00				
13. GDP growth	0.03	0.01	0.10	0.15	−0.02	−0.04	0.01	0.05	−0.12	0.01	0.00	−0.13			
14. Size of population	−0.04	−0.03	−0.13	0.16	0.19	0.04	0.03	0.03	−0.11	0.01	0.04	0.09	−0.10		
15. Ease of starting a business	−0.03	0.09	−0.15	−0.56	0.24	0.06	0.01	0.15	−0.03	−0.08	−0.05	0.32	−0.18	−0.16	

[a] Observations, 291,424

[b] Observations, 23,597

level 1 intercept, where γ_{00} is the overall intercept, which is the mean of the intercepts across countries. W_j is the country-level predictor. γ_{01} is the slope or main effect of the country-level predictor. γ_{10} is the slope or main effect of the individual-level predictor. Finally, u_{0j} and u_{1j} are country-level residuals.

Multilevel equation of the current study:

$$\begin{aligned} Y_{ij} = {} & \gamma_{00+}\gamma_{01}\text{ResolveInsovency}_j + \gamma_{02}\text{GDP}_j \\ & + \gamma_{03}\text{GDPGrowth}_j + \gamma_{04}\text{Population}_j \\ & + \gamma_{05}\text{EasedoBusi}_j + \gamma_{10}\text{Education}_j \\ & + \gamma_{20}\text{Income}_{ij} + \gamma_{30}\text{Age}_{ij} + \gamma_{40}\text{Gender}_{ij} \\ & + \gamma_{50}\text{Education}_{ij} + \gamma_{60}\text{FearFail}_{ij} \\ & + \gamma_{70}\text{FamiliarityTies} \\ & + \gamma_{80}\text{EntrepreneurialSkills}_{ij} + u_{0j} + e_{ij} \end{aligned}$$

We also captured the influence of country-level insolvency measures on individuals' likelihood of engaging in innovation- and growth-oriented entrepreneurship using the same model specifications discussed above. However, there might be a sample selection issue at play since entrepreneurs who want to innovate or grow can only be observed for individuals who decided to become an early-stage entrepreneur in the first place. The choice to be an entrepreneur might be influenced by factors that also drive individuals to innovate or to have high aspirations for business growth. In this case, the estimation will be biased unless the selection process is not taken into consideration (Heckman 1979). For the first stage, we used Heckman two-stage regressions with multilevel probit models to estimate the probability that an individual will be involved in early-stage entrepreneurship. For the second stage, we used multilevel logit models to estimate the probability that an individual will engage in innovation- or growth-oriented entrepreneurship given specific levels of insolvency procedures in a given country.

The first-stage regression estimated the probability that an individual will engage in early-stage entrepreneurial activity assuming that the self-selection process is influenced by both individual-level and country-level variables. The regression modeled as a function of individuals' gender, age, education, household income, fear of failure, familiarity ties with other entrepreneurs, and entrepreneurial knowledge and skills and country-level GDP per capita, GDP growth, population size, and ease of doing business. In the selection model, we needed to include one variable that drives entrepreneurial entry but does not affect ventures' innovation or growth aspirations and then exclude this variable from the outcome model to ensure the model can be identified without bias. Familiarity ties with other entrepreneurs have been shown to influence one's chance of becoming an entrepreneur (De Soto 2000; Licht and Siegel 2006; Nanda and Sorensen 2010); however, there has been no theoretical or empirical evidence showing they influence new firms' innovation or growth aspirations. Therefore, we included familiarity ties with other entrepreneurs in the selection model. The regression results are shown in Table 6.

Outcome model:

$$\begin{aligned} Y_{ij} = {} & \gamma_{00+}\gamma_{01}\text{ResolveInsovency}_j + \gamma_{02}\text{GDP}_j \\ & + \gamma_{03}\text{GDPGrowth}_j + \gamma_{04}\text{Population}_j \\ & + \gamma_{05}\text{EasedoBusi}_j + \gamma_{10}\text{Education}_j \\ & + \gamma_{20}\text{Income}_{ij} + \gamma_{30}\text{Age}_{ij} + \gamma_{40}\text{Gender}_{ij} \\ & + \gamma_{50}\text{Education}_{ij} + \gamma_{60}\text{FearFail}_{ij} \\ & + +\gamma_{70}\text{EntrepreneurialSkills}_{ij} + \gamma_{90}\text{imr}_{ij} + u_{0j} \\ & + e_{ij} \end{aligned}$$

In the second stage, we adopted a similar method—multilevel logit regressions—for the outcome model as the one we used to estimate opportunity- and necessity-driven entrepreneurship). Using this method, we estimated the effects of insolvency measures on innovation-oriented and growth-driven entrepreneurship controlling for the inverse Mills ratio computed from the estimation results from the first-stage selection model in addition to controls for age, gender, education, fear of failure, GDP (ppp) per capita, GDP growth, population size, and ease of doing business. The regression results are shown in Tables 7 and 8.

To test hypotheses 2a, 2b, and 2c, which propose that the impact of insolvency measures is stronger for productive entrepreneurship than it is for unproductive entrepreneurship, we needed to compare the effects of three insolvency factors on necessity-driven entrepreneurship with those on opportunity-, innovation-, and growth-driven entrepreneurship. In logistic regressions, as adopted in the current study, traditional tests of

Table 4 Multilevel logit regression on country-level resolving insolvency and individual-level likelihood of engaging in necessity-driven entrepreneurship

Necessity-driven entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Insolvency time (year)			0.917**	−0.001*				
			(0.031)	(0.001)				
Insolvency cost (% of estate)					0.768***	−0.004**		
					(0.060)	(0.001)		
Insolvency recovery rate (cents on the dollar)							1.117	0.002
							(0.099)	(0.001)
Age	0.978	−0.000	0.980	−0.000	0.979	−0.000	0.979	−0.000
	(0.016)	(0.000)	(0.016)	(0.000)	(0.016)	(0.000)	(0.016)	(0.000)
Gender (female = 1)	0.884***	−0.002***	0.882***	−0.002***	0.881***	−0.002***	0.883***	−0.002***
	(0.029)	(0.001)	(0.029)	(0.001)	(0.029)	(0.001)	(0.029)	(0.001)
Education 1 (some secondary)	0.792*	−0.004*	0.805*	−0.003*	0.801*	−0.003*	0.793*	−0.004*
	(0.083)	(0.002)	(0.084)	(0.002)	(0.084)	(0.002)	(0.083)	(0.002)
Education 2 (secondary)	0.808*	−0.003*	0.819****	−0.003****	0.826****	−0.003****	0.810*	−0.003*
	(0.082)	(0.002)	(0.084)	(0.002)	(0.084)	(0.002)	(0.083)	(0.002)
Education 3 (post-secondary)	0.721**	−0.005**	0.736**	−0.005**	0.738**	−0.005**	0.724**	−0.005**
	(0.074)	(0.002)	(0.076)	(0.002)	(0.076)	(0.002)	(0.075)	(0.002)
Education 4 (graduate experience)	0.644***	−0.007***	0.656***	−0.007***	0.656***	−0.006***	0.644***	−0.007***
	(0.070)	(0.002)	(0.072)	(0.002)	(0.072)	(0.002)	(0.070)	(0.002)
Income 1 (middle tier)	0.755***	−0.005***	0.756***	−0.004***	0.755***	−0.004***	0.756***	−0.005***
	(0.029)	(0.001)	(0.029)	(0.001)	(0.029)	(0.001)	(0.029)	(0.001)
Income 2 (top tier)	0.570***	−0.009***	0.568***	−0.009***	0.567***	−0.009***	0.571***	−0.009***
	(0.024)	(0.001)	(0.024)	(0.001)	(0.024)	(0.001)	(0.024)	(0.001)
Fear of failure (yes = 1)	0.862***	−0.002***	0.863***	−0.002***	0.863***	−0.002***	0.862***	−0.002***
	(0.030)	(0.001)	(0.030)	(0.001)	(0.030)	(0.001)	(0.030)	(0.001)
Familiarity ties with entrepreneurs (yes = 1)	1.587***	0.007***	1.585***	0.007***	1.583***	0.007***	1.586***	0.008***
	(0.053)	(0.001)	(0.053)	(0.001)	(0.053)	(0.001)	(0.053)	(0.001)
Entrepreneurial knowledge and skills (yes = 1)	4.671***	0.025***	4.672***	0.024***	4.673***	0.024***	4.671***	0.025***
	(0.210)	(0.003)	(0.210)	(0.003)	(0.210)	(0.004)	(0.210)	(0.004)
GDP per capita, ppp ($)	1.062	0.001	0.987	−0.000	1.048	0.001	1.022	0.000
	(0.075)	(0.001)	(0.073)	(0.001)	(0.085)	(0.001)	(0.080)	(0.001)
GDP growth	0.985	−0.000	0.994	−0.000	0.987	−0.000	0.980	−0.000
	(0.020)	(0.000)	(0.020)	(0.000)	(0.020)	(0.000)	(0.020)	(0.000)
Size of population	1.231*	0.003****	1.220*	0.003****	1.293*	0.004****	1.228*	0.003****
	(0.117)	(0.002)	(0.114)	(0.002)	(0.146)	(0.002)	(0.124)	(0.002)
Ease of starting a business	0.826***	−0.003**	0.862**	−0.002*	0.845**	−0.003*	0.838**	−0.003**
	(0.044)	(0.001)	(0.047)	(0.001)	(0.047)	(0.001)	(0.046)	(0.001)

Table 4 (continued)

Necessity-driven entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Constant	0.010***		0.010***		0.009***		0.010***	
	(0.002)		(0.002)		(0.002)		(0.002)	
Level 2 variance (SD)	0.584***		0.571***		0.692*		0.620**	
	(0.093)		(0.090)		(0.127)		(0.107)	
Observations	291,424	291,424	291,424	291,424	291,424	291,424	291,424	291,424
Number of groups	27		27		27		27	
Log likelihood	−19,560.5		−19,557		−19,553.9		−19,559.6	
Degrees of freedom	15		16		16		16	
Chi^2	1835.07		1842.07		1844.65		1835.93	
Goodness-of-fit LR chi^2 (1)			6.95***		13.12***		1.65	

Standard errors clustered on the country level in parentheses

*$p<0.05$; **$p<0.01$; ***$p<0.001$; ***$p<0.10$

coefficient equality across groups do not work the same way as they do in linear regressions because the dependent variable is scaled differently in each model. In other words, the regression coefficients among different models or groups are not directly comparable. Long (2009) showed that tests of equality for predicted probabilities in such models can be used for group comparisons. Long (2009) also demonstrated that testing the equality of predicted probabilities requires multiple tests since group differences in predictions vary with the levels of the variables in the model.

To facilitate interpretation of economically meaningful effects, we computed average marginal effects (AMEs) for all the independent variables. The effects are now interpreted in the measure of probability rather than as the odds ratio as shown in the models' raw coefficient. For continuous variables, such as insolvency time, cost, and recovery rate in the current study, the AMEs are the instantaneous rate of change for those variables of interest. It is more intuitive and informative to show the predictive margins over a set of values of the variables of interest as the effects of a predictor on the dependent variable in a nonlinear model vary based on the values of all other variables included in the model. We thus calculated the predicted probability of the four groups of entrepreneurship over a set of observed values for insolvency time, cost, and recovery rate and present the results graphically in the results section.

5 Results

Table 1 shows the average value of insolvency measures across 6 years in the 27 OECD countries included in our sample. Chile is the most inefficient country in terms of insolvency time; it takes more than 3 years to resolve insolvency in this country. In comparison, it takes less than 5 months in Ireland. In most countries, insolvent entrepreneurs need about 1 to 2 years to resolve insolvency. Norway has the lowest insolvency recovery cost (1% of estate), whereas Israel has the highest (23% of estate) followed by Italy (22% of estate). Insolvency recovery rate is rather high in Japan and Canada, both of which prescribe that 90 cents on the dollar can be recovered. Turkey and Chile are on the lower end, with less than 30 cents on the dollar recoverable by secured creditors through reorganization, liquidation, or debt-enforcement proceedings.

Table 2 provides the descriptive statistics for all the predictors and controls used. Table 3 shows the correlation matrix for the individual-level variables and country-level controls and predictors. To check for multicollinearity, we computed the variance inflation factors (VIFs) and tolerance values for all variables in our model (available upon request). VIF values greater than 10 or tolerance values less than 0.10 indicate reasons for concern due to collinearity among variables. We found low to moderate VIF values between 1.04 and 4.02, which indicates that the models are not tainted by multicollinearity.

Overall, we find that insolvency measures have strong effects on individuals' likelihood of engaging in various types of entrepreneurship. The results are rather consistent, except for growth-oriented entrepreneurship. As expected, the insolvency time and insolvency cost (percentage of estate) are negatively related to individuals' likelihood of engaging in opportunity-driven, necessity-driven, and innovation-oriented entrepreneurship. The *insolvency recovery rate* has, as expected, a positive effect on opportunity-driven and innovation-oriented entrepreneurship but has no impact on necessity-driven entrepreneurial activities. Marginal effects confirm that the proposed effects are stronger for productive entrepreneurship than for unproductive entrepreneurship.

To our surprise, the effects of insolvency regulations on individuals' likelihood of engaging in growth-oriented entrepreneurship are rather counterintuitive at first glance. Insolvency time has a *marginally positive* effect on growth-oriented entrepreneurship, whereas insolvency recovery rate has a *marginally negative* effect, but it is hardly significant. Insolvency cost shows no impact.

For *necessity-driven entrepreneurship*, insolvency time is negatively related to individuals' likelihood of engaging in necessity-driven entrepreneurship. Specifically, when all other variables are held constant at their observed values, the average marginal effects of a one-unit increase in insolvency time decrease the likelihood that an individual will engage in necessity-driven entrepreneurship by 0.1% (-0.001, $p < 0.05$). We also find that insolvency cost (percent of estate) is negatively associated with the likelihood of engaging in necessity-driven entrepreneurship. Specifically, when all other variables are held constant at their observed values, the average marginal effects of a one-unit increase in insolvency cost decrease the likelihood that an individual will engage in necessity-driven entrepreneurship by 0.4% (-0.004, $p < 0.01$). Insolvency recovery rate has no impact on individuals' likelihood of engaging in necessity-driven entrepreneurship. These effects are described in detail in Table 4.

For *opportunity-driven entrepreneurship*, we find stronger overall effects of the three World Bank insolvency legislation measures compared with necessity-driven entrepreneurship. First, insolvency time is strongly negatively related to individuals' likelihood of engaging in opportunity-driven entrepreneurship. Specifically, when all other variables are held constant at their observed values, the average marginal effects of a 1-unit increase in insolvency time decrease the likelihood that an individual will engage in opportunity-driven entrepreneurship by 0.5% (-0.005, $p < 0.001$). We also find that insolvency cost (percentage of estate) is strongly negatively associated with the likelihood of engaging in opportunity-driven entrepreneurship. Specifically, when all other variables are held constant at their observed values, on average, the marginal effect of a 1-unit increase in insolvency cost decreases the likelihood that an individual will engage in opportunity-driven entrepreneurship by 1% (-0.01, $p < 0.001$). This effect is actually quite substantial. Insolvency recovery rate is strongly positively associated with individuals' likelihood of engaging in opportunity-driven entrepreneurship. A 1-unit increase in insolvency recovery rate will lead to a 1.5% (0.015, $p < 0.001$) increase in the probability that an individual will engage in opportunity-driven entrepreneurship. These effects are described in detail in Table 5.

For *innovative entrepreneurship based on new products*, we find a markedly stronger negative effect for insolvency time (year) and *cost* on individuals' likelihood of engaging in innovation-oriented entrepreneurship. Specifically, when all other variables are held constant at their observed values, the average marginal effect of a 1-unit increase in insolvency time decrease the likelihood that an individual will engage in innovation-oriented entrepreneurship by 12.1% (-0.121, $p < 0.001$), a substantial effect. The variable insolvency cost (% of estate) shows a similarly strong negative impact (-0.12, $p < 0.001$) on the individuals' likelihood of engaging in innovation-oriented entrepreneurship. Insolvency recovery rate is strongly positively associated with individuals' likelihood of engaging in innovation-oriented entrepreneurship. A 1-unit increase in insolvency recovery rate increases the probability that

Table 5 Multilevel logit regression on country-level resolving insolvency and individual-level likelihood of engaging in opportunity-driven entrepreneurship

Opportunity-driven entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Insolvency time (year)			0.914*** (0.018)	− 0.005*** (0.001)				
Insolvency cost (% of estate)					0.825*** (0.037)	− 0.010*** (0.002)		
Insolvency recovery rate (cents on the dollar)							1.310*** (0.057)	0.015*** (0.003)
Age	0.791*** (0.007)	− 0.013*** (0.001)	0.792*** (0.007)	− 0.013*** (0.001)	0.791*** (0.007)	− 0.012*** (0.001)	0.792*** (0.007)	− 0.013*** (0.001)
Gender (female = 1)	0.778*** (0.013)	− 0.014*** (0.001)	0.777*** (0.013)	− 0.014*** (0.001)	0.777*** (0.013)	− 0.013*** (0.001)	0.778*** (0.013)	− 0.014*** (0.001)
Education 1 (some secondary)	1.291** (0.107)	0.014** (0.005)	1.305** (0.108)	0.014** (0.005)	1.294** (0.107)	0.014** (0.004)	1.291** (0.107)	0.014** (0.005)
Education 2 (secondary)	1.335*** (0.109)	0.016*** (0.005)	1.346*** (0.110)	0.016*** (0.005)	1.344*** (0.110)	0.016*** (0.004)	1.335*** (0.109)	0.016*** (0.005)
Education 3 (post-secondary)	1.417*** (0.116)	0.019*** (0.005)	1.439*** (0.118)	0.020*** (0.005)	1.429*** (0.117)	0.019*** (0.004)	1.431*** (0.117)	0.020*** (0.005)
Education 4 (graduate experience)	1.627*** (0.135)	0.026*** (0.005)	1.647*** (0.136)	0.027*** (0.005)	1.635*** (0.135)	0.026*** (0.005)	1.623*** (0.134)	0.027*** (0.005)
Income 1 (middle tier)	1.141*** (0.024)	0.007*** (0.001)	1.144*** (0.024)	0.007*** (0.001)	1.143*** (0.024)	0.007*** (0.001)	1.149*** (0.025)	0.008*** (0.001)
Income 2 (top tier)	1.287*** (0.027)	0.014*** (0.001)	1.284*** (0.027)	0.013*** (0.001)	1.286*** (0.027)	0.013*** (0.001)	1.292*** (0.027)	0.014*** (0.001)
Fear of failure (yes = 1)	0.580*** (0.011)	− 0.030*** (0.002)	0.581*** (0.011)	− 0.029*** (0.002)	0.581*** (0.011)	− 0.029*** (0.002)	0.581*** (0.011)	− 0.030*** (0.002)
Familiarity ties with entrepreneurs (yes = 1)	1.996*** (0.034)	0.038*** (0.003)	1.995*** (0.034)	0.037*** (0.003)	1.995*** (0.034)	0.036*** (0.002)	1.994*** (0.034)	0.038*** (0.003)
Entrepreneurial knowledge and skills (yes = 1)	7.075*** (0.181)	0.106*** (0.007)	7.077*** (0.181)	0.105*** (0.007)	7.078*** (0.181)	0.103*** (0.007)	7.074*** (0.181)	0.109*** (0.007)
GDP per capita, ppp ($)	1.029 (0.038)	0.002 (0.002)	0.975 (0.037)	− 0.001 (0.002)	1.004 (0.036)	0.000 (0.002)	0.943 (0.036)	− 0.003 (0.002)
GDP growth	1.148*** (0.012)	0.007*** (0.001)	1.157*** (0.012)	0.008*** (0.001)	1.148*** (0.012)	0.007*** (0.001)	1.134*** (0.012)	0.007*** (0.001)
Size of population	0.883**** (0.063)	− 0.007**** (0.004)	0.883**** (0.060)	− 0.007**** (0.004)	0.922 (0.060)	− 0.004 (0.003)	0.889**** (0.056)	− 0.007**** (0.003)
Ease of starting a business	0.914** (0.025)	− 0.005** (0.002)	0.943* (0.026)	− 0.003* (0.002)	0.930** (0.026)	− 0.004* (0.002)	0.945* (0.026)	− 0.003* (0.002)

Table 5 (continued)

Opportunity-driven entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Constant	0.011*** (0.001)		0.011*** (0.001)		0.011*** (0.001)		0.012*** (0.001)	
Level-2 variance (SD)	0.441*** (0.064)		0.416*** (0.061)		0.398*** (0.058)		0.393*** (0.057)	
Observations	291,424	291,424	291,424	291,424	291,424	291,424	291,424	291,424
Number of groups	27		27		27		27	
Log likelihood	−58,349.5		−58,338.9		−58,340.5		−58,330.2	
Degrees of freedom	15		16		16		16	
Chi2	12,360.25		1032.96		12,375.96		12,390.13	
Goodness-of-fit LR chi^2 (1)			21.34***		18.03***		38.73***	

Note: Standard errors clustered on the country level in parentheses
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.10$

an individual will engage in innovation-oriented entrepreneurship by 18.6% (0.186, $p < 0.001$). These effects are described in detail in Table 7.

For growth-oriented entrepreneurship, we find somewhat differing effects compared with the first three types of entrepreneurship. First, insolvency time has a small and weak positive impact on the individual-level entry of growth-oriented entrepreneurs. When all other variables are held constant at their observed values, the average marginal effects of a 1-unit increase in insolvency time increase the likelihood that an individual will engage in growth-oriented entrepreneurship by 0.7% (0.01, $p < 0.1$). Insolvency cost has no impact on the likelihood of engaging in growth-oriented entrepreneurship. However, insolvency recovery rate is weakly negatively associated with individuals' likelihood of engaging in growth-oriented entrepreneurship. A 1-unit increase in insolvency recovery rate will reduce the probability that an individual will engage in growth-oriented

Table 6 Multilevel probit regression on individual-level likelihood of engaging in early-stage entrepreneurship (selection model)

Early-stage entrepreneurship	
Age	−0.008*** (0.000)
Gender (female = 1)	−0.115*** (0.008)
Education 1 (some secondary)	0.032 (0.032)
Education 2 (secondary)	0.043 (0.032)
Education 3 (post-secondary)	0.057**** (0.032)
Education 4 (graduate experience)	0.116*** (0.032)
Income 1 (middle tier)	0.022* (0.010)
Income 2 (top tier)	0.052*** (0.010)
Fear of failure (yes = 1)	−0.236*** (0.008)
Familiarity ties with entrepreneurs (yes = 1)	0.349*** (0.008)
Entrepreneurial knowledge and skills (yes = 1)	0.890*** (0.009)
GDP per capita, ppp ($)	0.126**** (0.069)
GDP growth	0.023*** (0.002)
Size of population	−0.030 (0.030)
Ease of starting a business	−0.004** (0.001)
Constant	−2.196** (0.835)
Level-2 variance (SD)	0.051*** (0.015)
Observations	291,424
Number of groups	27
Log likelihood	−70,045.322

Note: Standard errors clustered on the country level in parentheses
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.10$

Table 7 Multilevel logit regression on country-level resolving insolvency and individual-level likelihood of engaging in innovation-oriented entrepreneurship (outcome model)

Innovation-oriented entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Inverse Mills ratio	2.256*** (0.230)	0.193*** (0.024)	2.244*** (0.229)	0.183*** (0.023)	2.238*** (0.228)	0.166*** (0.022)	2.241*** (0.228)	0.150*** (0.024)
Insolvency time (year)			0.586*** (0.024)	− 0.121*** (0.009)				
Insolvency cost (% of estate)					0.558*** (0.054)	− 0.120*** (0.017)		
Insolvency recovery rate (cents on the dollar)							2.705*** (0.316)	0.186*** (0.023)
Age	1.027**** (0.017)	0.006**** (0.004)	1.031**** (0.017)	0.007**** (0.004)	1.028**** (0.017)	0.006**** (0.003)	1.030**** (0.017)	0.005**** (0.003)
Gender (female = 1)	1.149*** (0.035)	0.033*** (0.007)	1.145*** (0.035)	0.031*** (0.007)	1.143*** (0.035)	0.028*** (0.006)	1.147*** (0.035)	0.026*** (0.006)
Education 1 (some secondary)	0.955 (0.126)	− 0.011 (0.031)	1.058 (0.146)	0.013 (0.031)	0.993 (0.133)	− 0.001 (0.028)	0.999 (0.135)	− 0.000 (0.025)
Education 2 (secondary)	0.988 (0.129)	− 0.003 (0.031)	1.078 (0.146)	0.017 (0.031)	1.037 (0.137)	0.008 (0.027)	1.024 (0.136)	0.004 (0.025)
Education 3 (post-secondary)	1.102 (0.144)	0.023 (0.031)	1.250**** (0.170)	0.050**** (0.031)	1.165 (0.153)	0.031 (0.027)	1.179 (0.157)	0.031 (0.025)
Education 4 (graduate experience)	1.270**** (0.169)	0.057**** (0.031)	1.413* (0.195)	0.078* (0.031)	1.339* (0.179)	0.060* (0.028)	1.331* (0.180)	0.053* (0.026)
Income 1 (middle tier)	0.948 (0.034)	− 0.013 (0.009)	0.962 (0.035)	− 0.009 (0.008)	0.943 (0.034)	− 0.012 (0.007)	0.956 (0.035)	− 0.008 (0.007)
Income 2 (top tier)	0.886*** (0.032)	− 0.029*** (0.009)	0.878*** (0.032)	− 0.029*** (0.008)	0.875*** (0.032)	− 0.028*** (0.007)	0.883*** (0.032)	− 0.023** (0.007)
Fear of failure (yes = 1)	1.089* (0.041)	0.020* (0.009)	1.091* (0.041)	0.020* (0.009)	1.086* (0.041)	0.017* (0.008)	1.088* (0.041)	0.016* (0.007)
Entrepreneurial knowledge and skills		− 0.114*** (0.022)	0.624*** (0.058)	− 0.107*** (0.021)	0.624*** (0.057)	− 0.097*** (0.019)	0.625*** (0.058)	− 0.088*** (0.019)
GDP per capita, ppp ($)	0.619*** (0.057)	0.091*** (0.021)	1.158**** (0.103)	0.033**** (0.020)	1.682*** (0.155)	0.107*** (0.018)	1.405*** (0.125)	0.063*** (0.017)
GDP growth	1.470*** (0.137)	0.001 (0.004)	1.045* (0.019)	0.010* (0.004)	1.012 (0.018)	0.002 (0.004)	0.982 (0.018)	− 0.003 (0.003)
Size of population	1.003 (0.018)	0.046 (0.034)	1.194 (0.220)	0.040 (0.041)	1.346 (0.328)	0.061 (0.049)	1.343 (0.406)	0.055 (0.053)
Ease of starting a business	1.212 (0.177)	− 0.010 (0.012)	1.081 (0.055)	0.018 (0.011)	0.937 (0.048)	− 0.013 (0.010)	0.967 (0.049)	− 0.006 (0.009)

Table 7 (continued)

Innovation-oriented entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Constant	0.959 (0.049)		3.522*** (1.206)		3.537** (1.371)		4.403*** (1.932)	
Level-2 variance (SD)	4.084*** (1.281)		1.047 (0.159)		1.391* (0.233)		1.730*** (0.271)	
Observations	0.821		23,597	23,597	23,597	23,597	23,597	23,597
Number of groups	(0.140)		27		27		27	
Log likelihood	− 15,501.2		− 15,418.9		− 15,482.6		− 15,463.4	
Degrees of freedom	15		16		16		16	
Chi^2	218.72		382.13		257.57		297.94	
Goodness-of-fit LR chi^2 (1)			164.49***		37.16***		75.57***	

Note: Standard errors clustered on the country level in parentheses

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.10$

entrepreneurship by 1.3% (− 0.013, $p < 0.1$). These effects are described in detail in Table 8.

We plotted and compared the predicted probability of insolvency measures on productive and unproductive entrepreneurial activities across a set of values for the insolvency measures to show differences in the impact of these measures on the four types of entrepreneurship. We decided to remove these figures as there was no dramatic deviation in the predicted probabilities of the predictors from the mean value of the marginal effects. The average marginal effect reflects the true relationship between the predictors and the outcome variables. The figures are available upon request.

6 Discussion and conclusions

The Flash Eurobarometer Entrepreneurship Survey (European Commission 2004) suggested that the risk of bankruptcy is one of the most significant reasons that individuals choose not to engage in entrepreneurship. However, the perceived risk of bankruptcy differs significantly across nations. In this paper, we presented a comparative study on the association between insolvency regulations and individuals' likelihood of engaging in entrepreneurship in 27 countries. We recognized the heterogeneity of entrepreneurship, distinguished between unproductive and productive entrepreneurial activities, and conducted a multilevel analysis of the relationship between three different measures of resolving insolvency from the World Bank (2004–2009) and four different measures of entrepreneurship from the GEM (i.e., opportunity-, necessity-, innovation-, and growth-driven entrepreneurship).

Our analyses show that reducing "barriers to failure" may indeed stimulate entrepreneurship but to a different extent depending on the nature of the entrepreneurship undertaken. However, the effects of our three World Bank insolvency legislation measures differ across the estimates obtained. The World Bank measures of insolvency time, insolvency cost (percentage of estate), and recovery rate showed expected influences on opportunity-, necessity-, and innovation-oriented entrepreneurship. Time and cost are negatively associated with entrepreneurship, whereas recovery rate is positively related to entrepreneurship. Further, the effect is markedly stronger for opportunity- and innovation-oriented entrepreneurship than it is for necessity-driven entrepreneurship.

Table 8 Multilevel logit regression on country-level resolving insolvency and individual-level likelihood of engaging in growth-oriented entrepreneurship (outcome model)

Growth-oriented entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
Inverse Mills ratio	3.981*** (0.725)	0.114*** (0.017)	3.986*** (0.725)	0.115*** (0.017)	3.980*** (0.724)	0.114*** (0.017)	3.982*** (0.725)	0.113*** (0.016)
Insolvency time (year)			1.093**** (0.054)	0.007**** (0.004)				
Insolvency cost (% of estate)					0.995 (0.073)	−0.000 (0.006)		
Insolvency recovery rate (cents on the dollar)							0.851**** (0.073)	−0.013**** (0.007)
Age	1.076** (0.030)	0.006** (0.002)	1.075** (0.030)	0.006** (0.002)	1.076** (0.030)	0.006** (0.002)	1.075** (0.030)	0.006** (0.002)
Gender (female = 1)	0.617*** (0.034)	−0.040*** (0.005)	0.618*** (0.034)	−0.040*** (0.005)	0.617*** (0.034)	−0.040*** (0.005)	0.617*** (0.034)	−0.040*** (0.005)
Education 1 (some secondary)	1.415 (0.384)	0.029 (0.022)	1.395 (0.379)	0.028 (0.023)	1.415 (0.384)	0.029 (0.022)	1.424 (0.386)	0.029 (0.022)
Education 2 (secondary)	1.468 (0.392)	0.032 (0.022)	1.449 (0.387)	0.031 (0.022)	1.468 (0.392)	0.032 (0.022)	1.471 (0.393)	0.032 (0.022)
Education 3 (post-secondary)	1.585**** (0.423)	0.038**** (0.022)	1.555**** (0.415)	0.037**** (0.022)	1.585**** (0.423)	0.038**** (0.022)	1.581**** (0.421)	0.038**** (0.022)
Education 4 (graduate experience)	1.917* (0.516)	0.054* (0.022)	1.883* (0.507)	0.052* (0.023)	1.917* (0.516)	0.054* (0.022)	1.931* (0.519)	0.054* (0.022)
Income 1 (middle tier)	1.047 (0.071)	0.004 (0.006)	1.041 (0.070)	0.003 (0.006)	1.048 (0.071)	0.004 (0.006)	1.038 (0.070)	0.003 (0.006)
Income 2 (top tier)	1.775*** (0.110)	0.047*** (0.006)	1.777*** (0.111)	0.048*** (0.006)	1.775*** (0.111)	0.047*** (0.006)	1.763*** (0.110)	0.047*** (0.006)
Fear of failure (yes = 1)	0.996 (0.069)	−0.000 (0.006)	0.996 (0.069)	−0.000 (0.006)	0.996 (0.069)	−0.000 (0.006)	0.995 (0.069)	−0.000 (0.006)
Entrepreneurial knowledge and skills (yes = 1)	0.406*** (0.066)	−0.074*** (0.014)	0.405*** (0.066)	−0.075*** (0.014)	0.406*** (0.066)	−0.074*** (0.014)	0.405*** (0.066)	−0.074*** (0.014)
GDP per capita, ppp ($)	0.813** (0.057)	−0.017** (0.006)	0.861**** (0.066)	−0.012**** (0.006)	0.811** (0.063)	−0.017** (0.006)	0.904 (0.080)	−0.008 (0.007)
GDP growth	1.008 (0.028)	0.001 (0.002)	1.001 (0.028)	0.000 (0.002)	1.008 (0.028)	0.001 (0.002)	1.016 (0.029)	0.001 (0.002)
Size of population	1.072 (0.079)	0.006 (0.006)	1.075 (0.078)	0.006 (0.006)	1.073 (0.079)	0.006 (0.006)	1.083 (0.077)	0.007 (0.006)
Ease of starting a business	1.408*** (0.095)	0.028*** (0.006)	1.381*** (0.094)	0.027*** (0.006)	1.409*** (0.096)	0.028*** (0.006)	1.388*** (0.093)	0.027*** (0.005)
Constant								

Table 8 (continued)

Growth-oriented entrepreneurs	M0	Average marginal effect	M1	Average marginal effect	M2	Average marginal effect	M3	Average marginal effect
	1.765 (0.875)		1.811 (0.897)		1.762 (0.875)		1.763 (0.873)	
Level-2 variance (SD)	0.375*** (0.068)		0.370*** (0.066)		0.375*** (0.068)		0.363*** (0.066)	
Observations	23,597	23,597	23,597	23,597	23,597	23,597	23,597	23,597
Number of groups	27		27		27		27	
Log likelihood	− 7032.3		− 7030.7		− 7032.3		− 7030.5	
Degrees of freedom	15		16		16		16	
Chi^2	554.60		557.90		554.61		558.1	
Goodness-of-fit LR chi^2 (1)			3.13****		0.01		3.52****	

Note: Standard errors clustered on the country level in parentheses

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ****$p < 0.10$

Conversely, the impact of the measures on growth-oriented entrepreneurship was rather surprising. Insolvency time is weakly positively related to growth-oriented entrepreneurship, whereas insolvency recovery rate has weak negative effects. One possible reason for these divergent results for growth-oriented entrepreneurship could be that growth-oriented entrepreneurship in the GEM is measured using the forecasted number of employees, not financial measures, such as turnover or profits. Many innovation- and opportunity-driven entrepreneurs do not envision hiring many employees, but entrepreneurs in personnel-intensive but low-risk businesses, such as retail or personal services, may foresee hiring more people (Delmar and Wiklund 2008). Opportunity- and innovation-oriented entrepreneurship tend to involve higher risks of failure compared with growth-oriented entrepreneurship since the former involve higher market uncertainty as they seek to turn new ideas into marketable products and services (Low and Weiler 2012). For growth-oriented entrepreneurship, on the other hand, market uncertainty is generally lower since most entrepreneurs in this category expect to employ at least five employees within a five-year period.

Related findings were corroborated in a recent study by Estrin et al. (2016), who analyzed how specific components of bankruptcy laws affect the risk perceptions of 255,275 potential entrepreneurs in 15 OECD countries using a subset of the data employed in the current paper. The authors' found that elements of personal and corporate bankruptcy law that negatively affect growth-oriented entrepreneurship were those elements that leave debtors with less protection over their assets and decision rights during and after bankruptcy. This finding offers an explanation as to why insolvency legislation in general may impact opportunity- and innovation-oriented entrepreneurship differently than growth-oriented entrepreneurship. To close a business with ease or have a "fresh start" is thus arguably more relevant and inviting for opportunity- and innovation-oriented entrepreneurship than for growth-oriented entrepreneurship (Ayotte 2007). For entrepreneurs who primarily aspire to achieve rapid employment growth, other institutional mechanisms beyond insolvency legislation appear to be more important (Estrin et al. 2013).

These findings suggest that insolvency legislation is indeed related to entrepreneurial activities at the individual level, and these impacts differ in both nature and magnitude for productive and unproductive entrepreneurship. Our results contribute to research by showing

that entrepreneurship is heterogeneous and is affected by institutional constraints, specifically insolvency laws, in different ways (Lee et al. 2011; Estrin et al. 2016).

Our analyses suggest that while reducing barriers to failure can stimulate opportunity- and innovation-oriented entrepreneurship, it does not necessarily affect growth-oriented entrepreneurship undertaken by entrepreneurs seeking to expand organically by hiring others. These findings support and extend findings from the quasi-natural experimental study by Eberhart et al. (2016) in Japan by suggesting that more forgiving insolvency rules and regulations do in fact encourage *better* not just *more* entrepreneurship.

Overall, the analyses in this paper provide authorities food for thought, suggesting they consider balanced insolvency laws and regulations that take the societal costs of entrepreneurial failure into account. Compared with the null hypothesis of no changes in legislation, or the costs and benefits of alternative changes in rules and regulations related to entrepreneurship, considering more moderate insolvency rules and regulations does in fact encourage more productive—not just more—entrepreneurship.

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Compliance with ethical standards

Disclaimer All errors are ours alone.

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