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Start-up Costs, Taxes and Innovative Entrepreneurship

Pourya Darnihamedani[1]
Joern Hendrich Block[3]
Jolanda Hessels[1,2]
Aram Simonyan[4]

[1] *Erasmus School of Economics, Erasmus University Rotterdam, the Netherlands;*
[2] *Tinbergen Institute, the Netherlands;*
[3] *University of Trier, Trier, Germany;*
[4] *National Academy of Science of the Republic of Armenia, Yerevan, Republic of Armenia.*

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The Netherlands
Tel.: +31(0)20 525 8579

Start-up costs, taxes and innovative entrepreneurship

Pourya Darnihamedani [a], Joern Hendrich Block [a,b], Jolanda Hessels [a,d], Aram Simonyan [c]

[a] Erasmus School of Economics, Erasmus University Rotterdam, Rotterdam, The Netherlands

[b] School of Business, University of Trier, Trier, Germany

[c] National Academy of Science of the Republic of Armenia, Yerevan, Republic of Armenia

[d] Tinbergen Institute, Rotterdam, The Netherlands

Abstract: Prior research suggests that start-up costs and taxes negatively influence entry into entrepreneurship. Yet, no distinction is made regarding the type of entrepreneurship, particularly innovative versus non-innovative entrepreneurship. Start-up costs, being one-off costs, may reduce the entry of entrepreneurs whose ideas are not very promising, thus increasing the proportion of innovative entrepreneurs. Taxes, being recurring costs, may reduce the "prize" of innovation and the profit from entrepreneurship, discouraging individuals with innovative business ideas from becoming entrepreneurs. Analyzing a dataset of 632,116 individuals, including 43,223 entrepreneurs from 53 countries, we can confirm our main predictions. Our paper contributes to the discussion on how governmental regulation costs and taxes influence innovative entrepreneurship and technological development.

Keywords: Innovative entrepreneurship, corporate taxes, personal income taxes, start-up costs, entrepreneurial profit

JEL-classification: H24, H25, L26, L51, O31

Correspondence: Pourya Darnihamedani, darnihamedani@ese.eur.nl

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Introduction

Firms' (and individuals') allocation decisions are responsive to changes in the expected rewards of their efforts (Feldstein, 2002; Blume-Kohout and Sood, 2013). The costs imposed by government regulations influence the relative rewards of different business activities (Atkinson and Stiglitz, 1980; Pizer, 2002). Hence, such costs could also affect what types of entrepreneurs enter the market, e.g., whether entrepreneurs are innovative or not.

Entrepreneurs have to deal with one-off start-up costs, such as notary charges, when setting up their businesses, as well as recurring costs in the form of income and corporate taxes. A number of prior studies have linked start-up costs and taxes to the level of entrepreneurial activity within and across economies (Djankov et al., 2002; Lundstrom and Stevenson, 2002; Gentry and Hubbard, 2000; Braunerhjelm and Eklund, 2014). For example, for a sample of European firms, Klapper et al. (2006) show that high start-up costs hamper the creation of new firms, particularly in sectors that should naturally have high entry rates. Regarding the role of taxes, Cullen and Gordon (2007) find that high tax rates have a negative effect on entrepreneurial entry; their explanation is that high taxes reduce an individual's willingness to take entrepreneurial risks.

In any given country, start-up costs and taxes may not only influence entrepreneurial entry but also the likelihood of innovative entrepreneurship because these costs can change the relative rewards of innovation (Schumpeter, 1934; Baumol, 1990; 2010). Innovative entrepreneurs play an important role in the economy by enhancing competition and providing consumers with new, high quality products or services (Schumpeter, 1934; Da Rin et al., 2006; Baumol, 2010). Thus, from a policy perspective, it is important to understand how governments, through setting the "rules of the game," may stimulate innovative or non-innovative entrepreneurship (Baumol, 1990). Little is known about how start-up costs and taxes influence the type of entrepreneurship. We suggest that

innovative entrepreneurship is affected by both start-up costs and taxes. On the one hand, low start-up costs may lead to the entry of high quality entrepreneurs because lower costs are associated with more dynamic markets and lower levels of corruption (Djankov et al., 2002, De Soto, 1989). On the other hand, low start-up costs (low entry costs) encourage the entry of lower quality entrepreneurs, and hence the pool of entrepreneurs is of higher quality when start-up costs are higher (De Meza and Webb, 1987; Kaplan et al., 2011). This argument is in line with recent studies, such as Monteiro and Assuncao (2012), Branstetter et al. (2013), and Rostam-Afschar (2013), which find that low start-up regulations lead to the entry of low-ability entrepreneurs who are mainly active in low-tech industries (e.g., retailing business). In the same vein, we argue that, as one-off costs, start-up costs impose a selection effect and *increase* the share and likelihood of innovative entrepreneurship in a country. The argument is that, although high start-up costs generally discourage entrepreneurial entry (Klapper et al., 2006), such costs might have a less pronounced negative effect on the entry of innovative entrepreneurs. This is because innovative entrepreneurs expect a high return on their new ventures (Schumpeter, 1934) and therefore may be more willing, compared to non-innovative entrepreneurs, to pay high one-off costs to obtain the legal status to start a firm (Branstetter et al., 2013).

We further argue that taxes, which represent recurring costs that reduce the gains from innovation and entrepreneurial profit, have a deterrent effect and discourage, in particular, risk-taking entrepreneurs with innovative ideas. Innovative entrepreneurs are motivated by the expectation of high returns on their innovative activities in the form of "entrepreneurial profit" (Schumpeter, 1934; Hobsbawm, 1969, p. 40; Baumol et al., 2007). Taxes reduce the expected return on innovation and, thus, we argue that they discourage innovative entrepreneurship. High taxes partially remove the "prize" of introducing a new product to the market, while entrepreneurs

remain responsible and liable when their ideas fail (Gentry and Hubbard, 2000). In addition, high tax rates can reduce entrepreneurs' investment in innovation (Schumpeter, 1934; Henrekson, 2007) due to lower retained earnings (Henrekson and Sanandaji, 2011). For example, for a sample of Swedish individuals, Hansson (2012) found that the severity of the tax system has an adverse influence on the entry of highly educated entrepreneurs.

To investigate how start-up costs and taxes relate to innovative entrepreneurship, we use the Global Entrepreneurship Monitor (GEM) dataset comprising 632,116 individuals, including 43,223 entrepreneurs from 53 countries for the years 2004 to 2011. Our regressions show that the level of start-up costs has a significant positive relationship with innovative entrepreneurship, whereas the level of corporate and personal income tax rates shows a negative relationship. In this way, our study reveals how the type of costs (i.e., one-off entry costs versus recurring taxes) imposed by government regulations can influence the extent of innovative entrepreneurship in a country.

The rest of the paper is structured as follows: First, we use prior literature to discuss how start-up costs and taxes relate to innovative entrepreneurship. Next, we describe our data sources, variables and methods. Subsequently, we present our main results, together with a number of robustness checks. In the final section, we present the main conclusions, implications and limitations of the study.

1. Start-up costs and innovative entrepreneurship

Start-up regulations are procedures and requirements imposed by governments for starting a business. Start-up regulations are established to ensure that new companies meet minimum requirements to provide goods or services to the market (SRI International, 1999). Several prior studies suggest that minimal start-up regulations encourage entrepreneurship (Baumol et al., 2007;

Djankov et al., 2002; Klapper et al., 2006). Djankov et al. (2002) further show that countries in which start-up regulations are most burdensome have high levels of corruption but not better quality public or private goods compared to other countries. However, their suggestion that lowering start-up costs leads to the entry of higher quality entrepreneurs has been challenged by several recent studies (Rostam-Afschar, 2013; Kaplan et al., 2011; Branstetter et al., 2013). For example, for a sample of German individuals, Rostam-Afschar (2013) finds that reducing entry regulations leads to a higher number of untrained workers becoming entrepreneurs. This is mainly because high entry barriers primarily deter such untrained workers from becoming entrepreneurs. Trained workers, with a higher level of human capital, have sufficient means to become entrepreneurs, even if the entry barriers are considerably high (Becker, 1993; Davidsson and Honig, 2003).

We similarly argue that when start-up costs are high, individuals with ideas that are less promising or novel are less inclined than individuals with more promising or novel ideas to become entrepreneurs. This is due to three reasons. First, individuals with promising novel business ideas may be willing to bear high start-up costs because they expect high returns from their ventures and one-off entry costs are not directly linked to the rewards of innovation (Schumpeter, 1934); on the other hand, individuals with less promising and less novel ideas do not expect such high returns, and, therefore, they are not willing to incur such costs. Second, individuals with innovative ideas have good opportunities to attract external financing (e.g., venture capital or business angels' funds) (Desai et al., 2003). Because innovative entrepreneurs usually have better access to capital, they may be more able to incur high start-up costs compared to non-innovative entrepreneurs. Third, able entrepreneurs can signal their higher ability to banks by paying high start-up costs. Hence, innovative ideas may have higher chances to be funded (De Meza and Webb, 1987; 1999).

Otherwise, banks do not know the quality of entrepreneurs' projects due to asymmetric information and the high number of entrepreneurs and may assume because entry is inexpensive, that there are many low-ability entrepreneurs. Our arguments are in line with those of Branstetter et al. (2013), who find for a sample of Portuguese firms that marginal entrepreneurs tend to enter as a consequence of low entry costs. Such entrepreneurs have lower abilities compared to infra-marginal entrepreneurs. Branstetter et al. also find that marginal entrepreneurs usually establish their businesses in low-tech industries (e.g., agriculture, retail sector) where innovation is less likely, rather than in high- or medium-tech industries.

To summarize, we argue that high one-off start-up costs increase the share and likelihood of innovative entrepreneurship in a country.

2. Taxes and innovative entrepreneurship

Through taxes, governments are able to provide public goods (i.e., goods with benefits that cannot be entirely appropriated by market players and yet are needed by society), such as a police force, a legal system, an education system and public infrastructure (La Porta et al., 1999). In addition, taxes can be used to re-distribute income in a society to support low-income citizens (e.g., the unemployed) (Feldstein and Wrobel, 1998; Kaplow and Shavell, 1994). Governments face an important dilemma when making decisions about tax rates. On the one hand, they need to collect sufficient taxes to provide high-quality public goods and services for their citizens. On the other hand, they want to avoid the danger of deterring economic growth by onerous taxation (Lee and Gordon, 2005).

The tax system affects entrepreneurial decisions and can sometimes punish successful ventures more than unsuccessful ones (Gentry and Hubbard, 2000). We argue that taxes, being recurring

costs, can have a deterrent effect with regard to innovative entrepreneurship. There are a number of reasons why this deterrent effect may occur. First, high taxes reduce the "prize" of innovation because taxes usually increase with entrepreneurial profit, sometimes even in a progressive manner. In fact, high taxes re-distribute wealth from successful innovative entrepreneurs to other citizens in society with low or no income (e.g., the unemployed) (Baumol et al., 2007; Gentry and Hubbard, 2000; Holtz-Eakin et al., 1993). The entry of innovative entrepreneurs, as explained, largely depends on their expected returns on innovation. Because taxes will repeatedly take away part of the rewards from innovation, high levels of taxes are expected to discourage individuals with innovative ideas from starting a venture.

Second, high tax rates can have an adverse impact on entrepreneurs' ability to invest in innovation. Prior research has found that one of the main sources of investment capital for entrepreneurs, especially during the early stages of the venture, are retained earnings (Henrekson and Sanandaji, 2011). This is mainly due to the high agency costs of other sources of investment capital. High taxes take away part of the start-up's income that otherwise could be re-invested in innovation. In addition, high taxes may be associated with extensive "safety net programs," such as generous unemployment benefits and universal health insurance (Baumol et al., 2007). A tax-financed welfare system may reduce household savings and may limit entrepreneurial investments and capital accumulation (Kotlikoff, 1995; Fölster, 2002; Baumol et al., 2007), which are important determinants of a country's innovative entrepreneurship (Schumpeter, 1934; Baumol, 2010; Blanchflower and Oswald, 1998). In addition, such "safety net programs" usually point to a culture that does not appreciate and reward (hard) working individuals (Baumol et al., 2007). This could further lead to a lower tendency among entrepreneurs to innovate because innovation requires much effort to arrange a "new combination of means of production" (Schumpeter, 1934, p. 74).

There are two main taxes on entrepreneurs depending on the type of business. In many countries (e.g., the Netherlands and the US), profits are taxed under the corporate tax system when the business is incorporated (e.g., limited liability), while taxes are imposed on individual earnings only when the business is unincorporated (e.g., sole proprietorship) (Bruce and Mohsin, 2006). We contend that both types of taxes have deterrent effects on innovative entrepreneurship due to the above-mentioned reasons.

In sum, we expect a high corporate tax rate, as well as a high personal income tax rate, to reduce the share of and likelihood of innovative entrepreneurship in a country.

3. Data and variables

4.1. Data sources

We use both individual and country level data in our study. Our individual level data are from entrepreneurs who have participated in the Adult Population Survey (APS) of the Global Entrepreneurship Monitor (GEM). The data covers 53 countries for 2004 to 2011. GEM is the largest cross-country study of entrepreneurial activity, aspirations and attitudes (Reynolds et al., 2005). GEM collects data on individuals about different aspects of their entrepreneurial activity, such as the innovativeness of their ventures, as well as their personal start-up motivations, entrepreneurial ambitions and human capital characteristics, which make the GEM data suitable to use in our research.

At the country level, we use the World Bank Doing Business (WBDB) database and the World Competitiveness Yearbook (WCY) for information on start-up costs and taxes. The WBDB database contains several measures of business regulations and their enforcement for 155 countries from 2004 to the present. These measures demonstrate the regulatory expenses and procedures of

undertaking business and have been used in prior research to analyze regulatory influences on the productivity and growth of entrepreneurs (e.g., Levie and Autio, 2011; Dreher and Gassebner, 2013; Braunerhjelm and Eklund, 2014). We use the World Competitiveness Yearbook (WCY) for information about corporate and personal income tax rates, as well as for some control variables (e.g., GDP growth, GDP per capita). WCY includes annual data for 18 years for more than fifty countries that participate in the executive survey conducted by the IMD World Competitiveness Center. Several previous studies have used WCY measures to study the impact of country level factors on entrepreneurship (e.g., Hessels et al., 2008; van Stel et al., 2007).

4.2. Sample

The total GEM sample for 2004-2011 comprises 689,399 18-64 years old individuals including (early-stage and established) entrepreneurs, employees, unemployed individuals, students and retirees. Of these, 57,796 persons are early-stage entrepreneurs (8.4%), i.e., individuals who are setting up their businesses, as well as entrepreneurs who have started their own business in the last 42 months. For the purpose of this study, we focus on whether such early-stage entrepreneurs (which we will label "entrepreneurs") are innovative or not (see also the variables description below).

Table 1 shows the number of individuals and entrepreneurs per country and distinguishes between innovative and non-innovative entrepreneurs.

Table 1 about here

4.3. Variables

Our dependent variable is *innovative entrepreneur*. This variable is measured at the individual level, based on a question in the GEM survey asking entrepreneurs whether they provide a new product or service to the market. The variable is a dummy variable that takes the value 1 when the product or service offered is perceived by the entrepreneur to be *new to customers* and takes the value 0 otherwise.

Our main independent variables are *start-up costs* and *taxes*, which are measured at the country level. Start-up costs reflect the expenses required by law to register a new venture in a country. The second category, taxes, refers to the (logarithm of) corporate and personal income tax rates in a country. Table 2 provides a more detailed overview and description of our independent variables.

Table 2 about here

In addition, we add to the regression model a number of individual and country level control variables that are common determinants of innovative entrepreneurship, according to prior research (Acs and Audretsch, 1987; Koellinger, 2008; Anokhin and Schultze, 2009). At the individual level, the following variables are included: formal education (a dummy variable that indicates whether entrepreneurs have a university education or not), entrepreneurial networks (a dummy variable indicating whether the entrepreneur knows someone personally who started a new business in the last two years or not), perception of entrepreneurial skills (a dummy variable

indicating whether the entrepreneur perceives him- or herself to have relevant skills, knowledge and experience for setting up a business), recent prior entrepreneurship experience (a dummy variable that indicates whether someone quit as an entrepreneur in the past 12 months or not) and established business ownership (a dummy variable that equals one if the respondent owns a business older than 42 months), gender (a dummy variable that equals one for males), as well as age and age squared are included. In addition, "year" and "industry" are added as dummy variables to the regression model. The following industries are included in this research: business services (financial intermediation, real estate, renting and business activities); consumer oriented services (hotels and restaurants, other services); extractive industries (agriculture, fishing, mining and quarrying) and transforming (manufacturing, electricity gas and water, construction, trade and repairs, transports, storage and communication). At the country level, we include GDP growth and the (logarithm of) GDP per capita, which are both taken from the WCY database. After removing missing observations for all our variables, we retain a sample of 632,116 individuals of whom 43,223 are entrepreneurs.

4.4. Method

Given the binary nature of the dependent variable *innovative entrepreneur*, we use various probit regressions. We cluster the individual-level data by countries to avoid underestimation of standard errors and overconfident inferences (Huber and Stanig, 2011). Furthermore, we employ a Heckman probit model because there might be a selection bias when we assess the influence of start-up costs and taxes on the likelihood for entrepreneurs to be innovative. This is mainly because start-up costs and taxes could affect the entry of individuals into entrepreneurship (Djankov et al., 2002; Cullen and Gordon, 2007, Gentry and Hubbard, 2000), in addition to their effect on innovative entrepreneurship. Hence trying to estimate the influence of start-up costs and taxes on

an entrepreneur's likelihood to innovate may lead to biased estimators when such potential selection bias is not taken into account. Heckman correction (probit) models are used to address this methodological issue. Additionally, we have tested for the presence of a selection bias through likelihood ratio tests: The likelihood ratio test of rho (which compares the log likelihoods of the selection plus outcome models with the log likelihood of the probit model with sample selection) displays that a Heckman model is indeed required (Table 4).

The Heckman model has one selection and one outcome equation. The selection equation (the first stage) estimates entry into entrepreneurship, including all the above-mentioned individual and country level predictors. In addition, we add the employment status of individuals (dummy variables indicating whether someone is employed, unemployed, a student or a retiree) to the selection equation. The outcome equation (i.e., the second stage) estimates whether an entrepreneur innovates or not.

The Heckman probit model is similar to other Heckman correction models (Heckman, 1976; 1979; Puhani, 2000) regarding how it corrects for selection bias, except that the outcome dependent variable is a dummy variable and not a metric variable. Hence, we have:

$$Prob(E = 1|Z) = \varphi(Z\gamma) \qquad (1)$$

and

$$E = Z\gamma + u_1 \qquad (2)$$

where E designates entry into entrepreneurship (E=1 if the person is an entrepreneur and 0 otherwise), Z is the vector of predicting variables (e.g., start-up costs, corporate and income tax rates (log), GDP per capita (log), education level of the individual, entrepreneurial networks), γ is

a vector of unknown parameters, φ is the cumulative distribution function of the standard normal distribution and u_1 is the error term. The first stage of the Heckman model yields results that can be used to predict the likelihood of being an entrepreneur for each individual.

The second stage (the outcome model) has the following form:

$$I^* = \varphi(X\beta + u_2) \qquad (3)$$

where I^* represents entrepreneur's likelihood to innovate, X is the vector of predicting variables (e.g., start-up costs, tax rates, education level), β is a vector of unknown parameters and u_2 is the error term.

The model assumes that error terms u_1 and u_2, have normal distributions and are homoscedastic. The error terms are correlated with $corr(u_1, u_2) = \rho$. When standard probit techniques are applied to equation (3), it yields biased results, while the Heckman probit model provides consistent, asymptotically efficient estimates for all parameters in such models (Van de Ven and Van Praag, 1981).

Moreover, as with simple probit models, we cluster standard errors by countries. In the next section, we present the regression results. The main control variables correspond to Braunerhjelm and Eklund (2014) and are added stepwise to avoid multicollinearity concerns.

4. Results

5.1. Descriptive statistics

Before we describe our main results, we present descriptive statistics and correlations for the variables used in our study (Table 3). A total of 18.4% of the entrepreneurs are innovative and introduce new products or services to the market. Forty nine percent (49.0%) of the entrepreneurs have a university education, 3.4% have recent prior entrepreneurship experience and 37.0% have another entrepreneur in their networks. Regarding country-level indicators, on average, it takes 8.6% of a person's average income (measured as GDP per capita) to register a company. In addition, corporate and personal income tax rates are, on average, 27.0% and 31.5%, respectively.

The correlation matrix shows that the correlations between individual-level variables are low. Regarding macro-level variables, we find high correlations between log GDP per capita and start-up costs (correlation is -0.65), as well as between corporate and personal income tax rates (correlation is 0.48). In light of these high correlations, we adopt a stepwise approach in our regression analysis.

Table 3 about here

4.2. Main findings

Table 4 presents the Heckman probit regression results. Concerning start-up costs imposed by the government, we find a significant positive relationship between the required start-up costs and entrepreneurs' likelihood to innovate (Model I in Table 4). Hence, *ceteris paribus*, early-stage entrepreneurs are more likely to innovate when start-up costs are high in a country. We find a marginal effect of 0.1%-point. That is, evaluated at the sample means, a 10%-points increase in start-up costs from the mean leads to an increase in the predicted probability of innovative entrepreneurship of 1%-point — an increase of 9.8% in the likelihood for entrepreneurs in a country to be innovative.

Concerning the role of corporate and personal income tax rates, our results (Model II and Model III in Table 4) show an overall significant negative relationship between both types of taxes and entrepreneurs' likelihood to innovate. We find a marginal effect of -1%-point for the variable corporate tax rate (log). That is, evaluated at the sample mean, a 10%-point decrease in a country's corporate tax rates from the mean leads to an increase in the predicted probability of innovative entrepreneurship of 0.6%-points — an increase of approximately 6% in the probability that entrepreneurs innovate. Moreover, we find a significant marginal effect of -1.7%-points for the variable personal income tax rate (log).

Table 4 about here

4.3. Additional findings

Next to the main predictors, the impact of the control variables on an entrepreneurs' likelihood to innovate is also reported in Table 4. At the country level, GDP growth and log GDP per capita have insignificant associations with entrepreneurs' likelihood to innovate. At the individual level, a high level of formal education, knowing another entrepreneur, prior entrepreneurship experience and (perceived) entrepreneurial skills have significant positive associations with entrepreneurs' propensity to innovate. Among these variables, perception of entrepreneurial skills seems to have the strongest relationship with innovation (a marginal effect of 5.4%-points).

Regarding the selection model and at the country level, only log GDP per capita consistently shows a significant negative relationship with entry into entrepreneurship. Hence, countries with a higher GDP per capita have a lower likelihood of entrepreneurial entry. At the individual level, prior entrepreneurship experience, perception of entrepreneurial skills, having entrepreneurial networks and being male show a significant positive relationship with individuals' likelihood to become an entrepreneur. Being an established business owner and age, however, negatively relate to entry into entrepreneurship.

4.4.Robustness checks

Hierarchical regression

The likelihood ratio test results provided in Table 4 show that a Heckman model is necessary due to the existence of a selection bias. Yet, we also find that when we use simple probit regressions, taking only the sample of entrepreneurs without accounting for selection bias, results are similar to the Heckman regressions. However, these models with clustered standard errors are not specifically designed to analyze hierarchical data (Franzese, 2005; Rabe-Hesketh and Skrondal, 2012). As entrepreneurs are nested in countries, a multi-level regression designed to combine variables from different aggregation levels takes into account possible intra-class correlations, thus reducing the likelihood of type 1 and type 2 errors (Hofmann et al., 2000). Multi-level models estimate the variances of the random effects and use this information to give observations different weights. Thus, multi-level models not only correct the standard errors but also provide better estimations of coefficients. Hence, we also analyze our data employing multi-level logit regressions with random intercepts as a robustness check.

Unlike multi-level models, clustering standard errors does not need to have asymptotics in terms of the number of observations per cluster, (Huber and Stanig, 2011). In addition, it has been argued that clustering standard errors provides model-free standard errors, while multi-level models require a correct model for the structure of variance e.g., standard deviations are constant at each level (Gelman and Hill, 2007). Moreover, multi-level models assume that errors and regressors are uncorrelated at all levels requiring the model to contain all relevant variables. Thus, multi-level modeling imposes more assumptions on the model than using cluster-adjusted standard errors

(Primo et al., 2007; Gelman and Hill, 2007), which is one of the main reasons why we use the multilevel regressions merely as a robustness check.

The multilevel logit regressions show similar results as the Heckman probit regressions (Table 5, columns I, II and III). Using these models, we also find that start-up costs have a significant positive relationship with the probability for entrepreneurs to be innovative and that corporate and income tax rates have a significant negative association with the likelihood of innovative entrepreneurship.

Instrumental variable approach

One limitation of a cross-sectional study of the relation between taxes and entrepreneurship is the possibility of confounding factors (e.g., social security, good quality infrastructure). We try to deal with this possible endogeneity issue by using air transport - measured by (log of) passengers carried including both domestic and international aircraft passengers registered in the country - as instrument for taxes. Air transport depends on several factors such as the location of a country (and airport), transportation infrastructure and the population of a country. Hence, using it as an instrument can help to address the possible endogeneity issue in the relationship of taxes with innovative entrepreneurship.

We argue that air transport is associated with tax rates because countries with a large population, a good location and a decent transportation infrastructure have more passengers and these countries need to have higher tax rates to finance decent public goods (e.g., transportation infrastructure) for citizens. The correlation between the instrument and (corporate and income) tax rates is high since F-statistics, when we regress air transport on tax rates, are above 10 indicating that the instrument is not weak. In addition, and in order to check the validity of the instrument, we use Hansen's J

test which shows that the instrument is valid as it is uncorrelated with the error term of our regression model with innovative entrepreneur as the dependent variable.[1]

We use instrumental variable probit regression analysis clustering the data by countries. Results of the instrumental variable approach are provided in Table 5, columns IV and V. The results confirm our previous finding that tax rates have a significant negative relationship with the likelihood of innovative entrepreneurship in a country.

Table 5 about here

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5. Discussion

Our results support the conclusion that start-up costs and taxes have significant and profound effects on whether nascent entrepreneurs innovate or not. Several prior studies have found that heavy start-up regulations reduce entrepreneurial entry at least in the form of "formal entrepreneurship" (De Soto, 1989; Djankov et al., 2002; Klapper et al., 2006). Based on these studies, a negative relationship between start-up costs and innovative entrepreneurship can be expected due to two main arguments: First, and in line with public choice theory (Stigler, 1971), it could be claimed that entry costs keep out competitors and increase incumbent benefits. While this may be socially inefficient (Djankov et al., 2002), we argue the contrary — that such costs can actually increase the likelihood of entrepreneurs to be innovative because their expected returns

[1] Results of the validity and strength tests of the instrument are available from the corresponding author upon request.

on innovation are less likely to be competed away (Schumpeter, 1934; Gilbert, 2006). Low start-up costs, which make entry relatively easy, can stimulate an excessive entry of non-innovative entrepreneurs (Porter, 1980; Shane and Venkataraman, 2000; Branstetter et al., 2013). When facing high start-up costs, entrepreneurs may be willing to enter only if their ideas are promising and the expected returns on their ideas are high.

A second argument for expecting a negative relationship with innovation is that high entry regulations associate with corruption and bribery, which can subsequently upset innovative entrepreneurial efforts (Djankov et al., 2002; De Soto, 1989; Baumol et al., 2007). This association, however, has recently been challenged after the influential studies of De Soto (1989; 2000) and Djankov et al. (2002), as many countries (including those with higher levels of corruption) have significantly lowered the barriers to new business creation (van Stel et al., 2007; Monteiro and Assuncao, 2012). For instance, Russia has lowered its start-up costs from 13% in 2002 to 5% in 2006 and to 2% in 2012. Given that our database is mostly composed of upper middle- and high-income countries in the years from 2004 to 2011 (Table 1), the above-mentioned link between entry regulations and corruption seems loose and unsupported. Furthermore, recent empirical studies on start-up regulations and entrepreneurship (e.g., Monteiro and Assuncao, 2012; Branstetter et al., 2013) have cast doubts upon the negative associations, suggested by Djankov et al. (2002), between the time and costs required for starting a business and the quality of entrepreneurs in emerging and advanced economies. According to these studies, marginal entrepreneurs decide to register their firms when start-up costs are low (De Meza and Webb, 1999). These marginal entrepreneurs are less able entrepreneurs and less likely to have a promising innovative idea compared to infra-marginal entrepreneurs (Tokman, 1992).

In this study, we find that in more tax-friendly countries, entrepreneurs show a higher propensity to engage in innovation. As we explained earlier, higher rates of corporate and personal income taxes can adversely affect the prize of innovation for entrepreneurs. This argument fits a more general notion in the innovation literature that firms' propensity to engage in innovation is responsive to changes in the expected profitability of their potential products (Gilbert, 2006; Blume-Kohout and Sood, 2013). While onerous taxation can lower the amount of the innovation prize, entrepreneurs tend to credit themselves for their successes (Cullen and Gordon, 2005; Parker, 2009). Hence, entrepreneurs with a tendency to innovate are likely to severely resent governments' efforts to take away part of their earnings (Baumol et al., 2007). In line with our findings, some other studies suggest that a high rate of tax payments on entrepreneurs (e.g., through a progressive tax system) can decrease their willingness to take risks (Gentry and Hubbard, 2000; Cullen and Gordon, 2007).

Moreover, a high tax rate can lower the possibilities for investments in innovation due to lower levels of retained earnings and lower levels of savings (Henrekson and Sanandaji, 2011). In addition, high tax rates reduce the expected (risk-adjusted, after tax) returns on innovative ventures and subsequently decrease venture capital investments in innovative start-ups (Da Rin et al., 2006). Heavy taxation can also have an adverse influence on the inflow of foreign direct investment (Djankov et al., 2010; Desai et al., 2004). Foreign investors normally bring their knowledge, experience and technologies along with their money to the countries they invest in (De Clercq et al., 2008; Baumol et al., 2007). In addition, foreign direct investment may provide the required funding for innovative entrepreneurs, e.g., by buying part of the new venture (Wright et al., 2005).

6. Implications

To date, little scholarly attention has been devoted to the influence of the costs imposed by regulations on innovative entrepreneurship. This suggests that regulations are not considered a source of costs that can take away the "prize" of entrepreneurial innovation. Although studies investigated the influence of institutions and regulations on the level and the type of entrepreneurs (Cullen and Gordon, 2007; Branstetter et al., 2013), it was not clear, particularly at the micro-level, how these regulations influence the relative rewards for innovation. Our goal in this article has been to investigate the effect of some of the most important, yet debated, costs imposed by regulations on entrepreneurs' propensity to innovate. Our focus on starting entrepreneurs is relevant because the type and quality of new actors that enter the market is likely to have implications for a country's overall entrepreneurial or business quality. Our argument is premised on the notion that entrepreneurs innovate mainly to gain above-average profit margins in line with Schumpeter's proposition (1934). In this context, the government can stimulate entrepreneurial innovation by using appropriate business regulations to structure the relative rewards for innovation (Baumol, 1990).

Several policy implications can be derived from our findings. First, the extent to which start-up regulation costs are linked to the expected profit of innovation can influence entrepreneurs' propensity to innovate. As mentioned, innovative entrepreneurs can contribute to economic development through offering new products to the market and through challenging established large corporations in the marketplace (Schumpeter, 1934; Klepper, 1996). The government can stimulate innovative entrepreneurship by tying costs *less directly* to the rewards of innovation. For example, and in line with the suggestion of Baumol et al. (2007), taxes on properties and goods

are preferred to taxes on income and profit if the goal is to promote innovative business activities and growth.

Second, and regarding start-up costs, our results suggest that in spite of a possible negative relationship with the supply of entrepreneurial ventures (Klapper et al., 2006), such costs actually have a significant positive relation with the likelihood of entrepreneurs to be innovative. Hence, this finding suggests that policy-makers should think more carefully about the consequences of having lower start-up costs. Lowering these costs, on the one hand, can increase the rate of entrepreneurship, leading to less unemployment and a more dynamic business environment (Branstetter et al., 2013; Klapper et al., 2006). On the other hand, lowering start-up costs may decrease the likelihood that entrepreneurs will innovate, possibly due to the (excessive) entry of imitative entrepreneurs and lower expected returns on innovation.

Third, if innovative entrepreneurship is indeed an important source of economic growth (Schumpeter, 1934; Da Rin et al., 2006), then our finding that entrepreneurs have a low propensity to innovate in countries with severe tax systems could partly explain why taxes may have a negative influence on economic growth as suggested in prior studies (Lee and Gordon, 2005). While previous studies have pointed to other detrimental effects of high corporate and income tax rates for the economy (Grossman, 1993), policy-makers should also be aware of the adverse consequences of high tax rates for firms' and entrepreneurs' propensity to innovate.

7. Limitations and further research

This study has a number of limitations that should be taken into account. First, using cross-sectional data makes it difficult to establish causal relationships. Although the instrumental variable approach helps to reduce the threat of omitted variable bias, a panel dataset of

entrepreneurs and a major change in tax rates or start-up costs across time constitute the ideal setting to investigate how these macro-level predictors influence entrepreneurs' decisions to engage in innovation. A second limitation concerns our use of a self-reported measure of innovation. Using an objective measure of innovation (e.g., new product sales as a percentage of total sales) would be preferred, although access to such data in a cross-country setting comprising enough observations for each country would be very difficult, if not impossible.

We would like to highlight two main avenues for future studies. First, it would be interesting to investigate the impact of other regulations, such as labor regulations on entrepreneurs' propensity to innovate. High costs imposed by labor regulations, for example, may increase the costs of innovation because innovation is often accompanied with labor adjustments (Scarpetta and Tressel, 2004; Da Rin et al., 2006), while such costs may discourage the entry of entrepreneurs with not so promising ideas. Second, we only look at one type of innovation (product innovation) in this study. Further research could investigate the relationship between taxes and other types of innovation. While our findings suggest that taxes reduce the likelihood of product innovation among entrepreneurs, taxes possibly have a similar, different or no effect on other types of innovation. High tax rates, for example, may stimulate entrepreneurs to buy new machinery and declare it as a cost to avoid paying large amounts of taxes, and hence, this could increase the likelihood of process innovation.

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Tables

Table 1 – Sample of individuals and entrepreneurs by country

Country	Total sample of individuals	Share of entrepreneurs in total sample of individuals	Share of innovative entrepreneurs in total sample of entrepreneurs
Argentina	7,732	13.63%	22.79%
Australia	7,330	9.65%	11.74%
Austria	2,253	7.68%	10.40%
Belgium	12,203	4.77%	14.67%
Brazil	12,041	15.42%	4.94%
Canada	1,202	9.82%	14.41%
Chile	16,817	15.49%	41.78%
China	10,385	19.37%	13.82%
Colombia	18,489	18.21%	23.21%
Croatia	7,213	9.47%	10.40%
Czech republic	1,829	6.56%	10.00%
Denmark	19,317	5.39%	24.24%
Finland	8,820	8.56%	12.45%
France	10,877	3.33%	9.18%
Germany	23,199	7.61%	10.72%
Greece	9,947	8.87%	15.93%
Hong Kong	2,661	8.72%	8.19%
Hungary	11,364	7.60%	5.27%
Iceland	8,997	14.93%	15.79%
India	3,562	13.62%	17.01%
Indonesia	1,432	22.97%	26.14%
Ireland	7,951	9.96%	14.77%
Israel	6,854	7.57%	20.27%
Italy	10,744	4.45%	16.74%
Japan	7,939	5.08%	11.41%
Jordan	3,053	17.95%	33.94%
Kazakhstan	1,315	13.31%	2.86%
Korea	3,751	12.02%	10.20%
Latvia	8,875	8.77%	11.70%
Malaysia	4,349	8.09%	8.16%
Mexico	8,811	8.52%	13.21%
Netherlands	16,158	6.14%	19.22%
New Zealand	1,920	19.38%	13.10%
Norway	9,652	8.20%	11.30%
Peru	8,958	34.29%	28.75%
Philippines	1,715	24.43%	7.88%
Poland	2,053	8.43%	11.48%
Portugal	3,175	8.98%	11.23%
Romania	6,708	3.44%	8.65%
Russia	7,135	2.55%	16.71%
Singapore	7,327	8.75%	15.76%

Slovenia	12,830	6.72%	16.59%
South Africa	8,981	8.90%	23.28%
Spain	163,679	5.96%	17.40%
Sweden	34,579	3.10%	10.15%
Switzerland	9,292	6.60%	14.93%
Taiwan	1,766	8.83%	45.51%
Thailand	5,881	16.44%	14.24%
Turkey	6,111	8.18%	39.08%
UK	95,337	6.98%	11.60%
United Arab Emirates	4,612	10.36%	13.56%
United States	17,648	9.38%	36.40%
Venezuela	2,570	21.09%	9.41%
Total	**689,399**		

Table 2–Description and data sources of the main country level variables

Variable	Description	Source
Start-up costs	The average costs of obtaining legal status to operate a firm which is measured as a percentage of per capita income. It contains all recognizable official expenses such as fees, costs of forms and procedures, photocopies, fiscal stamps, legal and notary charges.	WBDB
Corporate tax rate on profit	Maximum corporate tax rate, calculated on profit before tax	WCY
Personal income tax rate	Maximum personal income tax rate in percent of the individual's income	WCY

Table 3- Descriptive statistics and correlation matrix of the individual and country level variables

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Individual level variables															
1. Product innovation	0.18	0.39													
2. High level of education	0.49	0.50	0.05												
3. Entrepreneurial networks	0.37	0.48	0.01	-0.01											
4. Perceived entrepreneurial skills	0.49	0.50	0.01	-0.06	0.18										
5. Prior entrepreneurship experience	0.03	0.18	0.02	-0.02	0.07	0.06									
6. Established business ownership	0.08	0.28	0.02	0.02	0.04	0.04	0.03								
7. Age	43.23	26.63	0.00	0.05	-0.07	-0.02	-0.01	0.02							
8. Male	0.49	0.50	0.00	0.00	0.10	0.11	0.03	0.04	-0.02						
Country level variables															
9. Start-up costs	8.60	11.00	0.08	-0.05	0.03	-0.01	0.05	0.01	-0.05	-0.02					
10. Corporate tax rate (log)	3.29	0.68	-0.05	-0.03	-0.03	-0.01	-0.03	0.02	0.02	-0.04	0.04				
11. Personal income tax rate (log)	3.44	0.57	-0.07	0.02	-0.05	0.03	-0.08	0.01	0.04	0.02	-0.47	0.48			
12. Air transport (log)	17.13	1.45	-0.07	0.04	-0.08	-0.02	-0.03	0.02	0.06	-0.01	-0.29	0.20	0.38		
13. GDP per capita (log)	10.05	3.58	-0.07	0.14	-0.04	0.04	-0.10	0.02	0.08	0.06	-0.65	-0.07	0.49	0.29	
14. GDP growth	2.64	0.83	0.06	-0.05	0.03	-0.04	0.06	-0.01	-0.04	-0.03	0.32	0.11	-0.26	-0.12	-0.50

Table 4 – Results of the Heckman probit regression analysis of start-up costs and taxes on entrepreneurs' propensity to innovate

	Product innovation (model I)		Selection model	**Product innovation (model II)**		Selection model	**Product innovation Model (III)**		Selection model
Predicted probabilities	0.11			0.10			0.10		
	Marginal effect	t-statistics	t-statistics	Marginal effect	t-statistics	t-statistics	Marginal effect	t-statistics	t-statistics
Country level variables									
Start-up costs	0.001	2.26**	-0.60						
Corporate tax rate (log)				-0.010	-5.37***	-0.73			
Income tax rate (log)							-0.017	-2.01**	-1.23
GDP per capita (log)	-0.002	-0.20	-4.80***	-0.014	-1.53	-4.11***	-0.007	-0.82	-3.95***
GDP growth rate	0.003	1.66*	0.86	0.002	1.17	0.92	0.002	1.47	0.85
Individual level control variables									
High level of education	0.019	4.42***	0.48	0.017	3.99***	0.43	0.018	4.22***	0.33
Entrepreneurial networks	0.013	1.85*	13.50***	0.014	2.09**	13.32***	0.013	1.94*	13.30***
Perceived entrepreneurial skills	0.052	3.10***	23.01***	0.054	3.46***	22.67***	0.054	3.36***	22.43***
Gender (male=1)	0.004	0.47	4.36***	0.004	0.49	4.14***	0.005	0.50	4.01***
Age	-0.001	-0.65	2.35**	-0.001	-0.49	2.34**	-0.001	-0.53	2.39**
Age-square	0.00001	0.47	-3.52***	0.000003	0.31	-3.48***	0.000006	0.33	-3.56***
Established business ownership	0.022	1.21	-6.80***	0.021	1.19	-6.79***	0.023	1.23	-6.79***
Prior entrepreneurship experience	0.022	2.96***	11.63***	0.021	2.96***	11.72***	0.021	2.89***	11.98***
Industry dummies		Yes			Yes			Yes	
Employment status dummies			Yes			Yes			Yes
Year dummies		Yes	Yes		Yes	Yes		Yes	Yes
Constant		-3.56***	-0.24		-1.99**	-0.57		-2.51**	-0.59
Sample size		632,116	43,223		632,116	43,223		632,116	43,223
Number of countries		53			53			53	
Likelihood Ratio test (rho=0)(prob>chi2)		***			***			***	

*** denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%.

Table 5 – robustness check results, multi-level and IV

Estimation method	(I) Multi-level	(II) Multi-level	(III) Multi-level	(IV) IV	(V) IV
Country level variables					
Start-up costs	0.015*** (0.003)				
Corporate tax rate (log)		-0.099*** (0.017)		-0.759** (0.340)	
Income tax rate (log)			-0.181** (0.085)		-0.481** (0.243)
GDP per capita (log)	0.178** (0.070)	-0.098 (0.068)	-0.027 (0.072)	-0.064 (0.045)	0.125 (0.112)
GDP growth rate	0.032*** (0.008)	0.026 (0.023)	0.027 (0.18)	0.021 (0.013)	0.020 (0.015)
Individual level control variables					
High level of education	0.114*** (0.028)	0.151*** (0.054)	0.145*** (0.052)	0.043 (0.047)	0.054 (0.038)
Entrepreneurial networks	0.076*** (0.028)	0.066* (0.035)	0.062* (0.035)	0.005 (0.027)	0.016 (0.022)
Perceived entrepreneurial skills	0.195*** (0.040)	0.274*** (0.069)	0.276*** (0.069)	0.139*** (0.051)	0.156*** (0.047)
Gender (male=1)	0.004 (0.027)	0.004 (0.043)	0.012 (0.044)	-0.32 (0.36)	0.009 (0.026)
Age	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.002)	0.002 (0.002)	-0.001 (0.001)
Age-square	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Established business ownership	0.268*** (0.051)	0.329*** (0.079)	0.325*** (0.071)	0.179*** (0.056)	0.184*** (0.045)
Prior entrepreneurship experience	0.068 (0.043)	0.088* (0.051)	0.089* (0.051)	0.000 (0.063)	0.036 (0.031)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Constant	-4.432*** (0.699)	-1.176 (0.802)	-1.596** (0.759)	1.909 (1.458)	-1.021 (0.632)
Sample size	45,111	45,111	45,111	45,111	45,111

*** denotes significance at 1%; ** denotes significance at 5%; * denotes significance at 10%.