EUROPEAN CENTRAL BANK
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WORKING PAPER SERIES
NO 1078 / AUGUST 2009

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EVIDENCE FROM NEW BUSINESS CREATION

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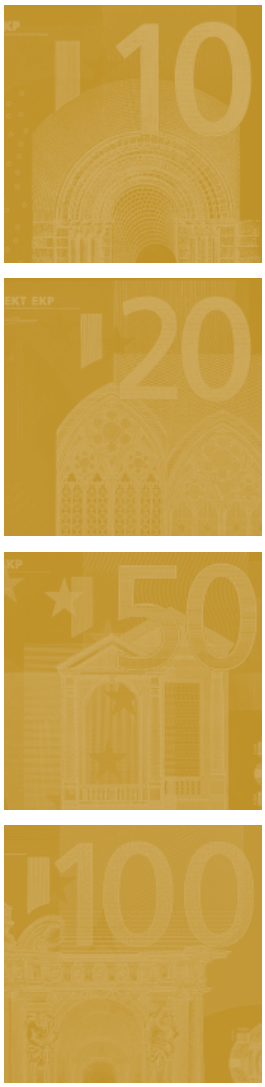

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EVIDENCE FROM NEW BUSINESS CREATION[1]

by Alexander Popov[2]

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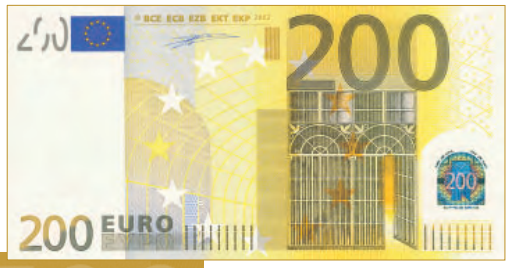

In 2009 all ECB publications feature a motif taken from the €200 banknote.

1 We thank Marco Da Rin, Philipp Hartmann, Ulrich Hege, Florian Heider, Josh Lerner, Simone Manganelli, Marina Martynova, Eric Nowak, Enrico Perotti, Jose Luis Peydro, Richard Rosen, Per Stromberg, Krishnamurthy Subramanian, and Gregory Udell, as well as seminar participants at the ECB, the 18th IT&FA conference, the 2008 EFA meeting, the RICAFE2 third conference, the 11th Symposium on Finance, Banking and Insurance, the 2009 MFA meeting, and the Federal Reserve Bank of Chicago for valuable comments. A special thanks is extended to Luc Laeven for providing us with the Amadeus and D&B data. We also thank Lieven Baert and Kim Bonnema for outstanding research assistance. The opinions expressed herein are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

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ISSN 1725-2806 (online)

CONTENTS

Abstract

Using a comprehensive database of European firms, we study how private equity affects the rate of firm entry. We find that private equity investment benefits new business incorporation, especially in industries with naturally higher entry rates and R&D intensity. A two standard deviation increase in private equity investment explains as much as 5.5% of the variation in entry between high-entry and low-entry industries. We address endogeneity by exploiting data on laws that regulate private equity investments by pension funds. Our results hold when we correct for barriers to entry, general access to credit, protection of intellectual property, and labor regulations.

Keywords: private equity, venture capital, firm entry

JEL Classification: G24, L26, M13

Non-technical summary

Recent years have spurred interest in the role of private equity investment in the financing of small new firms. While banks are often reluctant to finance such firms because of high uncertainty, information asymmetry, and agency costs, private equity investors are specialized to overcome these problems through the use of staged financing, private contracting and active monitoring. These unique features make them more likely to finance early stage and technology companies than banks. This paper investigates the previously unexplored effect that private equity investments have on new business creation in Europe. This question is highly relevant to policy makers given that they often perceive venture capital as an important contributor to the rising leadership of US firms in high technology industries. Hoping to rival this success, the European Union stimulates venture capital investment in an attempt to make Europe a hotbed for entrepreneurship.

Our study contributes to the literature in two main ways. First, although there is a large body of empirical literature looking at the effect of finance on firm entry, the vast majority of it has studied the impact of banks on business formation. While the effect of banking sector development and restructuring on small business formation is certainly important, the effect of private equity investment, especially start-up finance, is probably equally important and largely understudied. Secondly, while academic interest in venture capital has been growing steadily, there is still a remarkably limited research on the effects of private equity and venture capital on the real economy. Several recent studies have argued that venture capital can be credited with stimulating innovation, spurring entrepreneurial spawning, and enhancing productivity growth. However, most of this interest has focused on US evidence. This paper thus provides the first cross-country cross-industry study of the effect of private equity investment on new business creation in Europe, using data from Amadeus on entry and data from the European Venture Capital Association on firm creation. The data also enables us to distinguish between stages and investor types and to include the effects of later stage private equity, like buyout finance.

We first study if private equity investment, aggregated as well as by stage distribution, affects the extent of incorporation, using data on 1998-1999 and on 2006-2007. We aim at identification by following a difference-in-differences methodology based on cross-country cross-industry interaction effects. This approach allows us to bypass the omitted variables problem that has plagued traditional research by controlling for unobservable characteristics of the industries of interest as well as the business environment in the respective country. We find that the rate of incorporation in naturally high-entry and R&D-intensive industries is significantly higher in countries with a larger volume of private equity investment relative to GDP, and this is particularly true for smaller firms.

We conduct extensive robustness tests to correct for endogeneity and for the classic industry- and country-level determinants of new business creation suggested by the literature. While previous studies have show that regulations the firm needs to meet in order to be registered as a limited liability company explain a large portion of this variation, we show that private equity finance is also a very important determinant of firm entry when entry barriers are accounted for. Further accounting for access to finance in general and for other regulatory and legal characteristics of the business

environment leaves the main results unchanged. Finally, we account for the possibility that these results are driven by reverse causality. We use the variation in prudential regulation of the investment behavior of pension funds as an instrument for the supply of PE funds. Our results prove robust to this IV procedure.

This paper serves to shed light on the contribution of private equity investment to firm creation in Europe. We show that VC's contribution to creative destruction in the European context is very tangible, and has an important role alongside regulatory, tax, and labor market reforms in promoting a dynamic EU economy. In that context, a variety of policy initiatives, undertaken in recent years and aimed at promoting an active venture capital industry, are expected to stimulate further Europe's young innovative firms.

1 Introduction

It is generally accepted that access to credit is an important determinant of firm entry and growth (Rajan and Zingales (1998)). However, banks are often reluctant to finance small new firms because of high uncertainty, information asymmetry, and agency costs (Beck et al. (2005)). Private equity investors are specialized to overcome these problems through the use of staged financing, private contracting, and active monitoring (Hellmann (1998); Gompers and Lerner (1999, 2001a); Kaplan and Stromberg (2001)) and are therefore more likely to finance early stage and technology companies than banks. In this paper, we investigate the previously unexplored effect that these private equity investments have on new business creation in Europe. This question is highly relevant to policy makers given that they often perceive venture capital as an important contributor to the rising leadership of US firms in high technology industries (Gompers and Lerner (2001b)). Hoping to rival this success, the European Union stimulates venture capital investment in an attempt to make Europe a hotbed for entrepreneurship (Aernoudt (1999); Gilson (2003)). This paper puts the idea that venture capital fosters new business creation to the test.

Our study makes two key contributions to the literature. First, although there is a large body of empirical literature looking at the effect of finance on firm entry, the vast majority of it has studied the impact of developments in the banking sector on business formation, with mixed results. Petersen and Rajan (1995) show that financial liberalization hurts small young companies because creditors in competitive credit markets find it more difficult to internalize the benefits of assisting those firms. However, Black and Strahan (2002) find evidence that the rate of incorporation increases as a result of banking deregulation, and in a related paper Cetorelli and Strahan (2006) use a measure of bank deregulation to show how average firm size in an industry decreases with bank competition, arguably due to increased entry rates. Regarding general credit market development, Aghion et al. (2007) find that deeper and more developed banking sectors are associated with higher entry of small firms in sectors which are more dependent on external finance. While the effect of banking sector

development and restructuring on small business formation is certainly important, the effect of private equity investment, especially start-up finance, is probably equally important and largely understudied. This paper aims to fill this gap.

The second contribution is that we add to a remarkably limited research on the effects of private equity on the real economy. Kortum and Lerner (2000) show that venture capital investment in the United States is associated with more innovation as measured by patent counts and patent citations. Gompers et al. (2005) examine the propensity of publicly traded firms to create new venture backed firms. They find that younger public firms located in main hubs of venture capital activity are the most likely to create new ventures. Tang and Chyi (2008) find that venture capital investment enhances productivity growth. Regarding new business formation, we are only aware of one study that examines the impact of venture capital at the regional level in the U.S. Mollica and Zingales (2007) report that firm entry and innovation increase in U.S. regions that attract more venture capital. Our paper adds to this literature by providing the first comprehensive cross-country study examining the effect of private equity on firm entry in Europe. Moreover, our European data enables us to distinguish between stages and investor types and does not focus on the effect of venture capital alone but also includes the effects of later stage private equity, like buyout finance.

There are two main mechanisms suggested by the literature via which private equity in general and venture capital in particular should lead to higher rates of business incorporation. First, nascent entrepreneurs may recognize the need for capital in the future and only establish firms when they have reasonably high expectations of obtaining such funding. This implies that not just start-up finance, but later financing stages, like expansion finance, should matter too for firm entry. Second, firms may be engaged in "entrepreneurial spawning", that is, the propensity of former employees of publicly traded firms to start their own companies. There are several competing explanations for that. Christensen (1997) has argued that large, established firms are incapable of adopting radical new technologies because it would disrupt their established way of organizing business. It is also possible that these firms cannot evaluate new disruptive technologies as they fall outside of their line of business

(Stein (2002)). Firms sometimes choose to not adopt new technologies although they can, because this would lead to a decline in the productivity of their existing businesses (Schoar (2002)). In all of those cases, venture capital would be the obvious financing tool for the new firms born out of these technologies. Finally, Gompers et al. (2005) find evidence that entrepreneurial spawning is related to the fact that employees of established firms are trained and conditioned to be entrepreneurs by being exposed to the entrepreneurial process and by working in a network of entrepreneurs and venture capitalists. It needs to be emphasized that in this paper we only examine empirically the effect of private equity on new business creation, rather than studying the exact channels via which this effect works.

The literature has distinguished entry into an industry from firm creation. The first accounts for the migration of firms across industries, while the second emphasizes pure entrepreneurship (de novo firms). We focus on the second approach and define entry as the incorporation of a previously nonexistent firm in the respective industry and country. Our data comes from Amadeus, a comprehensive database of corporations across a number of developed and transition countries in Europe, in combination with country-level data on private equity and venture capital investment in Europe from the European Venture Capital Association (EVCA) yearbooks.

We first study if the volume of private equity investment, aggregated as well as by stage distribution, affects the extent of incorporation, using data on 1998-1999. We aim at identification by following the difference-in-differences methodology first introduced by Rajan and Zingales (1998) and focus on cross-country cross-industry interaction effects. In essence, we study whether the fraction of new incorporation is higher in an industry with higher "natural" entry rates when there is more private equity flowing into the country. This approach allows us to bypass the omitted variables problem that has plagued traditional research by controlling for unobservable characteristics of the industries of interest as well as the business environment in the respective country. We find that the rate of incorporation in naturally high-entry industries is significantly higher in countries with a larger volume of private equity investment relative to GDP, and this is particularly true for smaller firms. The same applies

to industries which are more R&D intensive.

We also look at staging and investor type, distinguishing between VC and buyouts, as well as between independent, captive, semi-captive, and public funds. We find that the effect of venture capital and start-up finance is comparable to the effect of total private equity finance, but that it was stronger in 2006-2007 than it was in 1998-1999. We also find that while cross-country differences in private equity investment by independent funds is both economically and statistically significant, the effect of captive and public funds on new business entry is at best non-existent. While Klapper et al. (2006) show that regulations the firm needs to meet in order to be registered as a limited liability company explain a large portion of this variation, we show that private equity finance is still a very important determinant of firm entry when entry barriers are accounted for.

In a fine-tuning of the basic approach, we account for the possibility that these results are driven by reverse causality, that PE is a proxy for other types of financial development, and that it is a proxy for other characteristics of the business environment. We use the variation in prudential regulation of the investment behavior of pension funds as an instrument for the supply of PE funds. Our results are robust to this IV procedure, as well as to accounting for access to finance in general and for other regulatory and legal characteristics of the business environment.

The paper proceeds as follows. In Section 2 we summarize the data. Section 3 describes the empirical methodology. Section 4 presents the empirical results. Section 5 concludes with the main findings of the paper.

2 Data

2.1 EVCA yearbooks

This paper uses data from two main sources: on new business formation from the firm-level Amadeus database, and on private equity investment from the EVCA yearbooks. The EVCA yearbooks compile annual data on private equity funds raised, funds allotted to

venture capital, and the actual allocation of private equity investment. We use the data for the 1998-1999 period, and in robustness tests for the 2006-2007 period.

Three caveats are in place. First, while the EVCA yearbooks try to be exhaustive in terms of the European countries they cover, in some cases they discontinue their reporting (e.g. Iceland after 2001). In others - notably, the new EU members from Central Europe (Czech Republic, Hungary, Poland and Slovakia) - EVCA only started reporting PE activity in 1998. Finally, for the Baltic and South-East European EU members EVCA has only run pilot projects limited in duration (Bulgaria in 2003 and 2004, Latvia in 2001, Romania 2000-2004, and Slovenia in 2003), or reported private equity investment jointly for several countries (Croatia and Slovenia, as well as Estonia, Latvia and Lithuania in 2005). Understandably, in cases when there were too few years included, or when it was judged impossible to disaggregate reliably the information on private equity, the data was not used. Apart from current EU members, the EVCA yearbooks also include information on Iceland, Norway, and Switzerland.

The second caveat deals with the reporting of investment by US private equity houses. If a deal has been backed by both a US and a European private equity house, the deal is split into two parts. The part of the investment coming from the European private equity firm is allocated to the respective European country, and the part of the investment coming from the US private equity firm is allocated to the US. However, if the US PE firm has no office in Europe, then its investment is not included in the EVCA figures. In addition, concerning US private equity houses investing in Europe, only investments made by those having offices in Europe are taken into consideration. This would imply that if a US PE firm, which has no office in Europe, invests in a European company, the investment would not be included in the EVCA figures. While the vast majority of US private equity houses operate through their European offices, it is still the case that the EVCA data is by construction incomplete.

Finally, while EVCA offers disaggregated data on the allocation of actual private equity investment across industries, it uses its own classification of 17 groups of industries, and it only reports the composition of investment by country of management rather than country

of destination. We first recalculated investment by industry and country of destination assuming the same pattern applies across industries as across aggregate volumes[1]. Next, we used the special translation key provided by the EVCA to translate the EVCA industries into 2-digit NACE rev. 2 and then into 2-digit NACE rev. 1.1 industries in order to be able to match them to the Amadeus database. In some cases the NACE two-digit industries fall under two or more different EVCA industries at the same time, and this double counting was resolved by assigning the 2-digit NACE industry to only one of the two or more EVCA industries interchangeably or dropping those altogether. The final results reported are robust to using different variants of this industry translation key.

Table 1 summarizes the information on total actual private equity investment normalized by GDP, both for the 1998-1999 and the 2006-2007 period. It gives a clear idea of the volatility of private equity investment both in aggregate and in relative terms. For example, total investment has decreased by a magnitude of 2 in the Czech Republic (from 0.042 to 0.023) and by a magnitude of 6.5 in Greece (from 0.027 to 0.004), but it has almost tripled in the UK (from 0.465 to 1.215), quadrupled in Sweden (from 0.2 to 0.82) and increased by a magnitude of 12 in Denmark (from 0.029 to 0.353). It is important to note that our results are robust to these country-level developments.

2.2 Amadeus database

The firm-level data come from the Amadeus database. Amadeus is a commercial pan-European database provided by Bureau van Dijk, containing financial information on over 10 million public and private companies in 38 European countries. It combines data from over 30 specialist regional information providers (IPs). The data is created by collecting standardised annual accounts (for up to 10 years), consolidated and unconsolidated, for approximately 9 million companies throughout Europe, including Central, Eastern, and South-

[1]EVCA reports aggregate PE investment by country of management and country of destination and PE investment in each industry by country of management only. We recalculate industry PE investment by country of destination assuming that the ratio between total and per-industry investment is the same for country of management and for country of destination. For the 2006-2007 wave, however, the disaggregated data come by country of destination.

Eastern Europe. The database contains detailed firm-level accounting data for a number of financial ratios, activities, and ownership. While initially received from over 50 different vendors across Europe, the data is then transformed into a single format enabling comparison across countries. The focus of the Amadeus database is on financial information, like firm profit, revenue, assets, debt, and value added. In addition to that, Amadeus provides firm-level information on year of incorporation and employment. We use the former to calculate the age of the firm, hence the share of "new" firms in each industry-country-year. The variable we create is referred to as $Entry_{ij}$, and it denotes the share of firms less than 2-years old in country i in industry j, calculated separately for 1998-1999 in the main regressions, and for 2006-2007 in the robustness tests. We only count the firms that are at least 1 full year of age to reduce measurement error.

Finally, Amadeus uses the 3-digit NACE industry classification standard, which we aggregate at the 2-digit level in order to have a sufficient number of firms in each industry for each country. Columns 2 and 4 of Table 2 summarize our main Amadeus data, aggregated at the country level, for the two time periods of interest.

One main concern is that the years 1998-1999 chosen for the main empirical exercises may not be "steady state" in terms of new business incorporation as they were too close to the peak of the dot-com bubble. Similar concerns apply to the period 2006-2007 which coincided with the peak of another business cycle. For that reason, we calculated average entry rates over the 1995-2007 period, using data on entry rates from Eurostat, and then compared the long-term averages to data for 1998-1999 and 2006-2007, again from Eurostat. Columns 3 and 5 of Table 2 presents the deviation of the latter from the long-term averages in percentage terms, for 1998-1999 and 2006-2007, respectively. The average deviation for the 1998-1999 sample is 5.9%, and only in three of the countries in the sample is it higher than 7%. This gives us confidence that the years 1998-1999 are pretty much "steady state" in terms of new business creation. The same applies to the second period chosen.[2]

[2]The little overall variation in entry rates is signified by the fact that even the years 2000 and 2001, which coincided with the peak of the internet bubble, show an average deviation of only 8.4% from the sample long-term average.

2.3 US industry-level entry data

As a benchmark for new business incorporation into an industry, we use data on firm entry in the respective NACE rev. 1.1 2-digit industry in the US, from the Dun and Bradstreet database of over 7 million corporations over the period 1998-1999. The methodology of using US industry characteristics as a benchmark in cross-country cross-industry studies was first introduced by Rajan and Zingales (1998), who argued that the composition of US industries in terms of external finance usage can be viewed as the industries' "natural" or "technological" composition, because US financial markets are relatively friction-free, compared with other financial markets around the world, including most industrial countries. The methodology has been used, among others, by Beck et al. (2008) to calculate the "natural" share of small firms in an industry, by Claessens and Laeven (2003) to calculate the industry's "natural" usage of intangibles, and most recently by Klapper et al. (2006) to calculate the "natural" rate of business incorporation, which we use in this paper.

It needs to be pointed out that proxying the "natural" rate of industry entry by entry in the respective industry in the US is somewhat arbitrary. It relies on the assumption that bureaucratic barriers to entry are lower there than in any country in Europe, and that the cost of financial intermediation and start-up financing is sufficiently lower in the US than in Europe as a whole. This technique does not argue that industries in the US have achieved the first best in terms of entry, but that the financial and regulatory environment is relatively more conducive to entry than the countries in our sample. For example, while entry costs in the US are around 0.5% of per capita GNP, in our sample of European countries they are on average around 20%; and while venture capital investment in the US in 1998-1999 was about 0.2% of GDP, it stood at 0.1% of GDP in the UK, 0.05% of GDP in France and 0.02% of GDP in Germany, with these three countries receiving the lion share of the private equity investment in Europe. Certainly, the entry costs in the US are non-zero, and it is impossible to know if the optimal amount of venture capital investment is not much larger than 0.2% of GDP, but what matters is that these characteristics of the US business environment are superior than in the countries in our sample. For robustness purposes, however, similar

to Claessens and Laeven (2003), we replace the US industry characteristics with industry characteristics from other regions in some specifications.

In Table 3, we compare the industry entry rates in the US to an aggregated measure of European entry from the Amadeus-EVCA dataset. In more than half of the industries, entry in the US is at least marginally higher than in Europe as a whole.

2.4 Sample construction

We employ the same sample selection procedure to the Amadeus dataset as Klapper et al. (2006) to see whether the effect of private equity investment survives the inclusion of barriers to entry in a sample where these barriers were already shown to be significant. We initially use the 2001 edition of Amadeus and limit the sample to the years 1998 and 1999. The year 2000 is not used due to some incompleteness of the information in each Amadeus edition concerning the previous year. The years prior to 1998 are not used due to the well-known survivorship problems of the Amadeus database: when a firm ceases existing, Amadeus keeps a record of it for 4 years, and then takes it out of the database. Consequently, while each yearly addition of Amadeus contains data for more than 4 years back, the sample of firms one will find reported for the time-period 4 years and more prior to the year of issuing, will not include many firms who existed in that year, but exited the market after that. Using the data indiscriminately will therefore induce survivorship bias and misrepresent the volume of entry, and so we focus our attention to the years 2 and 3 prior to the year the database was issued. In later robustness tests, in which we use the 2008 edition of Amadeus, we similarly focus our attention on the sample of firms in 2006-2007.

Firms in the final dataset we use are also required to have basic accounting information on the variables we are interested in (year of incorporation, employment, assets, etc.). This approach excludes phantom firms created for tax purposes. We drop firms that report only consolidated statements in order to avoid double-counting firms and subsidiaries abroad. We exclude industries where the activities are country-specific, namely agriculture, forestry, fishing, and mining. We also exclude utilities and post and telecommunications, which

tend to be heavily regulated and/or state-owned, and the financial services sector because, arguably, financial firms are subject to specific regulations which do not apply for other firms (for example, initial capital requirements). Finally, we exclude the public sector, education, the social sector, private households, and activities that cannot be classified. We are left with 37 NACE industries.

At the country level, we exclude the East European and South-East European countries due to insufficient availability of data on investment by private equity, although these countries are covered by Amadeus. The same applies to Luxembourg. Likewise, we exclude Switzerland, which has comprehensive coverage on private equity investment, but its Amadeus coverage is compromised by the fact that small firms are not required to file. Finally, we use Eurostat to confirm to what extent Amadeus is representative of the firm size distribution in the respective country. We then exclude Iceland, Ireland, and Portugal, for which the ratio of employment in firms with more than 250 employees in Amadeus to employment in firms with more than 250 employees in Eurostat is less than 0.5, and/or for which the difference between the share of small firms (10-50 employees) in Amadeus and in Eurostat is more than 0.25. The sample thus reached represents the best match of Amadeus and EVCA data that is possible to construct while avoiding limited coverage, insufficient observations and country-specific industry scope and legal requirements problems. The final sample consists of 2,788,680 firms for 1998-1999 in 16 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Spain, Sweden, and UK. Firm-level information is then aggregated at the industry level and matched with the EVCA data to create a dataset consisting of 571 2-digit NACE rev. 1.1 industry-country data points (37 industries in 16 countries, with 21 data points missing). Due to our sample selection method, we do not use 3 of the 17 EVCA industries (other electronics, financial services, and agriculture).

Table 4 gives the conversion key from the 2-digit NACE rev 1.1 industries into the EVCA industries used in robustness regressions. Note that out of the 37 NACE rev. 1.1 industries, 12 fall exclusively under 1 EVCA class, for 10 more than 70% of the 3-digit subclasses

fall under 1 EVCA class, and for 15 industries there is a clear "winner" (majority of 3-digit classes), but still the possibility of a measurement error remains. In these empirical exercises, we use different ways of matching the industries in the third group to EVCA classes, and we also perform the analysis after excluding them altogether. The reported results are robust to this method.

Our sample selection procedures leaves us with the same sample as in Klapper et al. (2006) in terms of business entry. This allows us to test the effect of private equity on business entry accounting for the effect of entry barriers in a sample in which the effect of entry barriers has already been documented.

3 Empirical methodology

We use a cross-industry cross-country regression as our main empirical model:

$$Entry_{ij} = \beta_0 + \beta_1(EVCA_{i(k)} \cdot Entry_{US}) + \beta_2(X_i \cdot Z_j) + \beta_3 D_i + \beta_4 D_j + \varepsilon_{ij} \qquad (1)$$

where $Entry_{ij}$ denotes the share of firms less than 2-years old in country i in industry j; $EVCA_{(i)k}$ denotes private equity investment in country i, or in EVCA industry class k in country i, normalized by the country's GDP and measured as total volume or disaggregated by stage; $Entry_{US}$ denotes the "natural" industry entry rate, as measured using US data; X_i is a vector of country characteristics; Z_j is a vector of industry characteristics[3]; D_i is a matrix of country dummies; D_j is a matrix of industry dummies; and ε_{ij} is the idiosyncratic error.

This specification has become very popular in the finance and growth literature because it alleviates the small sample problem of cross-country regressions, and it allows for eliminating the effect of unobservables characteristics of the business environment by including country dummies. Industry indicator variables are also included to account for unobservable industry-

[3] We use j to denote NACE Rev. 1.1 industry class and k to denote EVCA industry class as they are not identical, but they can be matched.

specific effects. Critically, we are interested in the magnitude and statistical significance of the estimate of β_1. This interaction term measures the effect of private equity investment on new business incorporation accounting for the industry's "technological" entry rate. Private equity investment is expected to make it easier for firms to enter the market, and that effect is expected to be larger in industries in which there are high "natural" entry rates. Hence, we expect the sign of β_1 to be positive. Note that we are not able to identify the direct effect of PE investment and of the industry's "natural" entry rate, as those are fully captured by the two sets of fixed effects.

It has become regular practice in the literature to account for potential convergence effects (that is, the fact the larger sectors may have naturally lower entry rates) by controlling for the industry share (see, for example, Cetorelli and Strahan (2006) and Beck et al. (2008)). We proxy this by the fraction of industry sales out of total sales in the country as reported in the Amadeus database.

Finally, in the main empirical exercise, we use average data for 1998-1999. Later, for robustness purposes, we perform the same estimation on data from 2006-2007.

4 Results

4.1 Private equity and entry: main results

In Table 5, column (i) we present the basic OLS regression when private equity investment (as reported by EVCA) is aggregated by country of destination. The coefficient on the interaction term is significantly positive, implying that relative entry into industries with naturally higher entry is disproportionately higher in countries with large levels of private equity investment, normalized by GDP. What the coefficient means numerically is the following: let's take a high entry-industry (at the 75th percentile of entry) and a low-entry industry (at the 25th percentile), and let's take two countries which score high (75th percentile) and low on private equity (25th percentile). The two countries in mind are Hungary (low) and Denmark (high), with the difference between the two being 0.859. Then, the estimated

coefficient implies that the difference in entry rates between the high-entry and the low-entry industry are 0.44 percentage points higher in Denmark than in Hungary. Thus, all else equal, an entrepreneur envisioning starting a firm in a high-entry industry is to a larger degree better off by operating in Denmark rather than in Hungary than an entrepreneur who wants to enter a low-entry industry. It is also useful to think of it in terms of the actual variations in entry rates between the 75th percentile and a 25th percentile industry which is 8%. Hence, private equity accounts for 5.5% of that difference.

This simple empirical test shows that first, private equity investment has a real effect through firm creation.[4] Second, the magnitude of increasing private equity investment by two standard deviations in our 16-country sample is about half of the effect of lowering entry barriers by two standard deviations in the 24-country sample used by Klapper et al. (2006).[5] In later tests, we perform horse race regressions to compare the effect of private equity against the effect of barriers to entry, property rights protection, tax burden, and other characteristics of the business environment, and in all cases private equity remains a significant predictor of the variation in cross-country cross-industry entry rates.

In the rest of the columns of Table 5, we test the basic result using different methodologies and sample specifications. In column (ii), we account for left and right censoring by replacing the OLS specification with a Tobit one. The rationale behind this is that entry rates are left-truncated at 0 and right-truncated at 1. The coefficient of the interaction term does not change, however, it becomes statistically significant at the 1% level. Next, we exclude the sub-sample of transition countries (column (iii)). The 1990s were a vibrant period in the economic history of Central Europe in terms of privatization, and we would like to eliminate the possibility that a large number of new private firms are actually old state-owned firms which have been counted only after they became private. Our results are robust to the exclusion of these countries, but the magnitude of the coefficients and the resulting numerical effect decreases slightly. We also look at the effect of private equity on incorporation of small

[4] However, before addressing the endogeneity probelm, we will be using the word "effect" with caution.

[5] Klapper et al. (2006) find that entry barriers explain about 10% of the entry difference between high- and low-entry industries.

firms only (less than 10 employees, column (iv)). The reason for that is that our effect so far could be upward biased by the fact that some of the "new" firms in our sample may in fact be the result of M&A. We find that the difference in small firm entry rates between a high- and a low-entry industry (75th percentile vs. 25th percentile) is 4.6%, and so a coefficient of 0.263 implies that differences in private equity investment explains about 9.5% of the mean difference. We can thus conclude that private equity has a real effect on firm creation, and this effect is strongest for small new firms.

Finally, we replace our variable measuring entry rates with a variable measuring exit rates. Entry and exit are considered complementary in creative destruction theories (Schumpeter (1942); Aghion and Howitt (1992; 1998); Geroski (1995)). We use data from Eurostat on the share of firms who dropped from the sample at time t but were in it at time $t-1$ to proxy for the exit element of the creative destruction hypothesis. The implicit hypothesis being tested is that entry rates are also affected by unobservable variables like entrepreneurial culture and risk attitudes, and so observing an effect of private equity investment on entry rates may overstate the true effect of private equity by having the true effect contaminated by demand considerations. Exit rates are much more likely to be determined by the supply of funds rather than the demand for them; one most likely channel for that effect is that inefficient incumbent firms will leave the population of firms faster under pressure from more efficient PE-backed newcomers. The last column of Table 5 confirms that private equity investment works well along the lines of the theory of creative destruction, with its effect on exits being economically and statistically at least as strong as the measured effect on entry.

4.2 Private equity and entry: contemporaneous vs. long-term effect

There are a number of robustness checks we need to perform on our measure of private equity. First, we have only regressed so far new business entry in 1998-1999 on the contemporaneous measure of private equity investment. Alternatively, we could do so using an average measure

of private equity investment over several years back. Such an approach would make sure that the estimated effects are not biased by a temporary idiosyncratic shock to private equity investment, especially given the degree of fluctuation of investment highlighted in Table 1. It is also conceivable to hypothesize that new entrants pay more attention to the long-term state of the private equity industry rather than to current investment because long-term investment patterns usually convey more information about the future availability of private equity finance. For example, the business registration fees and the initial investment are usually financed with own funds or with financial help from the "three F" (family, friends, and fools), and hence the incentive to start a company which will later be financed with venture capital or expansion money, or outright bought by a private equity investor, is provided by the long-term presence of private equity investors rather than the current state of the market. Indeed, our evidence suggests that the long-term presence of private equity also associated with higher relative entry than contemporaneous one (Table 6). In fact, for both total new firms and new firms with less than 10 employees, the effect of longer-term private equity is even higher, suggesting that it goes beyond the direct affect of actually financing the seed and start-up stages of the firm's life. This is along the lines of the theories outlined in the introduction, with new firms not only being born out of old relationships between venture capital and entrepreneurship, but also from the expectation of getting finance in later stages via expansion financing.

4.3 Alternative measures of propensity to entry

Next, we account for the possibility that our measure of entry is not the best proxy of propensity to entry. Prior literature (e.g. Gerotski (1995)) has suggested that exit rates are a good proxy for propensity to entry because higher firm creation is necessarily associated with higher firm destruction. In the first two columns of Table 7, we use the Dun and Bradsteet data to calculate the average share of exiting firms for 1998-1999, per 2-digit industry. US industry exit rates turn out to be as good proxies for propensity to entry as US entry rates, in the sense that the effect of private equity investment on entry is relatively

higher for industries with higher exit rates, repeating the results of the previous estimation. However, the result only holds when we perform the estimation for the new firms with less than 10 employees only (column (ii)).

We next make use of the fact that new firms are generally small because entry by larger firms may reflect M&A activity. As much as it applies to the rest of the world, it should also apply to our benchmark US case. We therefore replace the original proxy for "natural" entry with a measure of the average industry entry rates over 1998-1999 for small and medium enterprises (SMEs), or firms with less than 250 workers. When we apply that methodology, the estimate of β_1 remains positive, implying relatively higher entry due to private equity investment in industries that have higher entry by SMEs in the US. The estimates are significant at the 5% level. This result holds for entry by new firms in different size classes.

Finally, we use Claessens and Laeven's (2003) insight that it is not necessary to use US data to calculate "natural" industry characteristics, as long as we use benchmark data from a business environment that greatly outperforms the countries in the dataset in terms of business opportunities, finance, and regulations. They show that using UK and Hong Kong data to calculate "natural" intangibles usage yields identical results as when using the US benchmark. We test that prediction by using UK data from Amadeus rather than US one to calculate industry entry rates. This methodology also accounts for the fact that what we assume are "natural" or "technological" entry rates could be driven by peculiarities of the US industry structure. Using a UK benchmark makes sure that we are pinning entry in Europe in general against an industrial structure which is more oriented towards manufacturing than the US, and against a legal system which is more creditor-friendly than the US (La Porta et al. (1998)). We exclude from the regressions the industry data points from the UK. The regression results confirm that entry in the UK and entry in the US are similar benchmarks for natural propensity to entry. Our estimates for β_1 are significant at least at the 1%, but only when we look at total new firms.

4.4 Private equity and access to finance

After accounting for the possibility that our main proxy for "natural" propensity to entry is imperfect, we next account for the possibility that private equity investment is a mere proxy for other types of finance or for return to investment. For instance, countries with higher volumes of private equity investment will tend to have better developed banking sectors, so our measure of private equity will be capturing the effects of the credit market on entry via business loans. Also, countries with dynamic PE and VC industries will tend to have higher investor protection, and so again our volume measure will be contaminated by the effect of the expected return on investment on entry. Most importantly, as Perotti and Volpin (2007) argue, the volume of finance may matter less than access to finance per se. Hence, our PE measure might be picking up the effect on new business entry of easier access to all kinds of finance, including consumer loans and mortgages. In all of those cases, our estimates would be biased.

Therefore in Table 8 we proceed to measure the effect of private equity investment on entry alongside the effect of finance in general. In column (i), we show the estimates of a regression which includes a measure of private credit by commercial banks, normalized by GDP. This measure is widely accepted as a good proxy for a range of financial issues, like access to business loans, depth of the financial sector affecting the ability of financial players to gain access to investment opportunities, etc. (Rajan and Zingales (1998); Beck et al. (2008)). The effect of private credit on new business entry is both economically and statistically significant, as expected. Importantly, the effect of private equity investment remains significant, although in the case of all firms its magnitude decreases somewhat. However, in the case of firms with less than 10 employees, the effect of private equity in new business incorporation remains as strong as before (column (v)).

Next, we account for the fact that private credit is also a volume measure and thus an imperfect proxy for access to finance. Therefore, we employ a formal proxy for access to financial services (columns (ii) and (vi)) taken from the World Bank's "Finance for All? Policies and Pitfalls in Expanding Access" which is a composite indicator measuring the

percentage of the adult population with access to an account with a financial intermediary. While this index captures more than access to business loans, it is a better measure than the volume of private credit of how easy it is to access financial services in general. The correlation between the two measures is 0.71, implying that they are highly but not perfectly correlated, and so the formal index could indeed be capturing more access issues than private credit. Again, while it is correlated with new business incorporation, including it in the regression doesn't eliminate the effect of private equity on firm entry. While in the case of total new firms the estimate of β_1 again loses part of its economic and statistical significance, it remains the case that the volume of private equity finance impacts business creation independent of general access to financial services.

We also look at investors' protection. Rajan and Zingales (2003) argue that the absence of regulation protecting investors could be a very efficient barrier to new firm creation. The right measure of financial development, the argument goes, would capture not only the ease with which any entrepreneur or company with a sound project can obtain finance, but also the confidence with which investors anticipate an adequate return. The previous two measures we used would then be a poor proxy for this investor confidence, and we next proceed to incorporate in our regression a direct measure of the degree to which individual investments are protected by the legal system in the country.[6] The indicator we employ is a composite of the quality of three indices: transparency of transactions, liability for self-dealing, and shareholders' ability to sue officers and directors for misconduct. As expected, this index has a very significant effect on entry when interacted with our measure of "natural" entry rates, pointing to the fact that investors indeed take into account the degree of legal protection affecting the expected return to individual investments in start-up companies. Tellingly, the effect of private equity investment on business entry survives this extension of the basic model (columns (iii) and (vii)).

Finally, we do a horse race in which we include all country-level measures used in Table 8 so far interacted with our measure of natural industry entry (columns (iv) and (viii)).

[6] Perotti and Volpin (2007) also use this measure as a proxy for access to finance.

We find that private credit doesn't enter significantly anymore, and access to finance is insignificant in the case of entry of all new firms, but in general, our results confirm that the depth of financial system, access to finance and investor protection all matter for entry. Importantly, the private equity interaction continues to enter positively and statistically significantly, albeit with a somewhat decreased order of magnitude.

4.5 Endogeneity and selection

The empirical methodology chosen is traditionally prone to endogeneity problems. A measured positive coefficient on the composite term of interest does not automatically imply causality; it could be that private equity is endogenous to firm entry rates, or it could be that a set of omitted variables is jointly driving both the propensity to enter and the propensity to invest in start-up companies, in interaction with our industry characteristics of choice. The traditional solution in this line of research is to use an instrumental variables (IV) procedure to account for this potential endogeneity. It has been generally agreed that the country's legal origin is a strong predictor of the degree of legal regulation and the quality of the financial system nowadays (La Porta et al. (1998)). However, in the case of private equity and entry there are two problems which may reduce legal origin to an inefficient instrument. For one, it could be that the link between the exogenous component of the legal system and private equity investment is relatively weak, but more importantly, it is conceivable that legal systems affect entry via channels other than private equity investment, like barriers to entry, for instance. Hence, we rather look at the types of laws that were in place in the 1990s, regulating the ability of pension funds managers to engage in private equity investment. The method is akin to Kortum and Lerner (2000), who use a 1979 clarification of the Employee Retirement Income Security Act (ERISA) "Prudent man" rule by the Department of Labor allowing pension funds to engage in PE investments as an instrument for VC investment.[7] The idea is that the increased supply of funds reduces the

[7] Gompers and Lerner (1999) show that VC investment increases more than five-fold following the ERISA "Prudent man" rule clarification by the US Department of Labor.

cost of financing to venture capitalists, and hence serves as a supply shifter, while it has no effect on the availability of ideas that need start-up finance.[8]

We create a dummy equal to 1 if pension funds were allowed to invest in private equity in the respective country prior to the sampling period, and to zero otherwise. We also create a variable which is constructed by interacting the pension funds dummy with the average size of pension funds in the respective country as share of GDP over the 1995-1999 period[9]. Being correlated with the predetermined components of private equity and venture capital investment and exogenous to current business opportunities makes these variables reasonable instruments, even in a small-sample context with linear estimation.[10] In an (unreported) exercise we find that a first-stage regression including the two instruments one at a time, as well as together, explains between up to 65% of the cross-country variation in private equity, with an F-value of up to 12.5. In addition, countries that enacted such a measure have seen there PE funds raised increase by 95.5% more on average over the period 1991-1999 than countries which did not. We report the estimates from the second stage in columns (i)-(ii) and (vi)-(vii) of Table 9. We find that the estimate of β_1 is still positive and still highly significant, and does not vary dramatically in magnitude from the estimates of the OLS regressions.

However, a common flaw of this method is that countries with large industries with high natural entry may have both higher entrepreneurial culture (resulting in more entry regardless of private equity investment) and higher levels of private equity investment (due to higher demand for all types of finance). One method to control for that possibility is to exclude the industries that are in the right tail of the industry size distribution. We restrict our sample to the industries that are in the bottom tertile, bottom two tertiles, or outside the top 10% of their country's industries in terms of size. When we do that, in all cases we get

[8] Unfortunately, given the aggregated data we are provided with, it is impossible to construct a more direct proxy of the cost of finance.

[9] The data for pension funds size in the 1990s comes from Eurostat.

[10] It is possible that these laws were enacted following pressure from a growing PE industry, or a lack of entrepreneurial activity (which would make them correlated with PE and hence null the exclusion restriction). It is a fact, however, that the formal motive expressed during the legislative process has universally been diversification of risk (EVCA yearbooks, 1991-1999).

estimates which are still positive and significant, similar to magnitude to the ones estimated previously, and they do not vary much regardless of the definition of "small industries" that we use. The coefficient after the exclusion of the top 10% is reported in columns (iii) and (viii) (for entry by all firms and by firms with less than 10 employees, respectively).

Another selection concern is that in countries whose culture is adverse to entrepreneurial activity (and hence, there is naturally less entry), there are also stricter rules guiding private equity investment, as the local legislatures would be adverse to business activity in general. We account for that possibility by distinguishing the general quality of laws in the respective country. The above argument would imply that if it is a selection problem, private equity investment will have a larger effect in countries where the quality of laws is generally lower. This is not the case; in fact as indicated in columns (iv) and (ix), the effect is the opposite – more private equity leads to relatively higher entry in high-entry industries in countries with well-developed legal systems, implying no omitted variable bias.

Finally, we have to account for the possibility that by focusing on legal entry, we may be overlooking activity in the informal sector. To account for the possibility that our results are biased by not considering a potentially large dynamics in the informal sector, we next use Enste and Schneider's (2000) measure of the size of the informal economy to control for that. In columns (v) and (xi) of Table 9, we regress firm entry on two triple interaction terms, in which the industry natural entry-country private equity investment has been interacted with dummies for high and low degree of the informal economy, where low share of the informal economy equals 1 if the country is in the bottom tertile of the informal economy share, and to 0 otherwise, and high share of the informal economy equals 1 if the country is in the top tertile of the informal economy, and to 0 otherwise. The coefficient on the triple interaction term including the low informal economy dummy is positive, implying that in countries where for tax or regulatory reasons there is little activity in the informal sector, private equity is indeed associated with higher entry in industries that naturally have higher entry rates.

4.6 Robustness

We conduct an extensive robustness analysis whose detailed exposition is left for a companion paper available upon request for the sake of brevity. We first estimate the effect of private equity investment on entry, accounting for the standard industry determinants of entry that have been suggested by the literature. In particular, it has been pointed out that entry rates are affected negatively by financial dependence and capital intensity, and positively by technological opportunities and industry growth, among else.[11] We therefore want to make sure that the effects we are measuring are not driven by other industry characteristics for which our measure of "natural entry" is a proxy. We find that some characteristics of the business environment matter for entry exactly as predicted: higher intellectual property protection is associated with higher entry in industries that naturally invest more in R&D, and lower entry costs are associated with relatively higher entry in industries that are growing faster. Importantly, in all cases higher private equity investment keeps its independent effect on entry, and this effect is still relatively stronger for naturally high-entry industries. This effect also survives the "horse race".

Next, we look at a set of characteristics of the business environment, which the literature has identified as predictors of entry: entry barriers, labor regulations, human capital, intellectual property rights protection, and taxes. To the degree that all of those tend to follow a similar path over time, the effect of private equity investment on entry could be contaminated by developments along other dimensions of the business environment. We account for all those possibilities by including an interaction of the industry's natural propensity to entry with another characteristic of the business environment, one at a time, and all of them simultaneously. We confirm that barriers to entry have a detrimental effect on entry rates. We find that labor regulations have no significant effect on entry, although Europe is traditionally regarded as a labor constrained environment. Better protection of intellectual property rights is associated with relatively more entry in high-entry industries, which also tend to be the ones that are the most intangibles-intensive. Finally, cross-country variation

[11] See Geroski (1995) for a summary of the empirical evidence on that.

in profit taxes does little to explain the cross-country cross-industry variation in entry rates between high and low entry industries, and neither does a higher level of human capital or accounting for the business cycle. Again, the effect of private equity survives all robustness checks, including the horse race.

As mentioned before, our data contains information on the distribution of private equity investment across 17 different industries as classified by EVCA. This calls for a disaggregated approach in which we replace our measure of private equity investment at the country level ($EVCA_i$) with a measure of private equity investment at the country and industry level ($EVCA_{ik}$). The first difficulty is that the disaggregated data comes by country of management, unlike data on total private equity investment, which is reported both by country of management and country of destination. We convert the industry data by country of management into country of destination by assuming that in each industry, the gap between private equity by country of management and by country of destination is the same as the gap between private equity by country of management and by country of destination for the whole economy. This approach is obviously prone to measurement error and so the results we report should be taken with caution. The second difficulty deals with the issue of the NACE rev. 1.1 -> EVCA industry classification translation key, highlighted in Section 2, for which we use the translation key developed and presented in Table 4. After repeating the estimation reported in Table 5, this time with disaggregated industry data, the effect on new business incorporation of the interaction of private equity with the industry's "natural" entry rates are still economically and statistically significant.

Finally, we use the fact that the data from EVCA also allows us to account for the staging of private equity investment (seed, start-up, expansion and replacement, and buy-out), and for investment by type of investor (independent, captive, semi-captive, or public funds). The caveats of the previous paragraph apply again in the sense that the data on staging and investor type comes by country of management only, and so our conversion of the data into country of destination relies on the assumption that the gap between, for example, venture capital investment by country of management and by country of destination

is the same as the gap between private equity by country of management and by country of destination. However, in 2006 EVCA started reporting the stage distribution of private equity finance by country of destination too. Hence, in this last empirical exercise, we match data from the 2006-2007 EVCA yearbooks with data from Amadeus on entry for 2006-2007, using the 2008 CD.[12] We find that investor type matters: all the effect of PE investment on new business entry comes from investment by independent investors, while the effect of captive, semi-captive and public funds is at best non-existent. We also find that in 2006-2007, start-up finance, VC and total private equity have an equally strong effect on new business incorporation. One way to read this is that nascent entrepreneurs anticipate future financing needs and are more likely to decide to start their own business at a time when more venture capital is available. A second explanation is offered by entrepreneurial spawning where venture-backed firms are more likely to create other new ventures (Gompers et al., (2005)). However, this remains just a hypothesis until a more refined empirical approach looks into the channels via which private equity investment affects new business incorporation.

5 Conclusion

This paper uses a cross-industry cross-country estimation technique in the spirit of Rajan and Zingales (1998) to identify the impact of private equity and venture capital investment in general and start-up finance in particular on entrepreneurship. We use two waves of the Amadeus database, which includes data on about three million firms all across Europe: a sample for the years 1998-1999 in the main empirical analysis, and a sample from 2006-2007 for robustness purposes. The Amadeus represents one of the largest data sets on European firms from these periods, and it is made particularly valuable by the fact that it includes extensive data on SMEs, private as well as publicly traded corporations, and is not limited to manufacturing like many similar data sets. It also includes data on the age of the firm and its year of incorporation, giving us the opportunity to proxy entry rates by the share of

[12] The same selection criteria apply as in Section 2.4.

young firms across the full range of NACE Rev 1.1 industries.

We match that data to data from the European Venture Capital Association (EVCA) on private equity investment in general and start-up finance in particular in Western Europe and some Central European countries. We average the data from 1998-1999 to match with the first wave of Amadeus, and from 2006-2007 for the second wave. We examine 16 countries, 37 NACE double-digit Rev. 1.1 industries, and 14 EVCA industry classes.

We find that private equity investment has a beneficial effect on entry, which is relatively higher for industries which naturally have higher entry rates and are more R&D intensive. The effect remains strong once we exclude investment allocated to buy-outs, suggesting that early stage finance is important in this respect. Our results hold both in 1998-1999 and 2006-2007, when we account for industry size, and when we exclude the transition economies. The results stay unchanged after we address the endogeneity problem (does private equity induce entry or is it attracted to countries with a more dynamic industrial structure?) by using an IV procedure in which variation in national prudential regulation guiding the investment behavior of Europe's pension funds is used as an instrument for the supply of PE funds. We argue that by offering a unique combination of ownership and incentives, private equity investment seems to lower the cost of start-up capital and result in higher industry dynamics. The results are generally robust to using different proxies for entry, contemporaneous or historical volumes of private equity investment, and to correcting for omitted variable bias.

We also find that the effect of private equity is higher in countries with better judicial systems and in countries with smaller share of the informal economy. This result is only logical: to the extent that private equity targets industries that rely heavily on intangible assets like intellectual property, licenses and patents, its effect should be more pronounced in countries where the returns to those are protected by the legal system. At the same time, we find that the relatively higher effect of private equity investment on entry in high-entry industries is robust to accounting for other industry characteristics, as well as for other characteristics of the business environment that have been suggested by the literature as determinants of entry rates.

This paper is, to our knowledge, the first attempt to empirically link private equity investment to industry entry in a cross-country cross-industry setting. Our results imply that private equity in general and venture capital in particular have a positive effect in potentially bringing new ideas to the marketplace in the shape of young companies. In this paper we are not interested in the profitability of this enterprise, but as far as real effects are concerned, private equity investment seems to generate value through fostering entrepreneurial activity in the economy. A number of important questions remain unanswered due to the nature of our data. For example, what is the relative importance of the different channels via which private equity and venture capital affect entry? Is it more anticipatory considerations where nascent entrepreneurs are aware of future financing needs and are more likely to decide to start their own business at a time when more venture capital is available? Or is it entrepreneurial spawning where venture-backed firms are more likely to create other new ventures? Future research can greatly contribute by addressing those questions.

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Table 1
Summary statistics: EVCA data on private equity investment

Country	Total PE investment over GDP, in %	Total PE investment over GDP, in %
Austria	0.027	0.079
Belgium	0.119	0.084
Czech Republic	0.042	0.023
Denmark	0.029	0.353
Finland	0.111	0.149
France	0.117	0.375
Germany	0.081	0.145
Greece	0.027	0.004
Hungary	0.052	0.086
Italy	0.082	0.131
Netherlands	0.271	0.403
Norway	0.112	0.164
Poland	0.093	0.064
Spain	0.062	0.265
Sweden	0.200	0.820
UK	0.465	1.215

The data are averaged for the period 1998-99 (columns 2) and for 2006-2007 (column 3), and are aggregated over industries. The respective values include all private equity investment in the respective European country by European banks and private equity houses, as well as from international banks and private equity houses which have a European branch or partner. Source: EVCA yearbooks.

Table 2
Summary statistics on entry, by country

Country	New firms (<2 years old) as % of all firms, 1998-1999	Difference in weighed per-country entry rates in 1998-1999 from the 1995-2007 average, in %	New firms (<2 years old) as % of all firms, 2006-2007	Difference in weighed per-country entry rates in 2006-2007 from the 1995-2007 average, in %
Austria	12.2	1.9	9.7	3.9
Belgium	11.6	2.5	10.7	2.2
Czech Republic	11.5	6.2	8.9	8.6
Denmark	13.7	--	11.9	--
Finland	11.1	10.1	9.3	9.8
France	14.7	6.9	13.3	8.2
Germany	12.3	2.3	11.2	2.9
Greece	15.4	3.5	13.1	6.1
Hungary	17.4	3.8	11.2	21.7
Italy	3.5	6.6	2.7	7.4
Netherlands	8.5	12.1	7.2	8.9
Norway	16.9	--	12.1	--
Poland	12.0	4.0	9.3	4.7
Spain	11.4	5.5	10.1	11.3
Sweden	7.9	9.1	6.5	11.5
UK	15.0	6.4	13.2	5.7

The values reported are averaged over 1998 and 1999 (in column 2) and for 2006-2007 (in column 4), using data from Amadeus. The fraction of new firms is calculated as the number of firms 2 or less years old over all firms in this particular industry, and then aggregated over industries, where each industry is weighted by its relative share. In column (3) and (5), we calculate the percentage difference between average entry rates in 1998-1999 and 2006-2007, respectively, and the long-term average over 1995-2007, using in both cases data from Eurostat. Individual industries are again weighted by their respective relative shares. Source: Amadeus database and Eurostat.

Table 3
Entry rates by industry in Europe against the US benchmark

2-digit NACE rev 1.1 code and industry name	New firms as % of all firms, 1998-1999, Europe	New firms as % of all firms, 1998-1999, US
Manufacturing		
15. Food products and beverages	9.6	10.4
16. Tobacco products	16.1	14.8
17. Textiles	9.3	13.7
18. Wearing apparel; dressing and dying of fur	9.5	12.8
19. Tanning and dressing of leather; luggage, handbags, saddlery, harness, and footwear	8.6	18.2
20. Wood and products of wood and cork, except furniture	11.2	12
21. Pulp, paper and paper products	9.5	10.6
22. Publishing, printing and reproduction of recorded media	11.2	11
23. Coke, refined petroleum products, and nuclear fuel	10.8	11.5
24. Chemicals and chemical products	9.3	12.2
25. Rubber and plastic products	10.9	9
26. Other non-metallic mineral products	9.3	11.6
27. Basic metals	12.2	9.8
28. Fabricated metal products, except machinery and equipment	11.5	11.4
29. Machinery and equipment not elsewhere classified	10.4	8.6
30. Office machinery and computers	15.8	17.4
31. Electrical machinery and apparatus not elsewhere classified	11.0	11.8
32. Radio, television, and communication equipment and apparatus	13.8	16.5
33. Medical, precision, and optical instruments, watches, and clocks	9.7	11.4
34. Motor vehicles, trailers, and semi-trailers	10.8	10.4
35. Other transport equipment	13.0	16
36. Furniture; manufacturing not elsewhere classified	11.7	15.8
Construction		
45. Construction	13.7	16.3
Trade		
50. Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	13.4	10.2
51. Wholesale trade and commission trade, except of motor vehicles	14.9	10.6
52. Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	15.2	14.4
Hotels and restaurants		
55. Hotels and restaurants	14.8	11.8
Transportation		
60. Land transport; transport via pipelines	16.0	16.8
61. Water transport	11.9	11.2
62. Air transport	13.5	12.4
63. Supporting and auxiliary transport activities, and travel agencies	14.5	13.5
Services		
70. Real estate activities	16.0	10.6
71. Renting of machinery and equipment without operator and of personal and household goods	18.0	12.6
72. Computer and related services	22.4	21.4
73. Research and development	17.0	13.1
74. Other business activities	18.4	19.4
Other		
93. Other services activities	17.0	13

The values reported are averaged over 1998 and 1999, for Europe (column 2) and the US (column 3). The fraction of new firms is calculated as the number of firms 2 or less years old over all firms in this particular industry. Source: Amadeus database (column 2) and Dun and Bradstreet (column 3)

Table 4
2-digit NACE rev. 1.1 industry classification -> EVCA industry classification conversion key

NACE rev 1.1 industry class	EVCA industry class
22, 32	Communications
24, 30, 32, 33, 72	Computer
73	Biotechnology
23, 33, 85	Medical and health related
23, 24	Energy
15, 16, 17, 18, 19, 34, 35, 36, 50, 51, 52, 55, 63, 93	Consumer products
26, 27, 28, 29	Industrial products
24, 25	Chemicals and chemical related
31	Industrial automation
20, 21	Other manufacturing
60, 61, 62	Transportation
61, 63, 71, 74	Other services
45	Construction
70	Other

Source: EVCA -> NACE rev. 2 and NACE rev. 2 -> NACE rev. 1.1 translation key.

Table 5
Private equity and firm entry: measuring PE investment at the country level

	(i) OLS	(ii) Tobit	(iii) Tobit	(iv) OLS	(v) OLS
	Fraction of new firms				Fraction of exited firms
	PE investment	PE investment	Excluding trans. economies	Small firms only	PE investment
Industry share	-0.005	-0.005	0.156	-0.026	-0.012
	(0.09)	(0.109)	(0.116)	(0.055)	(0.101)
$Entry_{US}$ * Private equity	0.300	0.300	0.189	0.263	0.239
	(0.112)**	(0.078)***	(0.079)**	(0.117)**	(0.059)***
Observations	571	571	471	571	571
R^2	0.60			0.56	0.63

The reported estimates are from OLS regressions (columns (i) and (iv)-(v)) and from a Tobit regression (columns (ii) and (iii)). The dependent variable is the ratio of all new firms to total firms (in columns (i)-(iii)), the ratio of all new firms with less than 10 employees to total firms (column (iv)), and the ratio of all exited firms to total firms by 2-digit NACE rev. 1.1, averaged for 1998-1999 (column (v)). Industry share is the ratio of industry sales to total sales by all industries in each country. $Entry_{US}$ is the ratio of new firms to total firms in the US, by 2-digit NACE rev. 1.1. Private equity measures actual private equity investment at the country level, normalized by GDP, averaged for 1998-1999. All regressions include a constant, 2-digit industry dummies and country dummies, not reported. White's heteroskedasticity corrected standard errors standard errors are reported in parentheses. ***, **, and * report significance at the 1%, 5% and 10% level, respectively. See Appendix 1 for detailed variable definitions and sources.

Table 6
Private equity timing and firm entry

	(i) OLS	(ii) OLS	(iii) OLS	(iv) OLS
	All firms		Small firms	
	PE investment, 3-year average	PE investment, 4-year average	PE investment, 3-year average	PE investment, 4-year average
Industry share	-0.004	-0.003	-0.024	-0.023
	(0.091)	(0.091)	(0.054)	(0.054)
$Entry_{US}$ * Private equity	0.349	0.390	0.313	0.362
	(0.131)***	(0.156)***	(0.138)**	(0.163)**
Observations	571	571	571	571
R^2	0.60	0.60	0.56	0.56

The reported estimates are from OLS regressions. The dependent variable is the ratio of all new firms to total firms (columns (i)-(ii)) and the ratio of all new firms with less than 10 employees to total firms (columns (iii)-(iv)), by 2-digit NACE rev. 1.1 and averaged for 1998-1999. Industry share is the ratio of industry sales to total sales by all industries in each country. $Entry_{US}$ is the ratio of new firms to total firms in the US, by 2-digit NACE rev. 1.1. Private equity measures actual private equity investment at the country level, normalized by GDP, and averaged over 1997-1999 (columns (i) and (iii)) and 1996-1999 (columns (ii) and (iv)). All regressions include a constant, 2-digit industry dummies and country dummies, not reported. White's heteroskedasticity corrected standard errors standard errors are reported in parentheses. ***, **, and * report significance at the 1%, 5% and 10% level, respectively. See Appendix 1 for detailed variable definitions and sources.

Table 7
Alternative proxies for propensity to enter

	(i)	(ii)	(iii)	(iv)	(iv)	(vi)
	Fraction of new firms					
	Firm exit rates, US		SME entry rates, US		Firm entry rates, UK	
	All firms	Small firms	All firms	Small firms	All firms	Small firms
Industry share	-0.002	-0.018	-0.036	-0.003	0.004	0.022
	(0.119)	(0.072)	(0.118)	-0.118	(0.119)	-0.118
$Exit_{US}$ * Private equity	0.018	0.029				
	(0.026)	(0.017)*				
Entry by $SMEs_{US}$ *			0.234	0.207		
Private equity			(0.107)**	(0.107)**		
$Entry_{UK}$ * Private equity					0.271	0.086
					(0.106)***	(0.094)
Observations	571	571	571	571	534	534
R^2	0.60	0.61	0.60	0.55	0.60	0.67

The reported estimates are from OLS regressions. The dependent variable is the ratio of new firms to total firms (columns (i), (iii), and (v)) and of new firms with less than 10 employees to total firms (columns (ii), (iv), and (vi)), by 2-digit NACE rev. 1.1 and averaged for 1998-1999. Industry share is the ratio of industry sales to total sales by all industries in each country. $Exit_{US}$ is the ratio of firms that ceased to exist to total firms in the US. Entry by $SMEs_{US}$ measures entry rates by small or medium enterprises only (<250 employees) in the US. $Entry_{UK}$ measures the ratio new firms to total firms in the UK. Private equity measures actual private equity investment, normalized by GDP, by country, or by EVCA industry level. Industry share, $Exit_{US}$, Entry by $SMEs_{US}$, and $Entry_{UK}$ are calculated by 2-digit NACE rev 1.1. All regressions include a constant, 2-digit industry dummies and country dummies, not reported. White's heteroskedasticity corrected standard errors standard errors are reported in parentheses. ***, **, and * report significance at the 1%, 5% and 10% level, respectively. See Appendix 1 for detailed variable definitions and sources.

Table 8
Private equity and alternative proxies for finance

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
	All firms				Small firms			
	Private credit over GDP	Access to finance	Investors' protection	Horse race	Private credit over GDP	Access to finance	Investors' protection	Horse race
Industry share	-0.015	-0.010	-0.003	-0.008	-0.022	-0.03	-0.022	-0.019
	(0.109)	(0.108)	(0.109)	(0.108)	(0.069)	(0.068)	(0.067)	(0.068)
$Entry_{US}$ * Private equity	0.232	0.207	0.237	0.217	0.317	0.295	0.131	0.169
	(0.093)***	(0.085)***	(0.100)**	(0.128)*	(0.059)***	(0.054)***	(0.065)**	(0.082)**
$Entry_{US}$ *	0.583			0.195	0.375			0.072
Private credit over GDP	(0.333)*			(0.409)	(0.222)*			(0.267)
$Entry_{US}$ *		0.028		0.029		0.014		0.545
Access to finance		(0.011)***		(0.012)**		(0.006)*		(0.795)
$Entry_{US}$ *			0.198	0.209			0.242	0.221
Investors' protection			(0.118)*	(0.126)*			(0.078)***	(0.083)***
Observations	571	571	571	571	571	571	571	571
R^2	0.63	0.69	0.68	0.69	0.64	0.64	0.64	0.64

The reported estimates are from OLS regressions. The dependent variable is the ratio of new firms to total firms (columns (i)-(iv)) and of new firms with less than 10 employees to total firms (columns (v)-(viii)), by 2-digit NACE rev. 1.1 and averaged for 1998-1999. Industry share is the ratio of industry sales to total sales by all industries in each country. $Entry_{US}$ is the ratio of new firms to total firms in the US, by 2-digit NACE rev. 1.1. Private credit over GDP measures the ratio of private credit allocated by commercial banks to country total GDP. Access to finance measures general access to external finance by households and businesses. Investor's protection measures the degree of legal protection of private investment in the country. All regressions include a constant, 2-digit industry dummies and country dummies, not reported. White's heteroskedasticity corrected standard errors standard errors are reported in parentheses. ***, **, and * report significance at the 1%, 5% and 10% level, respectively. See Appendix 1 for detailed variable definitions and sources.

Table 9
Endogeneity and selection issues

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
	All firms					Small firms only				
	PE laws	PE laws and fund size	Small industries only	High-low legal efficiency	High-low shadow economy	PE laws	PE laws and fund size	Small industries only	High-low legal efficiency	High-low shadow economy
Industry share	0.001	-0.019	0.328	-0.095	-0.017	-0.016	0.019	0.082	-0.031	-0.034
	(0.091)	(0.097)	(0.239)	(0.092)	(0.091)	(0.053)	(0.059)	(0.157)	(0.059)	(0.065)
$Entry_{US}$ * Private equity	0.253	0.242	0.276			0.234	0.293	0.264		
	(0.144)*	(0.121)**	(0.120)**			(0.143)*	(0.135)**	(0.126)**		
High legal efficiency *				0.268					0.275	
$Entry_{US}$ * Private equity				(0.121)**					(0.122)**	
Low legal efficiency *				-0.435					0.179	
$Entry_{US}$ * Private equity				(0.472)					(0.302)	
Low share shadow econ *					0.278					0.262
$Entry_{US}$ * Private equity					(0.122)**					(0.122)***
High share shadow econ *					0.283					0.174
$Entry_{US}$ * Private equity					(0.176)					(0.127)
Observations	571	571	515	438	443	571	571	515	438	443
R^2	0.60	0.60	0.59	0.66	0.67	0.56	0.57	0.54	0.63	0.68

The reported estimates are from an IV regression (columns (i)-(ii) and (vi)-(vii)) and from OLS regressions (columns (iii)-(v) and (viii)-(x)). The dependent variable is the ratio of new firms to total firms (columns (i)-(v)) and the ratio of new firms with less than 10 employees to total firms (columns (vi)-(x)), by 2-digit NACE rev. 1.1 and averaged for 1998-1999. Private equity measures actual private equity investment at the country level, normalized by GDP. Private equity laws is a dummy equal to 1 if by 1998 pension funds were allower to invest in risk capital markets in the respective country. In columns (ii) and (vi), the dummy is interacted with the actual size of pension funds assets as share of GDP. Columns (iii) and (viii) perform the analysis on the sample of all industries excluding the top 10% in terms of share of sales. Industry share is the ratio of industry sales to total sales by all industries in each country. $Entry_{US}$ is the ratio of new firms to total firms in the US, by 2-digit NACE rev. 1.1. High(low) legal efficiencies are dummies equal to 1 if the country is in the top(bottom) 33% in terms of legal efficiency, and to 0 otherwise. High(low) share shadow economy are dummies equal to 1 if the country is in the top(bottom) 33% in terms of implied size of the unofficial economy, and to 0 otherwise. All regressions include a constant, 2-digit industry dummies and country dummies, not reported. White's heteroskedasticity corrected standard errors standard errors are reported in parentheses. ***, **, and * report significance at the 1%, 5% and 10% level, respectively. See Appendix 1 for detailed variable definitions and sources.

Appendix 1. Variables: definitions and sources

Variable	Definition and source
EVCA data	
Private equity	Actual PE investment by European banks, mutual funds and PE houses, as well as by international PE investors with a European branch or partner, normalized by GDP; by country or European Venture Capital Association (EVCA) industry classification. Source: EVCA yearbooks
Seed and start-up finance	Actual PE investment by European banks, mutual funds and PE houses, as well as by international PE investors with a European branch or partner, normalized by GDP, allocated to seed and start-up firms; by country. Source: EVCA yearbooks
Seed,start-up & expansion	Actual PE investment by European banks, mutual funds and PE houses, as well as by international PE investors with a European branch or partner, normalized by GDP, allocated to all private equity deals expect for buyouts; by country. Source: EVCA yearbooks
Independent PE	Private equity investment by independent PE funds, normalized by GDP, allocated to all private equity deals; by country. Source: EVCA yearbooks
Non-independent PE	Private equity investment by captive, semi-captive and public PE funds, normalized by GDP, allocated to all private equity deals; by country. Source: EVCA yearbooks
Amadeus data	
Entry	Number of firms 2 years or younger as a fraction of the total firms. Averaged for 1998-1999 and 2006-2007. Used at the 2-digit NACE rev. 1.1 level and aggregated weighted by employment at the EVCA industry classification level. Source: Amadeus
Exit	Number of exited firms as a fraction of the total firms. Averaged for 1998-1999 and 2006-2007. Used at the 2-digit NACE rev. 1.1 level and aggregated weighted by employment at the EVCA industry classification level. Source: Amadeus
Entry by small firms	Number of firms 2 years or younger with less than 10 employees as a fraction of the total firms. Averaged for 1998-1999 and 2006-2007. Used at the 2-digit NACE rev. 1.1 level and aggregated weighted by employment at the EVCA industry classification level. Source: Amadeus
Industry share	Fraction of the industry's sales in total sales. Averaged for 1998-1999 and 2006-2007. Used at the 2-digit NACE rev. 1.1 level and aggregated weighted by employment at the EVCA industry classification level. Source: Amadeus
US benchmark	
Entry US	Entry rates for US corporations. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Average for the years 1998-99. Source: Dun & Bradstreet.

Exit US	Exit rates for US corporations. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Average for the years 1998-99. Source: Dun & Bradstreet.
Entry by SMEs US	Entry rates for US corporations with less than 250 employees. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Average for the years 1998-99. Source: Dun & Bradstreet.
Entry UK	Entry rates for UK corporations. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Average for the years 1998-99. Source: Dun & Bradstreet.
Capital intensity	Measure of physical capital usage, equal to the industry-level median of the ratio of physical capital used to sales. The numerator and denominator are summed over all years for each firm before dividing. Computed for all U.S. firms for the period 1990-99. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Source: Compustat.
R&D intensity	Measure of dependence on research and development, equal to the industry-level median of the ratio of R&D expenses to sales. The numerator and denominator are summed over all years for each firm before dividing. Computed for all U.S. firms for the period 1990-99. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Source: Compustat.
Financial dependence	Industry-level median of the ratio of capital expenditures minus cash flow over capital expenditures. The numerator and denominator are summed over all years for each firm before dividing. Cash flow is defined as the sum of funds from operations, decreases in inventories, decreases in receivables, and increases in payables. Capital expenditures include net acquisitions of fixed assets. This definition follows Rajan and Zingales (1998). We compute this measure for all U.S. firms for the period 1990-99. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Source: Compustat.
Industry growth	Measure of industry growth, equal to the industry-level median of value added per worker. The numerator and denominator are summed over all years for each firm before dividing. Computed for all U.S. firms for the period 1990-99. Calculated for 2-digit NACE industries (original data on a 4-digit SIC level). Source: Compustat.
<u>Country-level variables</u>	
Private credit over GDP	Ratio of domestic credit to the private sector scaled by GDP, average over the period 1995-99. Source: International Monetary Fund's International Financial Statistics (IMF-IFS).
Access to finance	General index of access to external finance by households and businesses. Source: Finance for All? The World Bank, 2007.
Investors' protection	Index of the degree of protection of investors, calculated as an average of three indices: transparency of transactions, liability for self-dealing, and shareholders' ability to sue officers and directors for misconduct; averaged over 1995-1999. Source: Doing Business Database (WB).

Share shadow economy	Share of the informal economy, calculated as the size of the informal economy as a percentage of official GNI. Average over the period 1999-2000. Source: Enste and Schneider (2000).
Property rights protection	Index of degree of protection of intellectual property rights. Source: Park and Ginarte (1997).
Entry procedures	Number of procedures to register a business. Data for the year 1999. Source: Djankov et al. (2002).
Labor regulations	Index of the legal ease of hiring and firing workers; averaged over 1995-1999. Source: Doing Business Database.
Profit tax	Measure of the marginal tax on profit. Source: PriceWaterHouseCoopers Worldwide Taxes 1999-2000).
Human capital	Average years of schooling for an individual in the respective country. Source: Barro and Lee "International Data on Educational Attainment" dataset.
Output gap	Difference between actual and potential GDP, averaged for 1998-1999 and 2005/2006. Source: Econ stats online, http://www.econstats.com/weo/V027.htm
Pension funds size	Assets held by all pension funds in the respective country normalized by GDP and averaged for 1998-1999. Source: Eurostat

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