Private Equity in the Global Economy: Evidence on Industry Spillovers

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Abstract

Using a novel dataset on global private equity investments in 19 industries across 48 countries, we find that following investments by private equity funds labor productivity, employment, profitability, and capital expenditures increase for publicly-listed companies in the same country and industry. This suggests that positive externalities created by private equity firms are absorbed by other companies within the same industry. These effects are more pronounced in country-industries with higher levels of competition suggesting that the competitive pressure from private equity-backed firms forces industry peers to react. On the financial side, we provide evidence that buyout investments lead to higher debt levels within the industry. Overall, our findings suggest that private equity investments have important spillovers to the real economy.

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1 Introduction

Recent studies find evidence of average improvement in firm performance following a private equity (PE) transaction (Cumming et al. 2007, Kaplan and Stromberg 2009). However, little is known about how PE transactions impact competing firms in the same industry. This is surprising given frequent negative publicity about buyout transactions adversely spilling over to the broader industry. For example, substantial attention was paid to the spillovers in the gaming industry from PE-backed Caesars Entertainment which declared bankruptcy in January 2015. The firm was blamed for industry-wide job losses and broad downward pressure on industry financials.[1] Using a novel dataset on actual private equity investments between 1990 and 2011, this paper explores the dynamic relationship between private equity investments and characteristics (such as productivity growth, employment growth, capital expenditures, etc.) of public market firms in the same industry over the next several years.

Our analysis builds on the idea of "knowledge spillovers" dating back to Marshall (1890). A large literature has examined how technological advancements and productivity gains at some companies spill over to the other companies within the same industry. In a review of studies related to spillovers from multinational corporations onto local companies, Blomstrom and Kokko (1998) conclude that technology and productivity spillovers take place within an industry as companies compete and directly interact with each other or knowledge is transferred through employees. Caves (1971), Blomstrom and Persson (1983), Bolmstrom (1986), Blomstrom and Wolff (1994), Kokko (1994), Kokko (1996), and Javorcik (2004) are examples of studies providing evidence for the existence of spillovers from foreign multinationals to domestic companies. In general, the impact of private equity investments may not be limited to the companies receiving the investments. Operational and financial changes made by private equity firms after an acquisition likely create positive and negative spillovers for the industry as a whole. Hence, how overall industry dynamics change following private equity investments is an important issue for understanding if documented economic gains from PE investments increase welfare or simply come at the expense of comparable losses at other firms in the industry.

As another motivating example, we consider the buyout of the rental car company Hertz Corporation in 2005. Hertz's performance improved significantly following the

[1] See, for example, "A private equity gamble in Vegas gone wrong," by William D. Cohan, Fortune, June 5, 2015.

transaction. More to the point of this study, Hertz's two main competitors, Avis-Budget and Dollar-Thrifty, soon implemented new strategies to increase efficiency, perhaps triggered by competitive pressure from the increasingly efficient Hertz. For example, over the two years following the buyout of Hertz, profitability and productivity increased at both Avis-Budget and Dollar-Thrifty.[2] Our analysis attempts to determine what types of economic and financial spillovers occur in the wake of private equity investments and if these changes are likely to be welfare increasing for the economy. In short, we seek to determine if the more typical case is like Caesars Entertainment or Hertz.

We utilize a large sample of global private equity fund investments in portfolio companies, and then measure changes in economic and financial characteristics of the public companies within the same country and industry as the private equity investments. We find that private equity capital invested in an industry leads to higher employment growth, profitability growth, and labor productivity growth within the *public firms* in the *same domestic industry* over the next few years: on average, a one standard deviation increase in the amount of private equity capital invested (adjusted by industry sales) leads to a 0.9% increase in employment growth, 1.2% increase in labor productivity growth, and 2.6% increase in profit growth.

As is the case with all financial research, it is a challenge to pin down the direction of causality due to the potential endogenous nature of private investment activity. We utilize a panel vector autoregression (panel-VAR) method to mitigate problems of reverse causality. Essentially, we condition our analysis on recent history of other characteristics' impacts on PE investment. We find no evidence that past values of employment growth, profitability growth, or labor productivity growth are associated with the amount of private equity capital invested in an industry overall though these effects may exist at the firm level for those receiving PE investments. Regardless, we are able to identify a statistically significant causal link from private equity to the real economy. We conduct a range of tests (discussed below) to gauge the robustness of our results. It is important to note that it would be impossible to fully exclude the alternative story that PE companies have perfect foresight about industry prospects and invest accordingly which could also explain the positive association we document between PE investment and growth in public industry peers. However; first, this alternative story cannot explain our cross-sectional findings that we discuss below. Second, even if it is the case that PE companies have some foresight and this explains

[2]See Section 2.2 for a more detailed discussion of the buyout of Hertz Corporation.

part of our results, our findings are still important as they provide evidence on PE companies facilitating industry growth by identifying the potential and allocating capital accordingly.

Given the different goals and structures of buyout and venture capital (VC) transactions, we compare how the impact of private equity on the performance of public firms is different after buyout versus VC investments. Overall, our findings indicate that buyout investments are more likely to lead to spillovers through financial engineering (e.g., creating higher leverage) and stronger governance, while venture capital investments create positive industry-wide externalities through the introduction of new technologies and innovation.

Next, we explore the dynamic relationship between industry-wide investment among the public firms and private equity, and find that higher levels of private equity capital lead to higher growth in industry-wide capital expenditures suggesting that private equity companies not only contribute to short-term performance advancement but can also facilitate long-run growth through more real investment at the industry-level.[3]

We examine two financial variables: industry-wide net debt growth and stock market returns. We find that net debt of an industry grows faster following buyout capital investments into the industry suggesting that the financial structures introduced by private equity firms at the portfolio companies also spill over onto the other companies in the same industry leading to increased levels of leverage. We find no evidence for private equity capital chasing returns (i.e., past values of industry returns are not related to the level of private equity capital invested) or industry stock market returns increase following PE investments within a one-year period.

The dataset used in the paper is provided by Burgiss and is unique in its detailed coverage of private equity investments at the global level. Investment values are aggregated using actual portfolio company investments by both buyout and venture capital funds. The data cover a total private equity capital of $1.3 trillion invested in 48 countries across 19 industries from 1990 to 2011 and is the first dataset providing actual dollars of invested private equity capital at the industry level across a large number of countries.[4]

[3]More investment will lead to future growth if the investments have positive net present values. Assuming the increased investment is made in new technologies that lead to higher efficiency, it will facilitate long-run growth.

[4]Harris, Jenkinson, and Kaplan (2014) also use private equity fund flow data supplied by Burgiss in their study of private equity fund performance. Brown et al. (2015) compare Burgiss and other commercially available data sets in terms of what they say about private equity perfor-

While the existing research on private equity has utilized mostly data on U.S.-based funds, studying global investments in a cross-country setting is important for two reasons. First, while private equity fund formation was primarily a U.S. and U.K. phenomenon pre-1990, by 2011 40% of the total global private equity capital was invested in countries other than the U.S. and the U.K.[5] And yet, despite the fact that private equity has become a global asset class, there is very little evidence on global private equity. Second, and more importantly, the cross-section of countries allows for the study of the different impacts of private equity in countries and industries with different characteristics.

Our panel of country-industries enhances our power to test for the existence of a causal effect of private equity on industry spillovers. For example, we find that the impacts of private equity investments are concentrated in country-industries with higher levels of competition which is consistent with the hypothesis that spillovers come from competitive pressures applied by more efficient private equity-backed companies. Both the validity of the private equity business model and how well the spillovers are absorbed within an industry may depend on the institutional environment as well as the level of technological advancement in a country. Strong legal institutions are necessary for private equity companies to better implement the governance structures that make their portfolio companies more efficient (Cumming and Walz 2009). Consistent with this hypothesis we find positive spillover effects of PE investments onto the public companies that are concentrated in countries with better quality legal institutions and intellectual property rights.[6]

For spillovers from new technologies to be more effective, the companies that do not receive investment should be in need of new technologies. At the same time, some level of existing technological skills is needed for the spillovers to be absorbed. In line with this, the existing evidence on spillovers from foreign direct investments(FDI) shows that productivity spillovers are strongest for companies in countries with moderate levels of technological advancement.[7] We also find that the positive spillover

mance.

[5]See Figure 2. Also the data section provides the distribution of global private equity investments across the 48 countries in the sample.

[6]The protection of intellectual property rights is particularly important as it impacts how extensive the private equity companies would introduce new technologies at their portfolio companies. Similarly, Mansfield (1994) finds that technology spillovers are weakest in countries with weak intellectual property protection.

[7]Kokko (1994) and Kokko et al. (1996) are examples of studies that find that moderate technology levels lead to highest spillovers from FDI.

results are strongest in countries with moderate levels of innovative capacities. Overall, these results provide support for a causal effect of private equity investments on industry spillovers given that no alternative explanations we could devise would predict these cross-sectional differences (e.g., market-timing which we discuss in the robustness section).

This paper contributes to several literatures in finance and economics. First, we build on the growing body of studies that examine how company performance changes after private equity transactions (Kaplan 1989, Cao and Lerner 2009, Davis et al. 2009). With the evidence for positive spillover effects at the industry-level, our results support and complement the existing firm-level evidence. Second, our work contributes to the existing spillover literature by exploring spillover of management practices, knowledge, and technology from private equity-backed companies to public companies within the same industry. We provide evidence for a different channel for spillovers other than multinational corporations which is the most discussed channel in the literature.[8] Finally, we also contribute to the large literature of finance and growth that examines the link between financial development and economic growth of countries. Existing studies look at how the development of a country's public and credit markets affects output growth by providing a better allocation of capital (King and Levine 1993, Levine 2004). We consider the impact of a different financial asset class, private equity, and show that its entrance into an industry also enhances industry growth by creating positive externalities within the industry.

The remainder of the paper is organized as follows. The next section further discusses the related literatures and how the paper fits in, together with a real example of industry spillovers after a private equity transaction. Section 3 introduces the data and presents some descriptive analysis. Section 4 outlines the empirical strategy using the panel-VAR approach. Section 5 presents our main results and robustness tests. Section 6 concludes.

[8]This is an important contribution as 'the degree to which other modes of international business (besides traditional inward FDI) generate appropriate spillover benefits for the host country is an exceedingly important policy issue for which there is a disappointing amount of evidence.' (Blomstrom et al. 1999, p.15).

2 Related Literature and a Related Example

2.1 Related Literature

Jensen (1989) argues that private equity ownership, as compared to public equity ownership, can be a superior ownership structure as it provides a better alignment of incentives between owners and managers as well as a more efficient management of resources. Following Jensen, many papers that study the impact of private equity transactions on the target companies provide evidence for the positive impacts on firm-level performance. However, the popular press, labor unions, and policy makers consistently express concerns about the impact of the private equity on the real economy.[9] Thus, how private equity investments affect industry performance is a question that is of great importance not only to academic researchers but also to practitioners and policy makers.

On one hand, with the entrance of private equity investments into an industry, firms not receiving investments could be forced to improve efficiency by utilizing new technologies and practices to compete with the more competitive private equity-backed firms.[10] Thus, there are potential industry-wide externalities from the competitive pressure introduced by private equity. If companies are capable of absorbing the spillovers from private-equity backed firms, the industry overall might experience performance gains. On the other hand, if the companies that do not receive private equity investment cannot keep up with the new technologies and the competitive pressure, the efficiency gains at the PE-backed companies might drive demand away from their competitors.[11] Hence, the pressure might negatively affect the rest of the industry.[12]

According to Kaplan and Stromberg (2009), private equity companies improve

[9]Reports by the Financial Services Authority (2006) and the Service Employees International Union (2007) discuss concerns about private equity and its implications for the economy.

[10]Local companies either imitate the new technologies and practices introduced by private equity firms at their portfolio companies, or are forced to come up with more efficient methods themselves to respond to the increased level of competition within the industry.

[11]Aitken and Harrison (1999), for example, find that the entrance of more efficient foreign companies negatively impacts the performance of local firms because they attract customers away from domestic firms. Djankov and Hoekman (2000), Feinberg and Majumdar (2001), and Kathuria (2002) are other examples of studies providing evidence for negative impacts of spillovers from foreign direct investments.

[12]Even if competitive pressures drive the most inefficient companies out of the market, this may still be beneficial for the economy as a whole since PE-backed firms act as catalysts of a creative destruction process.

their portfolio companies using practices that can be summarized under three main headings: financial engineering, governance engineering and operational engineering. Financial and governance engineering refer to changes in the structure of ownership and financing that may lead to better monitoring and incentive alignment to overcome agency problems at the portfolio companies. Operational engineering refers to management practices that private equity owners use to improve operational efficiencies of their portfolio companies. Firm-level performance after private equity transactions has been examined in the existing literature in studies looking at transactions in the U.S., the U.K. or European Union countries.

Kaplan (1989) tracks large management buyouts of publicly held companies and finds evidence for improved operating performance at these companies as well as increased market values. Similarly, Muscarella and Vetsuypens (1990) study reverse leveraged buyouts (LBO), and find that profitability at target companies increase following the transactions. More recently, Davis et al. (2009) show that U.S. firms receiving a private equity investment experience higher subsequent productivity growth. Complementing the existing evidence on operating performance, Cao and Lerner (2009) provide evidence for superior stock market performance for reverse LBOs. Studying a sample of private equity-backed companies in Western Europe, Acharya et al. (2009) also find evidence for performance gains related to private equity investments. PE investment's impact on employment also receives considerable attention from the press and labor unions. Private equity companies are often blamed for sacrificing jobs for short-term profits. In one of the most detailed studies on this issue, Davis et al. (2011) examine establishment-level job creation and destruction at U.S. establishments using data from the U.S. Census Bureau. They find that private equity-backed companies have higher job destruction at existing establishments, but at the same time higher job creation at new establishments. Their conclusion is that the net impact of private equity transactions on employment is very modest. Similarly, Popov and Roosenboom (2008) find that venture capital leads to higher new business creation in their study of 21 European countries over the period 1998 to 2008.

Most of the existing studies on private equity transactions have found evidence for superior subsequent performance at the firm-level. However, it is still unknown how private equity transactions affect the other firms, which do not receive private equity capital, within the same country and industry. There is a large-established literature

that has provided evidence for the existence of productivity spillovers.[13] For example, several studies on different countries, including Caves (1974) on Australia, Globerman (1979) on Canada, and Blomstrom and Persson (1983) on Mexico, demonstrate positive spillover effects from FDI to domestic industries (see Blomstrom and Kokko, 1998 for a detailed review). Similarly, Bernstein and Nadiri (1989) provide evidence for research and development spillovers within an industry and find that overall costs in an industry decline following improvements in technology as knowledge migrates to other firms. On the other hand, Aitken and Harrison (1999) find that the entrance of foreign companies negatively impacts the performance of local firms.

Similar to FDI, private equity firms may introduce new technologies and managerial expertise to the industry through their portfolio companies. These new practices would then potentially spill over within the industry through different channels and lead to industry-wide efficiency gains.[14] As such, studying the impact of private equity on overall industry dynamics is of first-order importance in answering broader questions about private equity and economic impact.

A recent study by Harford et al. (2015) finds that LBOs have implications for the target firm's industry peers. They document positive abnormal long-run returns to LBO target industry peers driven by an increased likelihood of a potential acquisition. They also find that peer firms increase real investment and enter into more strategic alliances following an LBO in the industry.

This paper complements a recent study by Bernstein et al. (2016). In their study of 26 OECD countries between 1991 and 2007, they find that industries with at least one private equity transaction in the past five years grow faster in terms of employment and productivity. They, however, do not find evidence for differences between industries with high versus low amounts of private equity capital. There are several significant differences between our paper and theirs. First, they look at the overall industry performance following a private equity transaction, including the companies receiving private equity capital and do not specifically explore spillovers, while we

[13]The idea of spillovers was first introduced by Marshall (1890) in the form of knowledge spillovers among firms, and then improved by Arrow (1962), and Romer (1986). Later, Glaeser et al. (1992) put the ideas together and defined the Marshall-Arrow-Romer (MAR) model of knowledge spillovers, which argues that knowledge is industry specific and spills over within an industry once its created.

[14]One channel of spillovers is that the other firms copy the best practices and new technologies of the private equity-backed firms. It could also be the case that they are forced to come up with their own practices and technologies to become more efficient in order to keep up with the competitive pressure from the more efficient private equity-backed firms.

focus on aggregate industry measures of publicly listed companies only. This allows us to clearly identify the spillover effects from private equity-backed companies to companies that do not receive private equity capital within the same industry. Second, their measure of private equity is the existence of any private equity transaction in an industry, whereas we look at actual dollars of private equity capital invested. Third, they study a sample of OECD countries between 1991 and 2007, while we study 48 countries, including both developed and developing nations. This does not only allow us to provide the first evidence on the impact of private equity investments in developing nations but also to compare how the spillover effects are different for countries and country-industries with different institutional characteristics (which can also provide a tool for causal inference).

2.2 The Buyout of Hertz Corporation

The buyout of the car rental company Hertz Corporation in 2005 was one of the biggest buyout transactions in history. The company was acquired for $14 billion by a private equity consortium consisting of the Carlyle group, Merrill Lynch's private investments arm, and Clayton Dubilier & Rice. After the buyout, significant changes were made at the company to cut costs and improve operational efficiency. For example, before the buyout a returned car was being cleaned and refueled at different work stations. The new management realized this created unnecessary idle time. To increase efficiency, cleaning stations were moved to where the cars were refueled resulting in a large increase in the number of cars that could be processed every hour. In addition to operational changes, the PE group also changed the governance structure of the company and more closely monitored management.[15]

During the period after the buyout, the two biggest competitors of Hertz, Avis-Budget and Dollar-Thrifty, also experienced significant efficiency gains. For example, in 2006 Avis-Budget introduced a process improvement initiative called "Performance Excellence", designed to make the vehicle rental process easier, cut costs, and enhance the customer rental experience. Similarly, Dollar-Thrifty announced the implementation of several cost-saving initiatives, including some information technology outsourcing and new investment into existing IT systems to increase efficiency. Given the timing of these changes, it is plausible that they were made in response to the

[15]The New York Times article "Is Private Equity Giving Hertz a Boost?" published on September 23, 2007 discusses the Hertz buyout and talks about the operational changes at Hertz following the buyout.

competitive pressure from Hertz. During the 2006 to 2007 period, at Avis-Budget and Dollar-Thrifty profit margins increased by 10% and 7%, while labor productivity, measured by sales per employee, also increased by 5% and 6%, respectively. This specific example suggests that practices and technologies causing efficiency gains at a PE-backed company might quickly spill over onto other companies within the same industry.

2.3 The Food and Beverage Industry in Thailand

To motivate our research question with an actual data point, we pick and explore the Food and Beverage Industry in Thailand. In 1999 the Food and Beverage Industry received its largest injection to date of $29 million in buyout capital. Figure 4 depicts how overall industry employment, sales, and capital expenditures changed for Thai public companies in the Food and Beverage Industry. All three measures increased significantly over the three years following the increase in buyout investment. Anecdotally, this is consistent with positive spillovers from PE onto the public companies within the same industry.

3 Data and Descriptive Statistics

3.1 Data

The private equity investment data come from Burgiss, a software company providing record keeping and performance analysis services to the largest institutional investors in the private equity universe. The major advantage of this dataset over others is that Burgiss sources its data exclusively from limited partners, as opposed to general partners (GP); so, the typical biases associated with GP-sourced datasets are not present.[16] Recently, Brown et al. (2015) compare different commercial private equity datasets in what they say about private equity performance. For detailed information about Burgiss and its coverage of the private equity universe, see Harris et al. (2012) and Brown et al. (2011).[17]

[16]GP-sourced databases on private equity may have significant biases as GPs strategically stop reporting. In many cases, Burgiss cross-checks data across different investors in the same fund which leads to a high level of data integrity and completeness.

[17]We note that the Burgiss data primarily covers funds of "institutional" quality. However, investments from the large institutional investors constitute the vast majority of the total private equity capital raised around the world.

The primary variable from the Burgiss data is the amount of private equity capital measured in U.S. dollars, including both buyout and venture capital, at the country-industry-year level over the period 1990 to 2011. The data cover 77 countries though we examine only 48 because of other data limitations and sparse PE investment in some countries. Burgiss provides aggregated company level private equity capital invested at the industry level based on the Industry Classification Benchmark (ICB). So, an example of a unit of observation used in our analysis would be the *US dollar equivalent amount of private equity capital invested* in *India* in the *technology* industry in *2003*. This is the first dataset having actual dollar amounts of private equity capital invested at this level of detail globally. As the dataset is unique in its coverage of private equity investments around the globe, we start with some basic descriptive analysis.

Table 1 presents the distribution of private equity capital invested globally among 48 countries in the sample from 1990 to 2011. Panel A ranks the countries based on the total dollar amount of private equity capital received, with amounts in million U.S. dollars and inflation adjusted to 2011. Column 1 shows that the U.S. and the U.K. have received the most capital. While venture capital makes up about 25% of total capital invested in the U.S., its share is less then 10% for the U.K. Developed European countries are also among the countries receiving large amounts of investments. Similar to the U.K., more than 90% of the total amount of capital received is buyout capital in these European countries. China and India rank 3rd and 7th, receiving more than $37 billion and $23 billion of private equity investment, respectively. About 30% of the total amount of capital invested is venture capital in China, whereas VC makes up 17% of the investments in India.

In Panel B, countries are ranked by the total amount of private equity capital received as a percentage of their GDP.[18] The U.S. and U.K. are again on the top of the list. Sweden and Denmark rank 3rd and 4th while they were ranked only 9th and 14th in Panel A. Ireland, Israel, Bulgaria, Singapore and Czech Republic also rank high. China and India, on the other hand, move down the list considerably.

Panel C presents countries ranked by the amount of private equity capital received as a percentage of a country's FDI inflow.[19] The U.S. is again on top of the list followed by Denmark, Germany, and South Korea. India ranks 8th, while China ranks much

[18]The ratio is calculated separately for each year between 1990 and 2011, and then the average is reported for each country.

[19]The ratio is calculated separately for each year between 1990 and 2011, and then the average is reported for each country.

lower due to the large amount of FDI flowing into China. Figure 3 presents the time-series of the ratio of global private equity investments to global FDI inflows. It shows the increasing importance of private equity investments as another source of international capital flows. Overall, Table 1 shows that private equity has become global, and although U.S., U.K., and other big European countries remain big hubs for private equity investments, emerging economies such as China, India, and Brazil also get a large portion of the total private equity capital invested globally.

Table 2 provides the industry distribution of total private equity, buyout and venture capital invested globally from 1990 to 2011. The technology sector received the highest amount of capital, followed by industrial goods and services, and health care. The technology sector saw more venture capital than buyout ($133 billion versus $124 billion) while a very big portion of private equity capital invested in industrial goods and services is buyout (only 7% of total invested capital is venture capital). The health care sector received $168 billion of private equity capital in total, with 40% of it being venture capital. In almost all the other sectors, buyout capital makes up more than 90% of the investments with the exception of telecommunications where the share of venture capital is around 20%. Overall, Table 2 exhibits that venture capital went more into R&D intensive sectors such as technology and health care, while buyout capital dominated most of the other sectors.

The data on industry performance variables come from Datastream's Global Equity Indices that provides accounting as well as market price data for different industries in 53 countries classified based on the Industry Classification Benchmark (ICB). Datastream's indices cover over 75,000 securities worldwide. The industry-wide measures are calculated using data from financial statements of publicly listed companies whose stocks cover at least 75% of the total market capitalization in each country-industry. The private equity investment data are matched to the industry performance data at the country-industry-year level using the ICB classification. Additional country-level variables used in the analysis come from World Bank's World Development Indicators (WDI), which are then matched to the other data by country and year. Country-level data on legal environment, namely quality of institutions and intellectual property rights, and level of innovative capacity come from World Economic Forum's Global Competitiveness Index database. The final matched dataset has around 11,000 country-industry-year observations covering 48 countries and 19 industries.

Table 3 presents summary statistics for the industry- and country-level variables.

Variable definitions are provided in Table A1. Over the sample period, industry-wide employment grew at 7.1% on average, while median employment growth is 2.4%. Labor productivity growth averages at 6.6%. These are fast rates for industry-wide employment and productivity growth, but we note that the sample includes developing economies where production in industries outside of agriculture often grows rapidly. Average (median) net profit margin growth is 0.8% (0.2%). The average (median) industry return (annual percent change in the total return stock index for the industry) is 9.8% (12.2%). Panel B presents summary statistics for the country-level variables. Average (median) GDP growth is 2.2% (2.5%). Public market is a measure of the liquidity of a country's stock markets, measured as the total value of stocks traded as a percentage of GDP. The average (median) market value of public equities is 48% (22%) of GDP. Similarly, private credit to GDP is a proxy for the credit market development of a country, measured by the total amount of credit given to the private sector as a percentage of GDP. Private sector credit is on average 80% of a country's GDP.

3.2 Univariate Comparisons of Performance across Country-Industries

In Table 4, we compare average and median employment growth, profitability growth and productivity growth, along with some other variables, in subsamples of country-industry-years. Columns 1 and 2 of Panel A present mean (median) values for the subsamples based on a private equity indicator which takes the value of 1 if the country-industry received capital in that year, and 0 otherwise. Column 3 presents p-values for the mean (median) difference between these subsamples from a t-test (Wilcoxon rank-sum test). Average employment growth and profitability growth are both higher in country-industries with a private equity investment, while average labor productivity growth is higher in the subsample of country-industries that did not receive any private equity capital. The negative association with productivity growth might reflect private equity companies choosing less productive country-industries to invest where there is more room to add value. The average growth in capital expenditures, net debt and industry returns are not significantly different among the subsamples. Furthermore, countries that receive private equity capital seem to have more developed stock and credit markets, while having slower GDP growth on average. Thus, private equity capital flows more into developed countries, which typically have slower output growth and more developed financial markets. This is

consistent with the U.S. and U.K. receiving high amounts of capital and availability of better exit opportunities in those countries.

Next, we limit the sample to country-industry-years with positive amounts of private equity capital invested, and compare means among subsamples of high versus low levels of investment. Results are presented in Columns 4, 5 and 6 in a similar fashion. Several of the results are similar to the earlier comparison. Country-industries that received higher amounts of private equity capital have faster growth in employment and profitability on average at the time of investment, and the differences are larger in magnitude. Capital expenditure growth is not statistically different among the subsamples, as in the earlier comparison. In contrast to results reported in Panel A, industries that receive higher amounts of private equity capital have higher industry returns and debt growth.

Overall a couple of observations can be made from the univariate comparisons. Industries that receive private equity capital have higher employment and profitability growth than industries that do not, and among the industries that received investment, those with higher amounts of capital experience faster growth. Labor productivity growth seems to be lower in industries with private equity investments, but among the industries with private equity investments, there is no statistically significant difference. Industry stock returns have no clear relation to private equity investments made, however among the industries with private equity investments, more capital is associated with higher stock returns at time of investment.

These results suggest a possible positive relationship with the level of private equity capital invested in an industry and employment growth, profitability growth, and industry stock returns. The relationship of private equity with productivity growth, on the other hand, seems to be ambiguous. Although these results are suggestive, it is not possible to draw conclusions about the relationship between private equity and industry performance given the host of other factors that determine industry characteristics. Chief among these is that the decision of private equity companies to invest in a specific industry, in a specific country, is likely determined by industry growth, efficiency, etc. Though a multivariate analysis would allow us to include additional controls, OLS is not an appropriate model. Thus, we exploit the panel nature of the dataset and utilize a Vector Autoregression (VAR) model on the panel of country-industry-years. The next section discusses the panel-VAR approach.

4 Empirical Strategy – Panel VAR

A VAR is a system consisting of N linear equations with N variables where each variable is explained by its own lagged values together with the current and past values of the remaining $N - 1$ variables in the system. After being introduced by Sims (1980), it has been widely used to explain the dynamic behavior of multivariate economic and financial time-series. The main advantage of this estimation methodology is that it treats all the variables in the system as endogenous which leads to a better identification of the dynamic relationships between the variables in the system. In the absence of exogenous instruments, a VAR estimation is useful for addressing issues related to endogenous variables.

Although the VAR approach is long-established, it has not been widely used on panel data until recently. Love and Zicchino (2006) apply a VAR model on firm-level panel data from 36 countries in their study of the dynamic investment behavior of firms in an attempt to isolate the impact of financial factors from fundamental factors that affect firm investment. We follow their empirical methodology and apply a VAR on the panel of country-industry data from 48 countries in the period of 1990 – 2011. In addition to utilizing the time-series component of the data treating the variables in the system as endogenous, the panel VAR also allows for unobserved individual heterogeneity by including country-industry fixed effects in the estimation. More specifically, following Love and Zicchino (2006), we estimate a panel VAR system of the following form:

$$X_{ci,t} = \alpha_0 + \alpha_1 X_{i,t} + \mu_{ci} + \tau_t + \epsilon_t \ , \tag{1}$$

where

$X_{ci,t}$: a three or four variable vector consisting of industry-level variables together with a measure of private equity capital invested

$\mu\mu_{ci}$: country-industry fixed effects

τ_t : time fixed effects.

Country-industry fixed effects are included to control for any unobserved time-invariant individual heterogeneity in the variables. In a single model specification, fixed effects may be removed by demeaning all the variables in the model at the individual observation level (country-industry in this case). However, in this type of VAR

specification, where all variables are instrumented by their lagged values, fixed effects introduced by demeaning would be correlated with the regressors violating the exclusion restriction of the instruments. To avoid this problem, we apply a forward-mean differencing method, also known as the "Helmert" procedure (Arellano and Bover, 1995), where only the forward-mean for every country-industry-year is removed. After the Helmert transformation, the model is then estimated using a system GMM where lagged values of the regressors are used as instruments. The specification also includes time-fixed effects to remove the effect of global macro shocks that might affect all the variables in the system.

In a VAR specification, the ordering of the variables in the estimation does matter. The assumption is that every variable in the system affects the subsequent variables both contemporaneously and with a lag, while later variables affect the previous ones only with a lag. In other words, variables that appear earlier in the ordering are assumed to be more endogenous. In the estimations throughout the paper, we assume that private equity capital invested affects the industry variables both contemporaneously and with a lag, while it is impacted only with a lag.[20]

The goal of the panel VAR methodology is to identify the direction of causality between private equity capital invested in an industry and industry growth in terms of employment, productivity, and profitability. It should be noted that as the industry measures are aggregated from publicly listed companies in an industry, the effect that will be identified would be a measure of spillovers from private equity-backed companies to the rest of the industry.

5 Private Equity and Spillovers within the Industry

5.1 Private Equity and the Real Economy

In this section, we estimate a panel VAR as in equation 1, where the X vector includes the amount of private equity capital invested in an industry, adjusted by industry sales, industry-wide employment growth, profitability growth and labor productivity growth. This method identifies the impact of private equity capital on the growth in

[20] A caveat to this is, if private equity companies observe industry performance and quickly time their investment within the same year, the VAR where private equity capital is the first variable in the system will not capture this. However, all the results in the paper stay the same when we change the ordering of the variables in the system.

employment, productivity and profitability of the public firms in an industry so as to measure technology and productivity spillovers from private equity backed-companies to the rest of the industry.

Employment, labor productivity and profitability are jointly determined in an industry, and private equity companies observe past performance of an industry when deciding whether or not they should make an investment. As such, all the variables are endogenous. The VAR model allows us to identify the direction of causality between the variable of interest, private equity capital invested, and the other variables in the system to the extent that the amount of private equity capital invested in a country-industry is exogenous after controlling for lagged values of industry performance in that country.

If the private equity companies bring in new technologies and management practices that lead to improvements at the target companies, and other companies within the same industry absorb the resulting spillovers, we should observe a positive impact on industry prospects.[21]

Table 5 presents the results of the panel VAR estimation. The coefficients are from the system GMM estimation where all the variables at time t are regressed on their own lag together with the lags of the other variables in the model.[22] The first column shows how the amount of private equity capital invested at time t is affected by employment growth, profitability growth and productivity growth at time t-1. All the coefficients are statistically insignificant with the exception of the variable's own lag, suggesting that private equity capital invested is not affected by how the industry did a year ago in terms of employment, profitability, and labor productivity growth, after controlling for the amount of capital invested at time t-1 and removing country-industry, and time fixed effects. The significant coefficient on the amount of private equity capital at time t-1 suggests that private equity capital is persistent, which is not surprising given that many private equity (and especially VC) investments are

[21] Reverse causality could stem from private equity companies' predictions about the industry prospects which is hard to control empirically. However, the cross-sectional evidence presented in Section 5.4 is consistent with a causal effect of private equity on industry spillovers, while an explanation of superior foresight would not have the same cross-sectional predictions.

[22] Although the paper provides results with a one-year lag VAR only, results do not change when we estimate VARs with two- or three-year lags. Existing statistical tests for the optimal number of lags can not be applied to panel data. However, a likelihood ratio test between models with one, two and three lags indicates that the models with two or three lags do not fit significantly better than the model with one lag. Furthermore, Cochrane (2005) suggests that economic theory does not say much about the orders of autoregression terms, and short order autoregressions should be used to approximate for processes.

completed in rounds.

The second column presents the results from the part of the estimation where the dependant variable is employment growth. Employment growth at time t is significantly affected by productivity growth, and profitability growth at time t-1. After an industry experiences faster growth in profitability and higher productivity, it also grows faster in terms of employment subsequently. The main variable of interest for the purpose of this paper is private equity capital invested. It also has a significant and positive coefficient: public companies in industries that receive more private equity capital experience faster employment growth following the investment. Recall that any unobserved time-invariant heterogeneity is removed by country-industry fixed effects in the estimation. This result indicates that on average employment in a country-industry grows faster following a private equity investment. Because employment growth is total employment growth of the public companies in the industry (which do not receive private equity investment), the effect being measured is the spillover effect from private equity-backed targets on to public industry peers. This result is consistent with the hypothesis that as private equity-backed companies become more efficient, the other companies within the same industry are also forced to improve their operations to compete. More efficient operations result in growth resulting in more industry-wide employment.

The third column shows how labor productivity changes following a private equity investment into the industry controlling for changes in employment and profitability together with the growth in labor productivity from the previous year. Lagged employment and profitability growth are not statistically significant. The coefficient on the amount of private equity capital invested is positive and significant at the 1% level indicating that overall industry productivity grows faster following the flow of private equity capital. So, not only employment, but also labor productivity grows faster subsequent to private equity companies investing in an industry. This result is consistent with private equity companies introducing practices and technologies that increase operational efficiency of their portfolio companies, and these efficiency gains spilling over to higher productivity at competing firms.

While the second and third columns show the positive impact of private equity on labor productivity and employment growth, they do not provide evidence about the cost effectiveness of these improvements. The higher growth in labor productivity suggests an increase in sales, but does not show that this increase in sales is captured by higher profits. For example, if sales per employee increases because employees work

more hours or because of new investment in overly costly technologies, profits may deteriorate. This, in turn, may lead to lower firm values. As such, it is important to see how profitability changes as a response to the private equity investment within the industry. The fourth column presents these results. While neither lagged employment growth nor lagged productivity growth are significant after removing fixed effects and controlling for lagged profitability growth, the amount of private equity capital again has a positive and statistically significant relation: after an industry receives private equity investment, profitability grows faster in comparison to years with no or low private equity capital.[23] This result indicates that the gains in productivity and growth in employment are also reflected in profits.[24]

Overall, the results in Table 5 show that following private equity investments into an industry, public companies within the same industry that do not receive investment experience higher employment, productivity and profitability. These results suggest that after some companies in an industry receive private equity investment and become more efficient, other companies within the same industry are also forced to improve. This may result from the competitive pressure from the private-equity backed companies as well as from imitation of better practices implemented by the private equity companies. The panel VAR method controls for reverse causality to the extent that private equity companies make their decisions about investing in a particular industry based on what happened in the industry in the past. Past industry performance is not related to the amount of private equity capital invested into the industry suggesting a causal effect where private equity investments lead to spillovers within industries.[25]

[23]One might be concerned that profit margins increase due to a reduction in sales as profitability is measured as net profits over sales. However, in unreported tests we find that sales growth increases as well indicating that the increase in profitability results from higher sales and lower costs. Section 5.5 shows that buyout transactions lead to higher leverage levels within the industry suggesting that tax benefits from higher leverage is another factor leading to higher profitability.

[24]It is hard to tell if the spillover effects documented here are small or large since there is no benchmark to compare them to. However, they are comparable in magnitude to the effects found in Bernstein et al. (2016), the only other study looking at industry-level changes. It should be noted that their industry measures include the companies that actually receive private equity investments while we are examine changes in public companies within the same industry. Hence, one would expect their results to be larger in magnitude. However, they do not observe the amount of actual capital invested and use only an indicator variable for the existence of any private equity transaction, which makes it harder to compare their results to the magnitudes documented here.

[25]This is to the extent that private equity investments are exogenous after incorporating all the information about how the industry did in the past. While this finding excludes reverse causal-

The reported results indicate that private equity investments create positive externalities within an industry. As such, the gains at the rest of the industry suggest that private-equity backing leads to efficiency gains at the target company first, which then are also absorbed by the other companies within the same industry. Previous research has shown that private equity leads to performance gains at the target companies.[26] The evidence indicates firm-level performance gains ranging from 10% to 40% depending on the study and the measure of operating performance examined. The economic magnitudes of the positive effects presented here are significantly smaller than firm-level effects, which is logical given that what is being captured here are spillover effects only. The effects become larger when looking at a two- or three-year window, but are still significantly smaller than the documented firm-level effects.

These findings also complement the large body of studies that have provided evidence for positive spillovers from foreign owned companies onto local industries (Blomstrom and Kokko, 1998). Given the increased share of private equity investments when compared to FDI as shown in Figure 3, it is important for policy makers to consider private equity investments as an alternative source of productivity and technology spillovers. Additionally, our results suggest that spillover effects should be taken into account when assessing the impact of private equity on the real economy.

5.2 Buyout versus Venture Capital

The previous section shows that private equity investments lead to performance gains within the industry, however, we did not differentiate between the two main types of private equity: buyout and venture capital. In a typical buyout transaction the private equity firm acquires a target firm by purchasing all of the outstanding equity, often with a significant amount of debt financing. The typical buyout transaction

ity stemming from past values of industry performance affecting private equity investments, there might be other time-varying unobservables that are driving the findings. One could argue that private equity companies have superior foresight and time their investments based on their expectations about the industry prospects going forward. It would admittedly be impossible to perfectly control for expectations and fully exclude the alternative explanation of market timing. However, although no single finding would be conclusive by itself, the evidence provided throughout the paper, including the different findings for buyout versus venture capital as well as the cross-sectional findings, altogether are indicative of a causal relationship where private equity investments lead to spillovers. For a discussion of the alternative hypothesis of market timing and foresight by the private equity companies see the robustness section.

[26] Kaplan (1989) and recently Guo et al. (2011) both have shown that profitability increases after buyouts. Furthermore, Lichtenberg and Siegel (1990) and Davis et al. (2009) provided evidence for productivity gains following buyouts. The higher growth in industry-level productivity and profitability confirm the findings of the aforementioned studies.

is financed with 60 to 90% debt (Kaplan and Stromberg, 2009). Leveraged buyouts first appeared in early 1980s, declined in popularity in 1990s, but then re-emerged in the mid-2000s. Although buyouts are sometimes criticized for loading-up target companies with debt, cutting jobs, and reducing capital expenditures, the previously cited evidence shows that buyouts on average make their targets more efficient.

On the other hand, a typical venture capital transaction is an investment into a young company without acquiring majority control. Venture capital investments typically provide financing for small businesses that otherwise cannot get financing due to high risk and informational asymmetries. As such, venture capital prevents young companies from having to forgo positive investment opportunities. Additionally, venture capital investments are typically associated with an increase in the target company's innovative potential by allowing for more research and development investments and by providing expertise and guidance related to innovation. Kortum and Lerner (2000) provide evidence that venture capital investments indeed spur innovation, and this result is replicated in other studies using both U.S. and European data.[27]

Given the very different structures of these two transactions, they might also differ in terms of their impact on industry dynamics. To explore if buyout and venture capital have different impacts on industry dynamics, we repeat the panel VAR analysis from Table 5 by strategy. Panel A and Panel B of Table 6 present the results with buyout and venture capital, respectively. The results in Panel A indicate that the earlier results about the impact of total private equity capital invested on industry employment and profitability are replicated when using buyout capital only. So, buyout capital invested in an industry leads to higher employment and profitability growth. We do not find any evidence in line with the critics arguing that buyout transactions lead to job cuts, at least at the industry level. As for productivity, we do not find any evidence supporting the view that buyout transactions lead to higher productivity at the industry level. This suggests that buyout transactions lead to improvements in profitability through cutting costs and financial engineering, but their impact on labor productivity is not significant.[28]

Panel B presents the results with venture capital. The coefficient on lagged private

[27]For example, Popov and Roosenboom (2012) and Bernstein et al. (2015).

[28]This could be interpreted as buyouts leading to higher profits by cutting costs, but not through increases in sales. This would be consistent with buyouts adding value through financial engineering, where high levels of leverage lead to tax benefits as well as discipline managers with the pressure of making interest payments.

equity is larger for venture capital suggesting that VC investments are more persistent than buyout investments (and consistent with VC investments being conducted in multiple rounds). The impact of venture capital investment on employment growth and profitability growth is not statistically different from zero. So, unlike buyouts, we do not find reliable evidence for profitability gains or faster employment growth resulting from venture capital investments into an industry. Industry-level labor productivity, on the other hand, grows significantly faster following a venture capital investment.

The finding that profitability does not increase following venture capital investments, despite the significant increase in productivity, might be due to costly investments in new technologies that lead to higher innovation. The result that venture capital does not lead to higher employment might be the result of a crowding out effect. Companies receiving venture capital create new technologies, which initially might crowd out the existing businesses and stunt employment growth.

Venture capitalists typically make investments into small companies that are research and development intensive and have high growth opportunities. These firms often cannot get financing through other means. In that sense, venture capital investments reduce financial constraints. Therefore, in the short-term we might expect little or no employment or profitability spillovers onto the rest of the industry. Nonetheless, if venture capital leads to innovation and productivity spillovers, this should lead to higher profitability and employment growth in the long-run. In untabulated panel VAR's with 2- and 3-year lags we find that it is indeed the case. The amount of venture capital invested at time t-2 and t-3 leads to higher employment growth as well as higher profitability at time t.[29] This supports the argument that venture capital facilitates innovation of new technologies that result in productivity spillovers.

To summarize, while buyout investments lead to an increase in employment and profits we do not see an immediate impact on these from VC. However, VC has an impact on productivity growth in the next year and the evidence suggests a longer time may be needed for impacts to be reflected in higher profits and employment growth after venture capital investments. The lack of significant productivity spillovers from buyouts suggests that the operational and financial improvements introduced by private equity companies in buyout transactions are more focused at reducing costs and

[29]The effect of twice-lagged venture capital invested on profitability growth is larger in magnitude than the effect of lagged buyout capital invested. While a one standard deviation increase in lagged buyout invested leads to a 1.8% increase in profitability growth, a one standard deviation increase in twice-lagged venture capital invested leads to a 6% increase in profitability growth.

increasing profits, but do not necessarily lead to higher sales growth. The large impact of venture capital on productivity growth is consistent with the existing evidence showing a positive relation between venture capital and subsequent innovation (Kortum and Lerner, 2000; Mollica and Zingales, 2007; Bernstein et al., 2015). It is also consistent with the recent study of Gonzales-Uribe (2016), which shows that venture capitalists spur innovation through a better diffusion of knowledge. Furthermore, the larger effect on industry productivity might also be related to the absorptive capacity of the industries receiving venture capital investment. Venture capital investments are more common in high R&D industries, which have been shown to better absorb spillovers due to higher levels of technical knowledge and human capital in the FDI spillovers literature (Kogut and Chang, 1991).

5.3 Private Equity and Investment

Some evidence documents reductions in capital expenditures at PE-backed companies (Kaplan, 1989). While reduced expenses might increase profitability in the short-run, it raises concerns about future cash-flows being sacrificed for short-term operational gains. In contrast, studies looking at stock market performance of private equity-backed companies that are taken public provide evidence for superior returns, which indirectly suggests that long-run prospects are not hurt. To examine this issue directly, we estimate the panel-VAR model with growth in free cash flow, growth in capital expenditures, growth in market-to-book, and the private equity measure to detect the dynamic relationship between industry-level investment and private equity. Free cash flow is included to control for the sensitivity of investment to the availability of internal financing, while market-to-book is used as a proxy for investment opportunities.

Table 7 presents the results. The first column shows that the amount of private equity capital is not related to past values of cash flow, capital expenditure, and market-to-book growth, while the result about the persistence of private equity capital still holds. The second column shows that growth in free cash flows at time t is not related to private equity investments and capital expenditures at time t-1 (after controlling for cash flow growth at time t-1 together with country-industry and year fixed effects.)

The result on the impact of private equity capital on industry investment is provided in the third column. We find that capital expenditures grow faster following

private equity investments within an industry indicating that technology spillovers resulting from private equity companies lead to faster growth in capital expenditures at other firms.[30]

This finding suggests that even if capital expenditures are frequently cut at target companies for cost reduction purposes, other companies within the same industry increase capital expenditures to compete with the private equity-backed firms. As such, the increased level of investment in the industry will facilitate overall industry growth. This finding is also consistent with Harford and Kolasinski (2012) who find that private equity transactions do not lead to underinvestment at the target companies, as well as with Lerner et al. (2008) who provide evidence on increased portfolio company patent productivity as an example of long-run investment after buyout transactions. More closely, our finding is consistent with Harford et al. (2015) who find that LBOs lead to higher R&D investment at a target's industry peers.

5.4 Spillovers Conditional on Country and Industry Characteristics

5.4.1 Spillovers and Competitiveness

The results so far suggest that there exist productivity spillovers from private equity-backed companies in an industry to the public firms within the same industry. How much improvement private equity companies provide for their portfolio companies and how well the resulting positive externalities are absorbed by the other firms within the same industry might be different depending on the characteristics of the country as well as the industry. In this section, we exploit the cross-section of countries and industries to investigate where the spillovers from private equity-backed companies are most pronounced.

First, we explore the level of competition within a country-industry. Caves (1974) and Blomstrom and Kokko (1998) suggest that within industry competition leads to more productivity spillovers from FDI. Similarly, as in the example of the Hertz buyout, we expect the spillover effects from private equity to be higher in more competitive industries. We investigate this in Table 8 and the estimation is identical to the earlier panel VAR.[31] The table presents the main panel VAR results on subsamples

[30] As expected, lagged cash flow growth is also found to be positively related to capital expenditure growth suggesting that availability of internal financing facilitates investment as found in previous studies examining cash-flow sensitivity of investment. Furthermore, capital expenditure growth is also related to past values of market-to-book showing that investment increases in response to higher investment opportunities.

[31] For brevity, we only present the results for the private equity variable (the first row from Ta-

of country-industries with high versus low levels of competition. Industry-level gross margins are used as a proxy for the level of competition with the idea that higher margins can be charged in less competitive industries. As predicted, we find that the positive impacts on employment, productivity and profitability are concentrated in country-industries with higher levels of competition suggesting that the competitive pressure within an industry is indeed an important factor leading to spillovers.

5.4.2 Spillovers and Legal Environment

Starting with the seminal work of La Porta et al. (1998) which examines the interaction of law and finance, many studies have examined the relationship between the legal environment, financial development and growth of a country. Lerner and Schoar (2005) show that the legal origin and level of law enforcement affect the type and value of private equity transactions. In countries with a weaker legal endowment, private equity companies can add value by mitigating contractual shortcomings with private contracting; however, Balcarcel et al. (2012) show that reliability in the legal environment limits the flow of private equity capital into countries with less developed legal systems. So, although private equity might be more beneficial to countries with weaker legal institutions, the weak legal environment discourages private equity investment and more importantly limits the implementation of technologies and practices that add value to the portfolio companies. Cumming and Walz (2009) find that private equity companies have higher returns in countries with stronger legal conditions and conclude that external corporate governance mechanisms are necessary for private equity companies to implement more efficient governance structures at the firm level.

Blomstrom and Kokko (1998) discuss that efficient regulations and institutions in a country might lead to higher spillovers from multi-national corporations onto local companies, but they also note that there is not enough evidence to make a clear conclusion about the issue. Mansfield (1994) finds that the strength of a country's intellectual property protection has a significant effect on FDI flows as well as on the extent of technology transferred from U.S. firms to their foreign affiliates. This would suggest that the implementation of new technologies and practices is expected to be stronger in countries with stronger intellectual property rights.

ble 5) All the other results are identical: none of the industry variables at time t-1 are related to the amount of private equity capital invested at time t mitigating concerns about reverse causality.

Based on these arguments, we predict that the positive impacts documented earlier should be more pronounced in countries with stronger legal institutions as well as better intellectual property protection. We examine how the legal environment impacts spillovers by splitting the sample based on a measure of the quality of legal institutions and a measure of intellectual property rights from the global competitiveness index published by the World Economic Forum.[32] The results are presented in Table 9. Panel A-B and C-D present the results for countries with weak versus strong institutional quality and intellectual property rights, respectively. The results show that the effects are more pronounced for the subsamples of countries with stronger legal institutions and intellectual property rights. These findings underline the importance of a country's legal environment for private equity companies to facilitate efficiency gains at their portfolio companies and create spillovers within the industry.

5.4.3 Spillovers and Innovative Capacity

Another important facet of spillovers is the ability of local companies to absorb them. A large literature in development economics argues that less developed economies will grow faster because they have lower diminishing returns to capital, and in the long-run, they will catch-up with developed economies (Barro, 1997).[33] In line with the catching-up theory, countries, where initial inefficiencies are higher and skills are in shorter supply, would be in greater need of the practices and technologies introduced by the private equity companies. Hence, industries in countries with lower technology levels might benefit more from the entrance of private equity capital. On the other hand, productivity spillovers might not take place in countries where starting technology levels are too low, because companies in such countries might be unable to provide a competitive response to private equity-backed companies, and private equity may lead to a crowding out of existing firms. Several studies have provided evidence on this issue suggesting that too large of a technological gap between the home country of multi-national corporation and the host country leads to smaller spillover effects. For example, Kokko et al. (1996) find that spillovers are only absorbed by companies that have moderate technology gaps with foreign firms.[34] To study the spillovers from private equity investments in countries with different levels

[32]Institutional quality index combines information on the judicial efficiency, law enforcement, corruption, investor protection, and reporting standards in a country.

[33]For example, Blomstrom and Wolff (1994) show that the entrance of U.S. corporations into Mexico leads to a convergence in productivity levels of local Mexican firms and U.S. firms.

[34]Haddad and Harrison (1991), Cantwell (1989), and Kokko (1994) also find similar results.

of technological advancement, we repeat the panel VAR in subsamples of countries created based on a measure of innovative capacity. The innovative capacity score comes from the global competitiveness index created by the World Economic Forum.

Table 10 presents the results. Panel A and B present the results for the subsamples of countries with low and high innovative capacity scores, respectively. Panel C presents the results for the rest of the countries, which have moderate levels of innovative capacities. As predicted, the positive impact of private equity investments on industry growth are most pronounced for the countries with moderate levels of innovative capacities. While the coefficients are positive for countries with the highest or lowest levels of innovative capacities, the results are not statistically significant. The results are identical when we use technological readiness score from the global competitiveness index as the proxy for the absorptive capacity of a country.

Overall, the cross-sectional findings in this section indicate that the positive impacts of private equity capital on industry dynamics are most pronounced in countries and industries with specific characteristics. Three main conclusions can be drawn. First, the positive impacts of private equity investments are concentrated in competitive country-industries suggesting that the competitive pressure is an important channel for spillovers. Second, stronger legal institutions are needed for manifesting positive spillovers. Third, the spillover effects are most effective in countries with moderate levels of technological development as these countries are not only still in need of the new practices and technologies introduced by the private equity companies, but also have the sufficient level of technological development that enables them to absorb the spillovers.

Besides providing evidence consistent with the existing literature on spillovers, the results in this section are also very important as they provide support for a causal effect of private equity investments on industry dynamics. All the cross-sectional results are consistent with the argument that private equity companies lead to positive externalities and spillovers within the industry, which are reflected in higher employment, profitability and productivity growth. It is hard to identify alternative explanations that would provide the same predictions about the results for the cross-section of countries and industries.

5.5 Private Equity and the Financial Economy

So far, our analysis has focused on how the real side of the economy is affected by private equity. In this section, we study the impact of private equity capital on two financial variables: leverage and stock returns. In buyout transactions, private equity companies typically buy their target companies using high levels of debt which may lead to higher rates of financial distress and bankruptcy.[35] On the other hand, higher leverage can also be a source of value creation at the target companies by providing better incentives for management as well as tax benefits. Jenkinson and Stucke (2011) find that leveraged buyouts generate significant value by higher tax shields. Similarly, Guo et al. (2011) argue that about 30% of returns of private equity transactions are due to the tax benefits of higher leverage. Thus, it is important to examine the implication of buyout capital for the overall debt level of an industry.

Additionally, the results so far have provided evidence for industry-wide performance improvements following private equity investments. However, it is not shown what the implications are for share values. If these improvements are reflected in investor beliefs, we should observe a positive association between industry returns and the amount of private equity capital invested. A thread of the private equity literature has provided evidence that private equity companies invest into industries/companies that recently had high stock market returns. Our panel-VAR approach allows us to examine two-way causality.

To investigate these questions, we estimate a panel VAR model with the amount of private equity invested, growth in industry-wide debt, and growth in the value of industry return index to examine the dynamic relationship between private equity and the two financial variables. Table 11 presents the results. Panel A and B have the results for buyout and venture capital, respectively. The first columns of Panel A (B) show that the amount of buyout (venture) capital invested at time t is not related to debt growth at time t-1. The insignificant coefficient on lagged industry returns in the first columns of both panels contradicts the existing evidence that private equity companies chase returns and eliminates concerns about reverse causality. The second column in Panel A shows that buyout capital leads to higher growth in industry-wide debt and there is no evidence of debt causing higher PE investment. This result is

[35]The existing evidence on this issue is mixed. Andrade and Kaplan (1998) find that 23% of large public to private transactions defaulted during the 1980s. Kaplan and Stromberg (2009), on the other hand, find that the average default rate of leveraged buyouts is lower than the average default rate for all U.S. corporate bond issuers.

consistent with high levels of debt at the private equity-backed companies forcing the other firms in the industry to lever up as well, and hence industry-wide debt grows faster following the private equity investment.[36] Although higher debt levels would create value through tax shields, the impact on firm value would depend on the change in risk associated with financial distress and bankruptcy. Assuming that adverse effects of bankruptcy costs would be reflected in stock prices, looking at stock returns would be suggestive. The third column in Panel A shows that buyout investments in an industry lead to lower stock values. This result indicates that the spillovers in the industry are not welcomed by equity investors .[37]

The second column of Panel B shows that there is no significant relationship between the amount of venture capital invested and industry debt. Similarly, the third column of Panel B shows that there is no significant relationship between venture capital and industry stock returns within a one-year time frame.[38]

Overall, two conclusions can be drawn from the results in this section. First, the high debt levels of private equity backed-companies in buyout transactions lead to an increase in debt levels in the industry as a whole. Assuming the increase in leverage moves the industries closer towards the optimal capital structure, this might be one of the channels that private equity companies add operational value. However, the negative relation between buyout capital invested and stock returns suggests the higher levels of debt may be undesirable in the short-run. Second, the positive externalities created by the private equity companies in an industry on the real side are not reflected in higher stock returns over the short time frame we are looking at.[39]

[36]Similarly, Titman and Safieddine (1999) show that targets of unsuccessful takeover attempts also increase leverage and experience higher operating performance subsequently. Another interpretation of the increase in debt levels could be that the inflow of private equity capital into an country-industry is correlated with other capital flows, which would make debt financing cheaper and lead to higher debt within the industry. However, that would suggest the same increase after venture capital transactions as well, which is not the case as Panel B shows.

[37]This is somewhat surprising given the earlier results about industry-wide improvements in real performance. To see if/when the gains in operating performance are reflected in stock values, we repeat the panel VAR with 2- and 3-year lags. Stock values are also negatively impacted by the amount of buyout capital invested at time t-2, while they are positively related to the amount of buyout capital at time t-3. This suggests that investors initially dislike the inflow of buyout capital into the industry, which leads to lower stock values; however, the improvements in operating performance are later reflected in higher stock values.

[38]When we repeat the analysis with 2 and 3 year lags, we find a positive association between venture capital invested and industry stock returns but results are statistically insignificant.

[39]As a robustness check, we repeat the analysis in this section on Asian countries only, since private equity companies typically acquire minority stakes in those countries due to strict regu-

5.6 Robustness

5.6.1 The Alternative Explanation of Market-Timing

An alternative story that could potentially explain the findings of the paper is a market-timing argument. One could indeed argue that private equity companies have informational advantages and superior foresight about an industry's prospects. If that is the case, they would invest in a specific country-industry that they predict would grow, and that might be driving the results documented in this paper. The panel VAR controls for this to the extent that the expectations of the private equity companies about the industry growth are shaped by how the industry did in the past. However, it would be impossible to fully exclude an information story where the private equity companies have foresight and enter into an industry based on superior information as their expectations may not be perfectly correlated with the industry performance in the past. Nevertheless, the discussion in this section suggests that market-timing cannot be the only driver of the findings of the paper.

First, some existing evidence suggests that private equity companies are not timing the market when exiting a portfolio company (Ball et al. 2011). Given this lack of market-timing ability on exit, it seems less likely that PE investors are able to time the market when entering into an industry (i.e., when they have less operating knowledge of the industry). If PE firms can time investments in an industry this would be consistent with the documented faster growth in employment, profitability and productivity. However, if they have superior foresight and are able to time the market, industry stock returns should also be higher following their investments. The results in Table 11 show that stock returns are lower subsequent to buyout investments. Thus, this seems inconsistent with a market timing explanation.

The cross-sectional findings presented in Section 5.4 are all consistent with spillover effects from private equity-backed companies to the publicly listed firms within the same industry, while they are not with a market-timing explanation. Specifically, it is hard to conceive of why private equity companies have informational advantages in countries with better legal institutions and be able to time the market, whereas they cannot do so in other counties? In contrast, it seems more plausible that informational advantages of private equity companies are stronger in countries with

lations. Indeed, the results on buyout investments are quite different. We find that there is no significant effect on industry debt growth, which indicates that the minority stake buyouts are not highly levered as regular buyouts. Consistent with that, we do not find that stock returns are lower; they indeed are higher after private equity investments in Asia.

weaker legal institutions where informational asymmetries are higher. It is also hard to consider why private equity companies would be able to time the market in countries with a moderate level of technological capacity, but not in others. Finally, we predict and find that spillovers are stronger in more competitive country-industries, and it is again hard to understand why market-timing would work for competitive country-industries, but not for others.

While none of the above explanations may be sufficient to fully exclude a market-timing hypothesis, when put together they support a causal link where private equity investments lead to spillovers resulting in superior industry performance. Still, we acknowledge that it is not possible to fully exclude a selection argument in the lack of a natural experiment or a strong instrument. Nevertheless, even if one believes that selection could explain all the findings in the paper, it would still mean that private equity companies are helping the economy and fostering growth by selecting promising industries and helping those industries reach their growth potential.

5.6.2 Robustness Checks

The panel VAR allows us to utilize the time-series of the data and treat all the variables in the system as endogenous. However, it limits our ability to include additional control variables and a saturated set of fixed effects other than country-industry and time fixed effects that we already include in the panel VAR. As such, as a robustness, we estimate our models with different OLS specifications where we estimate single equations with the industry growth variables as the dependent variable. If the PE companies have a global investment function for investment, it would be important to control for country-level demand and supply shocks as well as industry-level global shocks across time. Hence, we include a rich set of fixed effects in our OLS specifications such as country, industry, and year fixed effects; country*industry and year fixed effects; country*year fixed effects; industry*year fixed effects; country*year and industry*year fixed effects. None of the fixed effects change our results. Additionally, when running the OLS models we also include a measure of exogenous growth opportunities, similar to Bekaert et al. 2007, to control for the private equity companies' expectations about the country-industry's prospects. The measure is the world-wide price earnings ratio for an industry, which should capture growth options, including expectations about the future, for a specific industry in a country. The results stay the same when this measure is included in the specifications. One characteristic of the PE data is that it has many zeros by nature as many

country-industries do not receive any PE capital for some years. As one might be concerned about this truncation, we repeat our analysis with a subset of non-zero observations. All of our results indeed get stronger both economically and statistically with this subset of observations. The results are also robust to a different aggregation of the industry level. When industry measures and private equity investments are aggregated at a broader level, which results in 9 industries instead of 19, the results stay the same. This provides further support that market timing is not the only driver of the results as it is less plausible to think that private equity companies are able to have perfect foresight for industries that are defined more broadly.

One of the shortcomings of the Burgiss data is that its coverage is relatively weak before 1995 (Brown et al. 2012). So, one might be concerned that those years might bias the results in the paper. Nonetheless, all the results are identical when years before 1995, after which Burgiss' coverage is more comprehensive, are dropped from the sample. As the U.S. and the U.K. receive a large portion of private equity capital invested, one might be concerned that the results in the paper are driven by these two countries only. Nevertheless, when we repeat all the analysis excluding the U.S. and the U.K., we find that all the primary results are the same.

Another concern might be that the spillovers cannot take place within a year, although the Hertz example showcases that they indeed can happen over a short period of time. To address this, we repeat the analysis in the paper using VAR's with two- and three-year lags. The main results do not change and the strongest effect is indeed in the first year following the private equity investment.[40] Overall, the main results of the paper seem to hold regardless of the estimation method, set of fixed effects, controls, or sample used.

6 Conclusion

Private equity investments have risen dramatically during the last two decades, not only in developed countries but in developing economies as well. While researchers have explored how private equity firms impact their portfolio companies, it is surprising that there is no evidence on the implications of private equity for the economy as a whole. The well-established spillover literature in economics provides evidence that productivity spillovers exist within industries (Blomstrom and Kokko, 1998). Using

[40]It should also be noted that a 1-year VAR will still have responses past 1 year by nature of how the systems are autoregressive, i.e. shocks will continue to propagate.

a novel dataset on global private equity investments in 19 industries across 48 countries, we study the impact of private equity on industry dynamics. By focusing on aggregate industry measures of publicly listed companies, we are able to identify the productivity spillovers from private equity-backed companies to the other companies within the same industry.

In our analysis of the real economic impact of PE investments, we find that employment growth, profitability growth, and labor productivity growth all increase across the public companies in an industry following PE investments. Additionally, we find that industry-level capital expenditures grow faster as well. Considering the endogenous nature of private equity investment into a specific industry, we utilize a panel VAR. While treating all the variables in the system as endogenous, the model also allows for fixed effects to control for individual heterogeneity at the country-industry level. Concerns about reverse causality are reduced as we do not find evidence that past values of industry dynamics are significantly related to the amount of private equity capital a country-industry receives. The improvements in industry-level performance documented in this paper are consistent with an interpretation that the companies receiving private equity capital become more efficient and put pressure on the other companies within the same industry, which leads to overall performance gains among the public companies within the industry. As such, while providing novel evidence on industry spillovers from private equity onto industries, our findings are also consistent with the existing evidence on the positive impact of private equity on firm-level performance.

The spillover effects we document are found to be concentrated in country-industries with higher levels of competition suggesting that competition is an important channel for these spillovers. We further find that the impacts on industry growth are more pronounced in the subsample of countries with stronger institutions and intellectual property rights suggesting that private equity companies need a strong legal environment to be able to implement governance practices that lead to efficiency gains at portfolio companies. The positive effects are concentrated in countries with moderate levels of innovative capacities. These results are largely consistent with the literature that examines spillovers from foreign direct investments onto local industries and finds that companies with moderate levels of technological advancement are better absorbers of productivity spillovers (Khogut and Chang 1991, Kokko 1994, Kokko et al. 1996). Overall, the cross-sectional results further indicate a causal effect where private equity investments lead to higher industry growth through spillovers.

Finally, we investigate the implications of private equity for the financial characteristics. We find that debt levels increase in industries that recently received private equity capital, which suggests that financial structures used by the private equity firms also spill over within the industry causing other firms to lever up. This is consistent with studies that have shown evidence for large gains from tax shields (Jenkinson and Stucke, 2011) as well as studies that have found that higher debt levels reduce agency problems and prevent overinvestment (Harford and Kolasinski, 2012).

The findings of the paper are important as they provide evidence on the impact of private equity on industry dynamics, rather than individual companies, which is a largely unexplored area. The private equity industry has been criticized, especially by the popular press and labor unions, regarding their impact on the companies they invest in. This paper presents a more complete picture of the implications of private equity for the global economy. Hopefully, future research will more clearly identify the specific channels which create spillovers from PE-backed companies to the broader set of firms in each industry.

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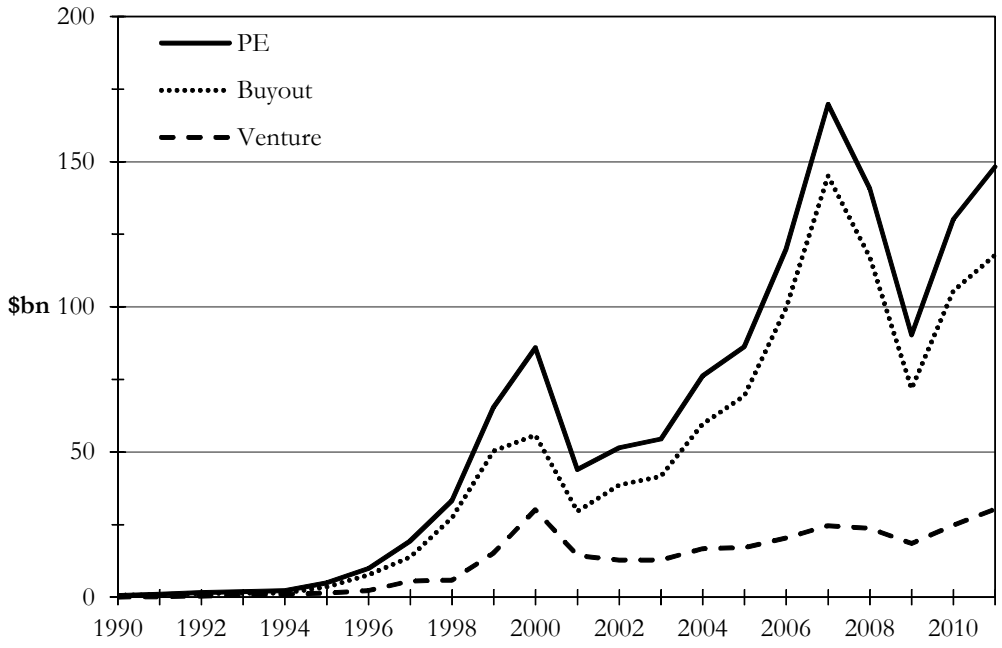
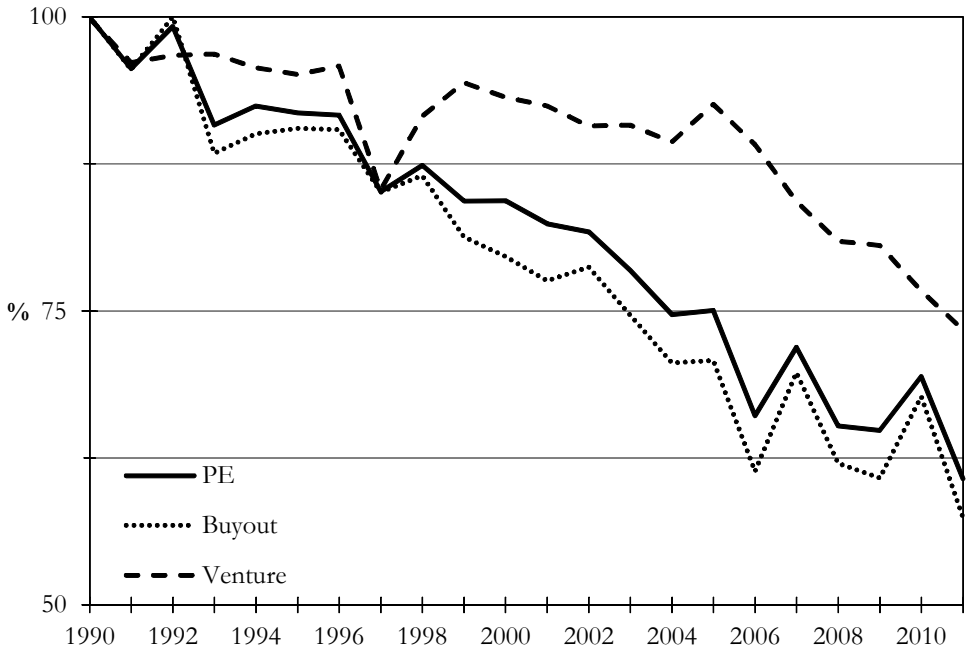
Figure 1: Time-series of Total PE Capital Invested Globally between 1990 and 2011



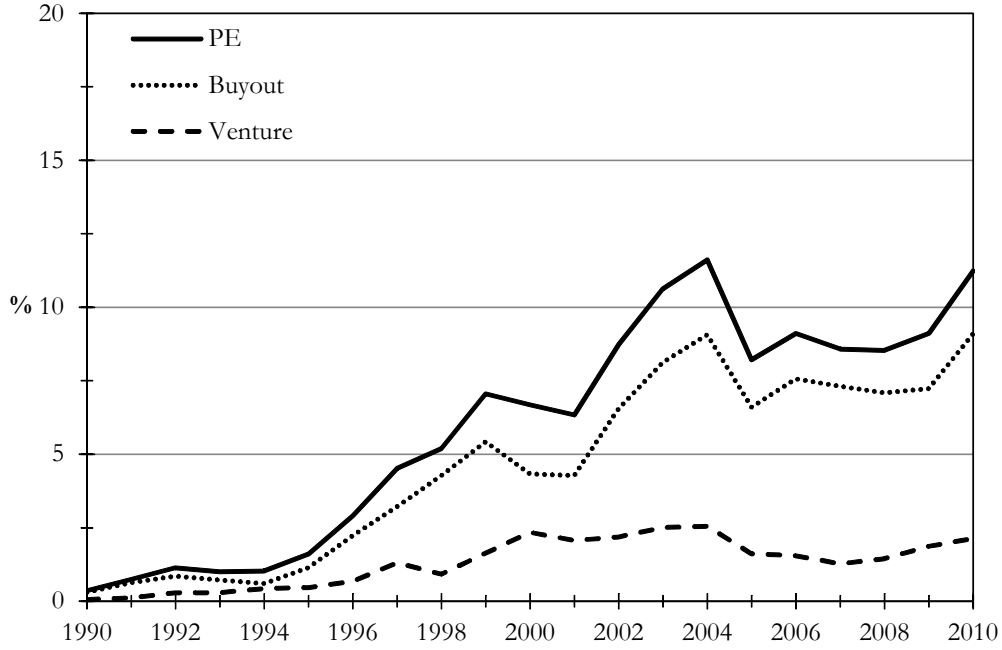
This figure plots the total amount of private equity capital invested in 48 countries between 1990 and 2011. The solid line plots the total of buyout and venture capital. The dotted line plots buyout capital and the dashed line plots venture capital. Amounts are in 2011 billion dollars.

Figure 2: U.S. and U.K.'s Share of the Total PE Capital Invested Globally, 1990 - 2011



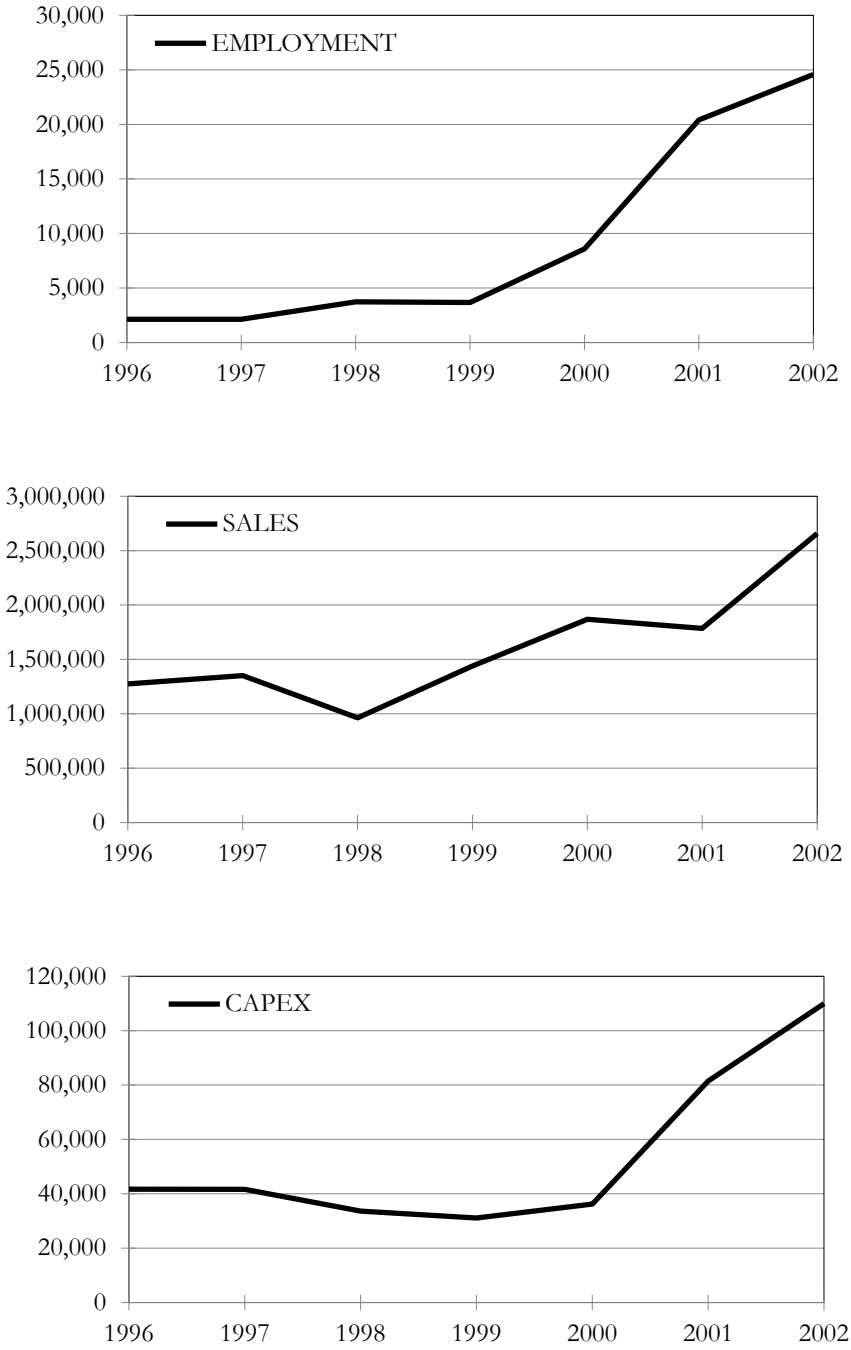
This figure plots the share across the U.S. and U.K. out of the total amount of global private equity capital invested between 1990 and 2011. The solid line plots their share out of the total of buyout and venture capital invested. The dotted line plots their share out of buyout capital and the dashed line plots their share out of venture capital.

Figure 3: Ratio of Total PE Capital Invested Globally to Total Global FDI Inflows, 1990 -2011



This figure plots the ratio of the total amount of global private equity capital invested to the total amount of global FDI inflows between 1990 and 2011. The solid line plots the ratio for the total of buyout and venture capital invested. The dotted line plots the ratio of buyout capital and the dashed line plots the ratio of venture capital. The ratio is calculated for every country for each year and the average across countries is plotted between 1990 and 2011.

Figure 4: Thailand Food and Beverage Industry around 1999



These figures plot industry employment, sales, and capex for the Thailand Food and Beverage Industry around 1999. The industry received $29 million PE capital in 1999. Employment is the total number of employees for all public companies in the industry. Sales is the total sales for all the public companies in the industry. Capex is the total capital expenditures for all public companies in the industry. Sales and Capex figures are in 2011 US dollars.

Table 1: Private Equity Investments Around the Globe

This table presents the distribution of private equity capital invested among the 48 countries in the sample between 1990 and 2011. The first, second, and third columns show the total amount of private equity capital, buyout capital, and venture capital, respectively. Panel A presents the countries ranked by the total amount of capital received. Panel B presents the countries ranked by the total amount of capital received as a percentage of GDP. Panel C presents the countries ranked by the total amount of capital received as a percentage of FDI inflow to the country. Amounts in Panel A are in 2011 million dollars. Panel B and C report averages of the ratios across years.

Panel A: Distribution of Private Equity Capital Invested Globally

Country	PE Capital Invested	Buyout Capital Invested	Venture Capital Invested
United States	852,771	622,343	230,428
United Kingdom	109,920	101,141	8,779
Germany	43,905	40,981	2,924
China	37,076	26,085	10,991
France	33,921	31,939	1,982
Italy	24,280	23,271	1,009
India	22,675	18,410	4,265
Netherlands	20,886	20,054	832
Sweden	17,871	17,096	775
Canada	17,771	14,513	3,258
Spain	16,677	16,495	182
Australia	15,620	15,033	587
Japan	11,841	11,216	625
Denmark	9,745	9,410	335
Brazil	8,359	7,614	745
South Korea	7,752	7,030	722
Israel	6,076	2,978	3,098
Norway	5,866	5,760	106
Switzerland	5,745	5,147	598
Hong Kong	5,227	4,533	694
Singapore	4,700	4,155	545
Argentina	4,506	4,481	25
Ireland	4,462	4,009	453
Belgium	4,329	4,086	243
Russia	4,036	3,660	376
Poland	3,557	3,106	451
Indonesia	3,460	3,403	57
Turkey	3,149	2,643	506
South Africa	2,880	2,801	79
Czech Republic	2,789	2,728	61
Finland	2,722	2,629	93
New Zealand	2,413	2,256	157
Austria	2,248	1,195	1,053
Mexico	1,464	1,411	53
Greece	1,306	1,305	1
Hungary	1,266	1,197	69
Thailand	863	789	74
Romania	783	719	64
Chile	734	624	110
Bulgaria	729	586	143
Portugal	681	681	0
Colombia	614	185	429
Egypt	481	442	39
Philippines	451	415	36
Malaysia	301	252	49
Venezuela	189	189	0
Slovenia	129	124	5
Peru	26	23	3

Panel B: Private Equity Capital Received as a % of GDP

Country	PE Capital Invested as a % of GDP	Buyout Capital Invested as a % of GDP	Venture Capital Invested as a % of GDP
United States	0.360%	0.262%	0.098%
United Kingdom	0.299%	0.274%	0.025%
Sweden	0.278%	0.266%	0.012%
Denmark	0.257%	0.248%	0.009%
Netherlands	0.224%	0.215%	0.009%
Ireland	0.185%	0.139%	0.046%
Israel	0.185%	0.088%	0.096%
Bulgaria	0.177%	0.142%	0.035%
Singapore	0.171%	0.148%	0.023%
Czech Republic	0.161%	0.157%	0.004%
New Zealand	0.142%	0.139%	0.003%
Norway	0.138%	0.136%	0.002%
Australia	0.134%	0.128%	0.006%
India	0.129%	0.106%	0.023%
Spain	0.109%	0.108%	0.001%
Hong Kong	0.107%	0.093%	0.014%
France	0.106%	0.100%	0.006%
Canada	0.100%	0.081%	0.019%
Hungary	0.100%	0.094%	0.006%
Germany	0.100%	0.093%	0.007%
Italy	0.095%	0.091%	0.004%
Switzerland	0.094%	0.084%	0.010%
Finland	0.088%	0.085%	0.003%
Belgium	0.078%	0.074%	0.004%
South Africa	0.077%	0.075%	0.002%
Poland	0.071%	0.060%	0.011%
Argentina	0.071%	0.070%	0.001%
Romania	0.069%	0.061%	0.008%
China	0.064%	0.045%	0.019%
Indonesia	0.062%	0.061%	0.001%
South Korea	0.053%	0.048%	0.005%
Austria	0.048%	0.026%	0.022%
Brazil	0.046%	0.042%	0.004%
Russia	0.045%	0.041%	0.004%
Turkey	0.039%	0.033%	0.006%
Greece	0.038%	0.038%	0.000%
Chile	0.036%	0.032%	0.004%
Thailand	0.027%	0.024%	0.003%
Portugal	0.025%	0.025%	0.000%
Slovenia	0.023%	0.022%	0.001%
Philippines	0.023%	0.021%	0.002%
Colombia	0.019%	0.006%	0.013%
Egypt	0.015%	0.014%	0.001%
Malaysia	0.013%	0.010%	0.003%
Mexico	0.011%	0.011%	0.000%
Japan	0.011%	0.010%	0.001%
Venezuela	0.007%	0.007%	0.000%
Peru	0.002%	0.002%	0.000%

Panel C: Private Equity Capital Received as a % FDI Inflow

Country	PE Capital Invested as a % of FDI Inflow	Buyout Capital Invested as a % of FDI Inflow	Venture Capital Invested as % of FDI Inflow
United States	22.88%	16.61%	6.27%
Denmark	12.53%	12.19%	0.34%
Germany	10.42%	9.05%	1.37%
South Korea	9.91%	9.28%	0.63%
Netherlands	7.69%	7.59%	0.10%
Finland	6.93%	6.87%	0.06%
United Kingdom	6.63%	6.03%	0.60%
India	5.35%	4.55%	0.80%
Israel	5.21%	2.33%	2.88%
South Africa	5.00%	4.93%	0.07%
Greece	4.84%	4.84%	0.00%
Italy	4.78%	4.48%	0.30%
Sweden	4.66%	4.40%	0.26%
Norway	4.03%	3.95%	0.08%
Indonesia	3.64%	2.35%	0.99%
New Zealand	3.00%	2.94%	0.06%
Argentina	3.00%	2.96%	0.04%
Czech Republic	2.97%	2.88%	0.09%
Japan	2.95%	2.76%	0.19%
Spain	2.56%	2.52%	0.04%
France	2.53%	2.35%	0.18%
Canada	2.30%	1.80%	0.50%
Australia	2.26%	2.14%	0.12%
Philippines	2.09%	1.98%	0.11%
Switzerland	1.90%	1.73%	0.17%
Austria	1.21%	0.60%	0.61%
Portugal	1.21%	1.21%	0.00%
Singapore	1.20%	1.04%	0.16%
Poland	1.18%	0.85%	0.33%
Turkey	1.10%	0.88%	0.22%
China	1.10%	0.79%	0.31%
Brazil	1.05%	0.96%	0.09%
Romania	1.02%	0.83%	0.19%
Bulgaria	1.00%	0.74%	0.26%
Ireland	0.95%	0.80%	0.15%
Thailand	0.68%	0.59%	0.09%
Hungary	0.67%	0.64%	0.03%
Hong Kong	0.59%	0.50%	0.09%
Russia	0.54%	0.53%	0.01%
Slovenia	0.51%	0.48%	0.03%
Belgium	0.42%	0.40%	0.02%
Mexico	0.39%	0.37%	0.02%
Malaysia	0.38%	0.31%	0.07%
Chile	0.37%	0.34%	0.03%
Venezuela	0.33%	0.33%	0.00%
Egypt	0.30%	0.27%	0.03%
Colombia	0.11%	0.11%	0.00%
Peru	0.03%	0.02%	0.01%

Table 2: Private Equity Investments Across Industries

This table presents the industry distribution of total private equity capital invested globally between 1990 and 2011. Industry classifications are at Industry Classification Benchmark's super-sector level. Column 1 reports values for total private equity, Column 2 for buyout, and Column 3 for venture capital. Amounts are in 2011 billion dollars, and provide the total amount of capital invested into a specific industry over the sample period.

	1	2	3
Industry	**PE Capital Invested ($bn)**	**Buyout Capital Invested ($bn)**	**Venture Capital Invested ($bn)**
Technology	258.57	124.78	133.78
Industrial Goods & Services	188.49	173.99	14.50
Health Care	168.30	104.22	64.07
Retail	120.82	106.93	13.89
Media	102.06	94.01	8.04
Financial Services	78.78	69.85	8.93
Travel & Leisure	65.32	62.99	2.33
Telecommunications	64.95	51.92	13.03
Personal & HH Goods	53.90	50.76	3.14
Food & Beverage	33.83	32.13	1.70
Oil & Gas	32.13	27.16	4.98
Insurance	27.39	26.32	1.08
Chemicals	26.91	25.74	1.16
Construction & Materials	25.70	24.34	1.36
Real Estate	21.76	20.37	1.39
Utilities	20.96	19.04	1.92
Automobiles & Parts	19.29	17.69	1.60
Banks	17.08	15.79	1.29
Basic Resources	11.63	11.04	0.59

Table 3: Summary Statistics

This table presents summary statistics for the industry and country-level variables in Panel A and B, respectively. Private equity, buyout, and venture capital invested are measured as a percentage of industry sales. Private equity, buyout, and venture capital invested with a plus provide summary statistics for the PE variables excluding the country-industry-years with no investment. *Employment growth* is the log difference in industry-level employment for public firms between time t and t-1. *Profit margin growth* is the log difference in industry-level net profits over sales for public firms between time t and t-1. *Productivity growth* is the log difference in industry-level sales per employee for public firms between time t and t-1. *CAPEX growth* is the log difference in industry-level capital expenditures for public firms between time t and t-1. *Industry returns* is the log difference in the value of the industry stock return index between time t and t-1. *Debt growth* is the log difference in industry-level net debt for public firms between time t and t-1. Industry growth variables are winsorized at the bottom and top 5% of the distribution. *Stocks traded to GDP* is the total value of stocks traded in the country as a percentage of GDP. *Private credit to GDP* is the total credit in the country as a percentage of GDP. Summary statistics are in percentages.

Panel A: Industry-level

Variable	N	Mean	Median	Std. Dev.
PE Capital Invested	11,764	0.97	0.00	7.06
Buyout Capital Invested	11,764	0.77	0.00	5.94
Venture Capital Invested	11,764	0.20	0.00	2.98
PE Capital Invested^{+}	4,071	2.81	0.23	11.79
Buyout Capital Invested^{+}	3,579	2.54	0.24	10.56
Venture Capital Invested^{+}	1,994	1.72	0.13	8.50
Employment Growth	11,764	7.07	2.44	16.24
Profit Margin Growth	11,764	0.77	0.15	47.86
Productivity Growth	11,764	6.55	7.09	20.95
CAPEX Growth	10,459	9.86	7.61	38.39
Industry Returns	10,514	9.81	12.19	21.43
Debt Growth	9,052	14.05	9.42	34.54

Panel B: Country-level

Variable	N	Mean	Median	Std. Dev.
GDP Growth	1,004	2.23	2.53	3.79
Stocks Traded to GDP	975	47.95	22.49	71.35
Private Credit to GDP	983	80.72	76.48	52.03

Table 4: Univariate Comparisons

This table shows that public companies in country-industries with more private equity investments on average have higher growth. The table presents mean (median) comparisons. Columns 1 and 2 present means (medians), and Column 3 presents *p*-values for the difference in means (medians) using a *t*-test (Wilcoxon rank-sum test) in both Panels. Panel A compares means (medians) of country-industry-years with and without private equity capital. Panel B compares means (medians) for country-industry-years with high versus low amounts of private equity capital among the country-industry-years with non-zero private equity investments. *Employment growth* is the log difference in industry-level employment for public firms between time *t* and *t*-1. *Profit margin growth* is the log difference in industry-level net profits over sales for public firms between time *t* and *t*-1. *Productivity growth* is the log difference in industry-level sales per employee for public firms between time *t* and *t*-1. *CAPEX growth* is the log difference in industry-level capital expenditures for public firms between time *t* and *t*-1. *Industry returns* is the log difference in the value of the industry stock return index between time *t* and *t*-1. *Debt growth* is the log difference in industry-level net debt for public firms between time *t* and *t*-1. *Stocks traded to GDP* is the total value of stocks traded in the country as a percentage of GDP. *Private credit to GDP* is the total credit in the country as a percentage of GDP.

Panel A: PE versus NON-PE Country-Industries-Years

	1	2	3
Variable	**PE**	**NON-PE**	**P-Value Mean (Median) Difference**
Employment Growth (%)	7.55 (3.78)	6.81 (1.69)	0.02 (0.00)
Profit Margin Growth (%)	1.74 (0.97)	0.26 (0.00)	0.09 (0.07)
Productivity Growth (%)	6.09 (6.28)	6.80 (7.59)	0.08 (0.01)
CAPEX Growth (%)	9.22 (7.94)	10.20 (11.66)	0.30 (0.92)
Industry Returns (%)	9.54 (13.00)	9.96 (11.66)	0.50 (0.88)
Debt Growth (%)	14.01 (8.95)	14.07 (9.74)	0.95 (0.98)
GDP Growth (%)	2.05 (2.01)	2.23 (2.34)	0.01 (0.00)
Stocks Traded to GDP (%)	101.99 (75.47)	46.46 (25.53)	0.00 (0.00)
Private Credit to GDP (%)	117.44 (113.19)	86.72 (82.91)	0.00 (0.00)

Panel B: HIGH-PE versus LOW-PE Country-Industry-Years

	1	2	3
Variable	**HIGH PE**	**LOW PE**	**P-Value Mean (Median) Difference**
Employment Growth (%)	8.64 (4.61)	6.45 (3.18)	0.00 (0.00)
Profit Margin Growth (%)	3.62 (1.09)	-0.01 (0.78)	0.05 (0.07)
Productivity Growth (%)	6.14 (6.24)	6.03 (6.32)	0.86 (0.80)
CAPEX Growth (%)	9.89 (9.02)	8.55 (6.99)	0.30 (0.13)
Industry Returns (%)	10.71 (14.02)	8.39 (11.78)	0.01 (0.01)
Debt Growth (%)	14.90 (10.55)	13.22 (7.86)	0.27 (0.18)
GDP Growth (%)	2.25 (2.11)	1.85 (1.98)	0.00 (0.00)
Stocks Traded to GDP (%)	109.35 (81.67)	94.88 (70.95)	0.00 (0.00)
Private Credit to GDP (%)	117.74 (113.39)	117.13 (112.99)	0.72 (0.65)

Table 5: Private Equity and the Real Economy

This table shows that following private equity investments employment, profitability, and labor productivity increase for public companies in the same country and industry. The table presents the results from the panel VAR estimation of equation 1 from Section 4, where the X vector consists of private equity capital invested, industry-level employment growth, labor productivity growth, and profitability growth. The system is estimated with GMM. Employment growth is the log difference in industry-level employment for public firms between time t and t-1. Productivity growth is the log difference in industry-level sales per employee for public firms between time t and t-1. Profitability growth is the log difference in industry-level net profits over sales for public firms between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.1427**	0.1307**	0.1642***	0.3700***
	(0.0668)	(0.0592)	(0.0611)	(0.1066)
Employment Growth (t-1)	0.0021	0.1397***	-0.0096	-0.1627
	(0.0031)	(0.0142)	(0.0167)	(0.1447)
Productivity Growth (t-1)	0.0012	0.0733***	-0.0574***	-0.0332
	(0.0020)	(0.0108)	(0.0139)	(0.0365)
Profitability Growth (t-1)	-0.0003	0.0069**	0.0027	-0.2456***
	(0.0007)	(0.0028)	(0.0037)	(0.0121)
N Obs.	10,281			

Table 6: Buyout versus Venture Capital

This table shows that buyout investments lead to higher profitability and employment, while venture capital leads to higher productivity. The table repeats the estimation presented in Table 5, separately for buyout and venture capital, and results are presented in Panel A and B, respectively. Employment growth is the log difference in industry-level employment for public firms between time t and t-1. Productivity growth is the log difference in industry-level sales per employee for public firms between time t and t-1. Profitability growth is the log difference in industry-level net profits over sales for public firms between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Buyout

	Buyout Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
Buyout Capital Invested (t-1)	0.1492*	0.1295**	0.0567	0.3442**
	(0.0813)	(0.0615)	(0.0775)	(0.1448)
Employment Growth (t-1)	0.0001	0.1399***	-0.0092	-0.1621
	(0.0029)	(0.0142)	(0.0167)	(0.1448)
Productivity Growth (t-1)	-0.0005	0.0567	-0.0577***	-0.0331
	(0.0021)	(0.0775)	(0.0139)	(0.0365)
Profitability Growth (t-1)	-0.0004	0.0069**	0.0027	-0.2456***
	(0.0007)	(0.0028)	(0.0037)	(0.0122)
N Obs.	10,281			

Panel B: Venture Capital

	Venture Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
Venture Capital Invested (t-1)	0.1372**	0.0858	0.6345***	0.4724
	(0.0544)	(0.1128)	(0.1649)	(0.3675)
Employment Growth (t-1)	0.0014	0.1399***	-0.0103	-0.1625
	(0.0010)	(0.0141)	(0.0166)	(0.1447)
Productivity Growth(t-1)	0.0017	0.0728***	-0.0582***	-0.0346
	(0.0018)	(0.0108)	(0.0139)	(0.0363)
Profitability Growth (t-1)	0.0000	0.0069**	0.0026	-0.2460***
	(0.0002)	(0.0028)	(0.0037)	(0.0122)
N Obs.	10,281			

Table 7: Private Equity and Investment

This table shows that capital expenditures of public firms increase following private equity investments into the industry. The table presents the results of the four-variable panel VAR estimation with GMM as in equation 1, where the X vector consists of private equity capital invested, industry-level cash flow growth, capital expenditures growth, and market-to-book growth, similar to Love and Zicchino (2006). Cash flow growth is the log difference in industry-level free cash flows for public firms between time t and t-1. Capex growth is the log difference in industry-level capital expenditures for public firms between time t and t-1. Market-to-book growth is log difference in the price-to-book index of an industry between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

	PE Capital Invested	Cash Flow Growth	Capex Growth	Market-to-book Growth
PE Capital Invested (t-1)	0.1667**	0.2587	0.5713**	0.1417
	(0.0856)	(0.6241)	(0.2651)	(0.0879)
Cash Flow Growth (t-1)	-0.0004	-0.3171***	0.0063	0.0041**
	(0.0004)	(0.0182)	(0.0055)	(0.0017)
Capex Growth (t-1)	-0.0007	0.0535	-0.0844***	-0.0132
	(0.0012)	(0.0388)	(0.0158)	(0.0149)
Market-to-book Growth (t-1)	0.0007	-0.0371	0.1919***	-0.0866***
	(0.0037)	(0.0879)	(0.0323)	(0.0145)
N Obs.	7,868			

Table 8: Industry Spillovers from PE and Industry Competitiveness

This table shows that the positive effects reported in Table 5 are concentrated in more competitive country-industries. The table repeats the analysis presented in Table 5 for subsamples of country-industries created based on the level of competition. Panel A and B present the results for the subsamples of country-industries with low versus high levels of competition, measured by the industry-level gross margins, respectively. Low (high) competition country-industries have gross margins above (below) the median of the sample distribution. The coefficients for the private equity variable are presented only, but the estimation is identical to the panel VAR in Table 5. Variable definitions are in Table A1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lag of the row variable. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Low Competition

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2220**	0.0990	-0.0605	-0.0798
	(0.1147)	(0.1119)	(0.1049)	(0.3254)
N Obs.	5,016			

Panel B: High Competition

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2826*	0.1545**	0.3849**	0.7844**
	(0.1506)	(0.0750)	(0.1711)	(0.3593)
N Obs.	5,069			

Table 9: Industry Spillovers from PE and Legal Strength

This table shows that the positive effects reported in Table 5 are concentrated in countries with a stronger legal environment. The table repeats the analysis presented in Table 5 for subsamples of countries created based on the level of legal strength. Panel A and B present the results for the subsamples of countries with weak versus strong legal institutions, respectively. Panel C and D present the results for the subsamples of countries with weak versus strong intellectual property rights, respectively. The coefficients for the private equity variable are presented only, but the estimation is identical to the panel VAR in Table 5. Variable definitions are in Table A1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Low Institutional Quality

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.1847*	0.0569	0.1165	0.0896
	(0.1076)	(0.1039)	(0.1144)	(0.3496)
N Obs.	5,022			

Panel B: High Institutional Quality

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2374*	0.1075**	0.2001*	0.6268***
	(0.1299)	(0.0527)	(0.1073)	(0.2339)
N Obs.	5,259			

Panel C: Weak Intellectual Property Rights

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.1830*	0.0525	0.1241	0.0791
	(0.0980)	(0.0940)	(0.1143)	(0.3500)
N Obs.	4,896			

Panel D: Strong Intellectual Property Rights

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.2351*	0.1108*	0.1944*	0.6331***
	(0.1298)	(0.0628)	(0.1017)	(0.2346)
N Obs.	5,385			

Table 10: Industry Spillovers from PE and Innovative Capacity

This table shows that the positive effects reported in Table 5 are concentrated in countries with moderate levels of innovative capacities. The table repeats the analysis presented in Table 5 for three subsamples of countries created based on a measure of innovative capacity. Panel A, B, and C present the results for the subsamples of countries with lowest, highest, and moderate levels of innovative capacities. The subsample of countries with the lowest (highest) innovative capacities includes the countries in the bottom (top) 25th percentile. The subsample of countries with moderate innovative capacities includes the countries that are in between the 25th and 75th percentile of the distribution. The coefficients for the private equity variable are presented only, but the estimation is identical to the panel VAR in Table 5. Variable definitions are in Table A1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Lowest Innovative Capacity

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.1671	0.0921	0.0732	-0.3805
	(0.1411)	(0.1243)	(0.1283)	(0.3618)
N Obs.	2,567			

Panel B: Highest Innovative Capacity

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.1328	0.0847	0.0965	0.1652
	(0.1384)	(0.0896)	(0.0858)	(0.2677)
N Obs.	2,838			

Panel C: Moderate Innovative Capacity

	PE Capital Invested	Employment Growth	Productivity Growth	Profitability Growth
PE Capital Invested (t-1)	0.1045*	0.1780**	0.2332**	0.8343***
	(0.0632)	(0.0799)	(0.1025)	(0.2755)
N Obs.	5,355			

Table 11: Private Equity and the Financial Economy

Panel A of this table shows that buyout investments lead to higher debt growth and lower stock returns among the public companies in the same country and industry. Panel B of this table shows that venture capital investments are not significantly related to debt growth or stock returns among the public companies in the same country and industry. The table presents the results from the panel VAR estimation of equation 1 from Section 4, separately for buyout and venture capital, where the X vector consists of private equity capital invested, industry-level debt growth, and industry returns. The system is estimated with GMM. Panel A and B present the results for buyout and venture capital, respectively. Industry returns is the log difference in the value of the industry stock return index between time t and t-1. Debt growth is the log difference in industry-level net debt for public firms between time t and t-1. Country-industry and time fixed effects are included in the estimation as defined in Section 4. Reported numbers show the coefficients of regressing the column variables on the lags of the row variables. Standard errors clustered by country and industry are in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.

Panel A: Buyout

	Buyout Capital Invested	Debt Growth	Industry Returns
Buyout Capital Invested (t-1)	0.1063**	0.5246**	-0.2218*
	(0.0438)	(0.2262)	(0.1231)
Debt Growth (t-1)	0.0005	-0.0218*	-0.0186**
	(0.0007)	(0.0151)	(0.0074)
Industry Returns (t-1)	0.0018	-0.0168	0.0089
	(0.0015)	(0.0204)	(0.0148)
N Obs.	7,732		

Panel B: Venture Capital

	Venture Capital Invested	Debt Growth	Industry Returns
Venture Capital Invested (t-1)	0.4177**	-0.3690	-0.6793
	(0.1853)	(2.5097)	(0.8541)
Debt Growth (t-1)	-0.0001	-0.0221	-0.0186**
	(0.0001)	(0.0150)	(0.0074)
Industry Returns (t-1)	-0.0001	-0.0175	0.0093**
	(0.0003)	(0.0204)	(0.0148)
N Obs.	7,732		

Table A1: Data Sources and Variable Definitions

This table provides descriptions of data sources and variable definitions used in the paper. Panel A defines the data sources, and Panel B presents the variable definitions with the data source for the variable in parenthesis.

Panel A: Data Sources	
Burgiss	The Burgiss Group is a software company that provides data record keeping and performance analysis services to the largest institutional investors in the private equity universe. Burgiss data is aggregated at the industry-level using actual fund investments into portfolio companies.
Datastream	Datastream's Global Equity Indices provide industry indices aggregated from financial statements of publicly listed companies across 53 countries and 170 sectors worldwide.
World Development Indicators (WDI)	The development indicators are from World Bank's primary database. It presents the most current and accurate global development data available, and includes national, regional and global estimates.
World Economic Forum's Global Competitiveness Index (GCI)	GCI assesses the competitiveness landscape of 144 economies, providing insight into the drivers of their productivity and prosperity. It provides different indices on a country's legal environment, as well as financial and technological development.
Panel B: Variable Definitions	
PE Capital Invested	$ Amount of private equity capital invested, normalized by industry sales, and logged. (BURGISS)
Buyout Capital Invested	$ Amount of buyout capital invested, normalized by industry sales, and logged. (BURGISS)
Venture Capital Invested	$ Amount of venture capital invested, normalized by industry sales, and logged. (BURGISS)
Employment Growth	Log difference in industry employment between time t and t-1. (DATASTREAM)
Profitability Growth	Log difference in industry profit margins, net profit over sales, between time t and t-1. (DATASTREAM)
Labor Productivity Growth	Log difference in industry sales per employee between time t and t-1. (DATASTREAM)
CAPEX Growth	Log difference in industry capital expenditures between time t and t-1. Capital expenditures include, but are not limited to, additions to property, plant and equipment as well as investments in machinery and equipment.
Cash Flow Growth	Log difference in industry free cash flow between time t and t-1. Free cash flow is the sum of funds from operations, funds from/used for other operating activities and extraordinary items.
Industry Returns	Log difference in the value of the industry return index retrieved from DataStream Global Equity Indices between time t and t-1. (DATASTREAM)
Debt Growth	Log difference in industry debt, total debt net of cash and cash equivalents, between time t and t-1. (DATASTREAM)
Market-to-book Growth	Log difference in the price-to-book index of an industry between time t and t-1. (DATASTREAM)
Stocks Traded to GDP	Total value of stocks traded over GDP. (WDI)
Private Credit to GDP	Total amount of private credit over GDP. (WDI)
Institutional Quality Score	Measures the institutional quality of a country. It is a combination of scores on legal institutions, property rights, investor protection as well as judicial efficiency. (GCI)
Intellectual Property Rights	Measures the strength of intellectual property protection in a country. (GCI)
Innovative Capacity	Measures a country's capacity to innovate and adapt to new technologies. (GCI)