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The growth of the private equity industry has spurred concerns about its potential impact on the economy. This analysis looks across nations and industries to assess the impact of private equity on industry performance. We find that industries where private equity funds have invested in the past five years have grown more quickly in terms of productivity and employment, and these industries appear to be less exposed to aggregate shocks. Robustness tests suggest that the results are not driven by reverse causality. These patterns are not driven solely by common law nations such as the United Kingdom and United States, but also hold in Continental Europe.

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In response to the global financial crisis that began in 2007, governments worldwide are rethinking their approach to regulating financial institutions, and private equity (PE) funds have fallen under the gaze of regulators. Most dramatically, the European Commission adopted in late 2010 the Alternative Investment Manager Fund directive, which contains a sweeping set of rules regulating the private equity industry (European Commission [2010]).

Regulators, politicians, and labor organizers have long expressed concern about the impact of PE funds, pointing to their need to rapidly return capital to investors and the potentially deleterious effects of such practices as the extensive leveraging of firms. Critics have pointed to case studies that illustrate the negative consequences of the transactions. For instance, Rasmussen (2008) points to the buyout of Britain's Automobile Association, which led to large-scale layoffs and service disruptions while generating substantial profits for the transaction's sponsor, Permira. The Service Employees International Union (2007 and 2008) presents studies that show the deleterious effect that excessive leverage, cost-cutting, and poor managerial decisions by PE groups can have on firms and industries in cases such as Hawaiian Telecom, Intelsat, KB Toys, and TDC.

A central hypothesis in the finance literature since Jensen (1989), however, has been that PE has the ability to improve the operations of firms. By closely monitoring managers, restricting free cash flow through the use of leverage, and incentivizing managers with equity, it is argued, PE-backed firms are able to improve operations in the firms they finance. Jensen suggested that these leveraged buyouts (LBOs) may not only affect the bought-out firm itself but may also increase competitive pressure and force competitors to improve their own operations.

Several case and clinical studies illustrate Jensen's (1989) hypothesis. For instance, in the Hertz buyout, the PE investor Clayton, Dubilier & Rice addressed inefficiencies in pre-existing operations procedures to help increase the profitability of Hertz. Specifically, CD&R created value by lowering overhead costs, reducing inefficient labor expenses, cutting non-capital investments down to industry standard levels, and aligning managerial incentives with return on capital (Luehrman (2007)). Similarly, the buyout of O.M. Scott & Sons led to substantial operating improvements in the firm's existing operations, in part due to powerful incentives offered to management and in part stemming from suggestions by the PE investors (Baker and Wruck (1989)).

This paper examines the impact of PE investments on aggregate growth and cyclicality. In particular, we look at the relationship between the presence of PE investments and the growth rates of productivity, employment, and capital formation across 20 industries in 26 major nations between 1991 and 2007. The magnitude of PE investments is substantial: in a given year and country, we estimate that approximately 4% of the average industry is acquired by PE investors, measured in terms of sales, which adds up to a significant presence given the extended holding periods of these investments.

For our productivity and employment measures, we find that PE investments are associated with faster growth. Industries where PE funds have been active in the past five years grow more rapidly than other industries, whether measured using total production, value added, total wages, or employment. We find few significant differences, however, between industries with lower or higher levels of PE activity. This may suggest that the impact of PE activity on industry performance is not primarily due to the direct effect of PE ownership on the firms they acquire, but rather that PE activity gives rise to spill-over effects on other firms in the industry.

One concern is that this growth may come at the expense of greater cyclicality, which could translate into greater risks for investors and stakeholders. Thus, we also examine whether economic fluctuations are exacerbated by the presence of PE investments, but we find little evidence that this is the case. Activity in industries with PE backing appears to be no more volatile in the face of industry cycles than in other industries, and sometimes less so. The reduced volatility is particularly apparent in total wages and employment. These patterns continue to hold when we focus on the impact of PE in continental Europe, where concerns about these investments have been most often expressed.

In our primary specification, we include country-industry, industry-year, and country-year fixed effects (FEs), so the impact of PE activity is measured relative to the average performance in a given country, industry, and year. For instance, if the Swedish steel industry has more PE investment than the Finnish one, we examine whether the steel industry in these two countries performs better or worse over time relative to the average performance of the steel industry across all countries in our sample, and whether the variations in performance over the industry cycles are more or less dramatic.

We believe it is unlikely that these results are driven by reverse causality, i.e., PE funds selecting to invest in industries that are growing faster and/or are less volatile. The results are essentially unchanged if we only consider the impact of PE investments made two to five years earlier on industry performance. Granger causality tests suggest that past PE investment causes industry performance, while past industry performance has no impact on future PE investment. The results continue to hold when we use an instrumental variables technique employing the size of the private pension and insurance company asset pool in the nation and year as a percentage of GDP.

This paper is related to the modest and mixed literature on the competitive effects of PE. Chevalier (1995a, 1995b) shows that buyouts of supermarket chains lead to positive outcomes for local rivals. These rivals are more likely to enter or expand in an urban region, if there are a number of firms that have undergone buyouts and charge higher prices in these markets. She suggests that these results are consistent with “softer” product market competition. Hsu, Reed, and Rocholl (2010), on the other hand, show that rivals experience a decrease in their stock prices and their operating performance around the time of PE investments in their industry, while competitors’ stock prices increase when a previously announced PE deal is withdrawn. The effects are particularly pronounced for more specialized and experienced PE groups. Similarly, Oxman and Yildrim (2008) find evidence suggesting that PE corporate governance practices spill over on competitors after a buyout.

It is important to note some limitations of this analysis. First, the question of economic growth and volatility is only one of many questions that regulators face when assessing the impact of PE investment. Among the unaddressed topics are the impact on the distribution of wealth across society and the competitive dynamics across industries. Second, it is too early to assess the consequences of the economic downturn in 2008 and 2009, a period where the decrease of investment and absolute volume of distressed PE-backed assets was greater than in earlier cycles. Third, our results suggest that spillovers from PE-backed companies are important, but data limitations prevent us from exploring them in more detail here.

The plan of this study is as follows: In the next section, we develop the hypotheses. The second section describes the construction of the dataset, and the results are presented in the third section. The final section presents concludes.

I. INDUSTRY PERFORMANCE AND PRIVATE EQUITY

Several alternative perspectives have been offered as to how PE investments affect the prospects of an industry. In this section, we begin by reviewing the suggestions about changes regarding overall performance; we then discuss hypotheses regarding the interaction between economic cycles and PE investments.

A. The Impact of PE Investments on Industry Performance

Our initial examination focuses on the performance of industries where PE funds have been active relative to industries where they have not.

The Jensen hypothesis that PE-backed firms have improved operations has been supported by a number of empirical studies, focusing on the effects on the individual PE-backed companies. Kaplan (1989) examines changes in accounting performance for 76 large management buyouts of public companies between 1980 and 1986. He shows that in the three years after the transaction operating income, cash flow, and market value all increase. He argues that these increases reflect the impact of improved incentives rather than layoffs. Looking at more recent deals on public-to-private transactions in the United States, however, Guo et al. (2009) find only weak evidence that gains in operating performance of bought-out firms exceed those of their peers. Muscarella and Vetsuypens (1990) examine 72 "reverse LBOs" (RLBOs), that is, companies taken private which went public once again. These firms experienced a dramatic increase in profitability, which they argue is a reflection of cost reductions. John et al. (1992) present supporting empirical evidence that the threat of takeover spurs firms to voluntarily undertake restructurings.

More recent studies have used large samples and a variety of performance measures to more directly assess whether PE makes a difference in the management of the firms in which they invest. Bloom et al. (2009) survey over 4,000 firms in Asia, Europe, and the US to assess their management practices. They show that PE-backed firms are on average the best-managed ownership group in the sample, though they cannot rule out the possibility that these firms were better managed before the PE transaction. Davis et al. (2008) compare all US-based manufacturing establishments that received PE investments between 1980 and 2005 with similar establishments that did not receive PE investments.[1] They show that PE-backed firms experienced a substantial productivity growth advantage (about two percentage points) in the two years following the transaction. About two-thirds of this differential is due to improved productivity among continuing establishments of the firms. Cao and Lerner (2009) examine the three- and five-year stock performance of 496 RLBOs between 1980 and 2002. RLBOs appear to consistently outperform other IPOs and the stock market as a whole. Large RLBOs that are backed by PE firms with more capital under management perform better, while quick flips — when PE firms sell off an investment soon after acquisition — underperform.

These findings might suggest that we would see superior performance for PE firms, regardless of the economic conditions. Moreover, if PE firms represent a significant fraction of the activity in certain industries (as we will show shortly), there may also be a positive effect at the industry level. Investigating the industry level allows us to capture the ‘contagion’ effects arising if improvements in bought-out firms spur their competitors to improve. This effect is not captured by studies focusing on the individual portfolio companies.

B. The Impact of Economic Cycles

Numerous practitioner accounts have suggested that the PE industry is highly cyclical, with periods of easy financing availability (often in response to the successes of earlier

[1] Establishments are specific factories, offices, retail outlets, and other distinct physical locations where business takes place.

transactions) leading to an acceleration of deal volume, greater use of leverage, higher valuations, and ultimately more troubled investments (akin to the well-known 'corn-hog cycle' in agricultural economics).

This pattern is corroborated in several academic studies. Axelson et al. (2010) document the cyclical use of leverage in buyouts. Using a sample of 1,157 transactions completed by major groups worldwide between 1985 and 2008, they show that the level of leverage is driven by the cost of debt, rather than the more industry- and firm-specific factors that affect leverage in publicly traded firms. The use of leverage is also strongly associated with higher valuation levels and lower PE fund returns. Kaplan and Stein (1993) document that the 1980s buyout boom saw an increase in valuations, reliance on public debt, and incentive problems (e.g., parties cashing out at the time of transaction). Moreover, in the transactions done at the market peak, the outcomes were disappointing: of the 66 largest buyouts completed between 1986 and 1988, 38% experienced financial distress, which they define as default or an actual or attempted restructuring of debt obligations due to difficulties in making payments. Twenty-seven percent actually did default on debt repayments, often in conjunction with a Chapter 11 filing. Kaplan and Schoar (2005) provide indirect supporting evidence, showing that the performance of funds is negatively correlated with inflows into these funds. Private equity funds raised during periods of high capital inflows, which are typically associated with market peaks, perform far worse than their peers.

These findings corroborate the suggestions that the availability of financing impacts booms and busts in the PE market. If firms completing buyouts at market peaks employ leverage excessively, we may expect industries with heavy buyout activity to experience more intense subsequent downturns. Moreover, the effects of this overinvestment would be exacerbated if PE investments drive rivals not backed by PE to aggressively invest and leverage themselves. Chevalier (1995b) shows that in regions with supermarkets receiving PE investments, the rivals responded by adding and expanding stores.

An alternative perspective, suggested by some recent events in the PE industry, is that PE-backed firms may do better during downturns because their investors constitute a concentrated shareholder base, which can continue to provide equity financing in a way that might be difficult to arrange for other companies during downturns, as frequently happened during the recent recession. This perspective would imply that PE-backed companies may outperform their peers during downturns, as they have access to equity financing that other firms do not have. The presence of liquid PE funds as shareholders may lead to fewer failures in difficult economic conditions.

A related argument, originally proposed by Jensen (1989), is that the high levels of debt in PE transactions force firms to respond earlier and more forcefully to negative shocks to their business. As a result, PE-backed firms may be forced to adjust their operations more rapidly at the beginning of an industry downturn, enabling them to better weather a recession. Even if some PE-backed firms eventually end up in financial distress, their underlying operations may thus be in better shape than their peers. This facilitates an efficient restructuring of their capital structure and lowers the deadweight costs on the economy. Consistent with this argument, Andrade and Kaplan (1998) study 31 distressed leveraged buyouts from the 1980s that subsequently became financially distressed, and found that the value of the firms post-distress was slightly higher than the value before the buyout, suggesting that even the leveraged buyouts that were hit most severely by adverse shocks added some economic value.

Finally, the structural differences between PE funds and other financial institutions may make them less susceptible to industry shocks. A major source of concern for financial institutions is the so-called ‘run on the bank’ phenomenon. Runs occur when holders of short-term liabilities, such as depositors or repo counterparties, simultaneously refuse to provide additional financing and demand their money back. Other versions of this phenomenon arise when companies simultaneously draw down lines of credit, hedge fund investors simultaneously ask for redemptions of their investments, or a freeze in the market for commercial paper prevents structured investment vehicles (SIVs) from rolling over short-term commercial paper. It is unlikely that PE investments create dangers through this mechanism. Private equity funds are typically prevented from borrowing themselves, and the funds’ only claimants are their limited partners (LPs), which are typically bound by ten-year lock-up agreements. Hence, the funds have no short-term creditors that can run. Still, extensive loans may be provided to the individual portfolio companies. However, these loans are typically made by a concentrated set of lenders and are without recourse to other portfolio companies or the fund generally. Hence, an individual creditor’s ability to be repaid is largely unaffected by the actions of other creditors, mitigating the incentive to run.

II. DATA SOURCES AND SAMPLE CONSTRUCTION

To analyze how PE investments affect industries, we combine two datasets: one containing information about PE investments compiled by Capital IQ, and another with industry activity and performance across the Organisation for Economic Cooperation and Development (OECD) member countries included in the OECD’s Structural Analysis Database (STAN).

A. PE Investment Sample

We use the Capital IQ (CIQ) database to construct a base sample of PE transactions. This database is recognized as the most comprehensive database of worldwide PE transactions.[2] Strömberg (2008) compares the CIQ LBO data during the 1980s with older LBO studies using 1980s data and estimates that during this early period, well before Capital IQ's formation, the database's coverage is somewhere between 70% and 85%. The base sample contains all private placements and M&A transactions in CIQ where (a) the list of acquirers includes (at least) one investment firm, (b) where the transaction is classified as 'leveraged buyout,' 'management buyout,' or 'going private,' (c) that were announced between January 1986 and December 2007, and (d) where the target company is located in an OECD country included in the STAN database. Thus, we only look at later-stage buyout transactions, and do not include venture capital investments. We exclude transactions that were announced but not completed as of December 2007, as well as transactions that did not involve a financial investor (e.g., a buyout led and executed by the management team itself was excluded).

This results in a sample with about 14,300 transactions, involving 13,100 distinct firms. Since we only have information about the deal size for 50% of our transactions (though more of the larger transactions), we impute missing deal sizes by constructing fitted values from a regression of deal size on fixed effects for country, investment year, and target industry. Using the imputed transaction sizes, we generate aggregate country-year-industry measures of PE volume in the form of summed deal sizes.[3]

B. Industry Data

[2] Most data services tracking PE investments were not established until the late 1990s. The most geographically comprehensive exception, SDC VentureXpert, focused primarily on capturing venture capital investments (rather than LBOs) until the mid-1990s.
[3] The results below are robust to the use of the data without the imputations.

The STAN database provides industry data across OECD countries compiled from national statistics offices. It contains economic information at the country, year, and industry level. Thus, a typical observation would be the German transport equipment industry in 1999. STAN includes measures of productivity, employment, and capital formation, as described in Table 1. Throughout this paper, we focus on the following measures of industry activity:

- Production (gross output), the value of goods and/or services produced in a year, whether sold or stocked, in current prices.
- Value added represents the industry's contribution to national GDP, i.e., output net of materials purchased. While the methodology for constructing this measure differs across nations, our focus here is on differences across time, which should reduce the effect of national differences in the measure.
- Labor costs, which comprise wages and salaries of employees paid by producers, as well as supplements such as contributions to social security, private pensions, health insurance, life insurance, and similar schemes.
- Number of employees, which is the traditional measure of employment, excluding self-employed and unpaid family members working in the business.
- Gross capital formation is acquisitions, less disposals, of new tangible assets, as well as such intangible assets as mineral exploration and computer software. This variable is the closest aggregate to capital expenditures.
- Consumption of fixed capital measures: the reduction in the value of fixed assets used in production resulting from physical deterioration or normal obsolescence.

C. Mapping Capital IQ to STAN Industries

Industries in the STAN database are classified by the International Standard Industrial Classification (ISIC) code. To link these data to the industry-aggregated PE activity, we matched the ISIC codes with CIQ's industry classifications. We used the existing mapping from the CIQ industry classification into SIC codes, and then used the existing matching between SIC and ISIC industries. The mapping of CIQ industry classifications to SIC codes includes only matches for the most detailed levels of the CIQ classifications. This poses a problem for more aggregated industries for which CIQ does not provide a match to a SIC and ultimately to ISIC. When the CIQ target industry is at a more aggregated industry level, we mapped all four-digit SIC codes that belong to the sub-categories of the industry classification of CIQ. In these cases, we had multiple four-digit SIC codes for a single CIQ industry. In some of the transactions all of the four-digit SICs corresponded to the same ISIC industry classification, creating a one-to-one mapping. In cases where the four-digit SIC codes corresponded to different industries in the ISIC scheme, we considered the particular deals and selected the most suitable industry. In 390 transactions, we were not able to determine with certainty the appropriate match in ISIC, and those transactions were dropped, leaving us with 13,910 PE transactions with ISIC classifications. Finally, we grouped ISIC sub-industries to balance PE activity across industries. Table 2 presents the distribution of deals across industries.

This results in a sample of 11,135 country-industry-year observations during the years 1986 to 2007. For each country-industry-year, we measure PE activity as the volume of PE deals occurring during the previous five years in this country and industry. In particular, an observation is a *PE industry* if it had at least one PE investment during those five years. (This definition was motivated by the holding periods reported by Strömberg (2008).) With this definition, we can only compare activity from 1991 to 2007, leaving us with 8,596 country-industry-year observations.

Tables 2, 3, and 4 present the distribution of deals across industries, years, and countries. In each table, we first present the number of observations and the number of those that are PE industries as defined above. We then present the number of deals, transaction volume, and the transaction volume including the imputed sizes of deals with missing information. Several patterns are visible:

- The heavy representation of buyouts as a share of economic activity in traditional industries, such as 'textiles, textile products, leather,' 'machinery and equipment,' 'pulp, paper, paper products, printing,' 'electrical and optical equipment,' and 'chemical, rubber, plastics and fuel products.'
- The acceleration in buyout activity, first modestly during the late 1980s and then especially in the mid-2000s.
- The greater level of activity in a handful of traditional hubs for PE funds, including the United States, the Netherlands, Sweden, and the United Kingdom.[4]

In Table 5, we present a simple comparison of the growth the industry measures for PE and non-PE industries. PE industries grow more quickly in terms of output and value added, as well as in terms of employment. But for gross fixed capital formation, the PE industries have a slower growth rate.

One natural question is whether the volume of buyouts during this period is sufficiently large to have a material impact on the industries in which the funds invest. The most direct

[4] The level of transactions is extremely high in Luxembourg, due to the tendency of many firms to domicile there for tax reasons, even though the bulk of their operations are elsewhere. As a result, we omit Luxembourg from the analyses below.

approach is to look at the implied share of PE investments in the 26 economies in our sample. We wish to compute the mean share of total industry value represented by PE transactions annually.

Because enterprise value is not available for privately-held firms, we must approximate this measure. In particular, we compute a "revenue multiple" from the publicly traded firms in Global Compustat for each industry and year as the ratio between the aggregate enterprise value (the sum of the market value of equity, plus the book value of debt and preferred stock) of all publicly traded firms across all sample nations and the revenues for the same set of firms.[5] We then assume that this ratio also characterizes the privately held firms in the industry in the same industry and year. Thus, we estimate the ratio of the aggregate volume of PE investments in each industry and year (not using imputed deals, in order to be conservative) and the product of the estimated revenue multiple and the aggregate production by public and private firms, as estimated by the OECD.[6]

These ratios vary by year, reflecting the ebb and flow of PE activity. If we examine the average annual share of PE activity across the entire sample period by industry, it varies from 0.9% (for transport equipment) to 13.5% (for machinery and equipment). The weighted average across all industries is 4.35%, with an inter-quartile range from 2.5% to 7.1%. This suggests that for the typical industry, the impact of PE over this period is quite substantial, especially in light of the five-to-seven year holding period, which characterizes the typical PE investment (Strömberg (2008)). This measure may understate the volume of PE activity. Not only are

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[5] Due to the small number of publicly traded firms, we are unable to compute a revenue multiple for the agriculture, hunting, forestry, and fishing industry category. While Global Compustat may not be comprehensive, we do not believe these omissions will introduce biases in the calculations of the multiples.

[6] It should be noted that the OECD constructs this measure to be as comparable as possible to the aggregate of the accounting measure of firm revenue.

transactions with missing data excluded, but as discussed above, but CIQ's coverage is incomplete.

Moreover, it can be anticipated that the effect of having a significant fraction of firms in an industry under buyout ownership may have substantial effects on competitors as well. As discussed in the introduction, earlier work suggests that the impact of PE extends beyond the bought-out firms, but also affects the behavior of rivals.

III. ANALYSIS

A. Industry Performance

We begin by examining the relationship between various industry characteristics and the role of PE in the industry. In each case, an observation is an industry-country-year triple, and the dependent variable is the growth rate of a given economic variable (e.g., employment).

We employ several specifications. First, we include an indicator that denotes whether the industry is a PE industry or not (defined, as noted above, as an industry with at least one PE investment during those five years). Note that this definition does not use the imputed deal values, since it only depends on the presence of PE deals. Second, we use two indicators to capture whether an industry is a low or high PE industry. A low PE industry (PE_5 *Low*) is a PE industry where the fraction of total imputed PE investments divided by total production (both normalized to 2008 US dollars) is smaller than the median (conditional on having a non-zero level of PE investment). We also perform the analysis dividing PE activity into quartiles to better measure the differential effects of different activity levels. All specifications include country-industry fixed effects.

To control for common shocks across industries and countries, we include industry-year, country-industry, and country-year fixed effects in our specifications. Since the inclusion of all three sets of fixed effects leads to a large number of independent variables relative to the number of observations, resulting in some loss of statistical power, we exclude the country-year fixed effects in some specifications. Hence, we estimate the fixed-effect panel regression

$$y_{ciy} = PE_{ciy}\beta + \eta_{ci} + \xi_{iy} + \mu_{cy} + \varepsilon_{ciy}$$

where y_{ciy} is the endogeneous variable of interest, e.g., the growth rate of employment; PE_{ciy} is an indicator for whether the industry is a PE industry; η_{ci} is a country-industry fixed effect (520 FEs); ξ_{iy} is an industry-year fixed effect (340 FEs); μ_{cy} is a country-year fixed effect (432 FEs); and ε_{ciy} is the residual error term.

The results in Table 6 indicate that industries with PE deals have significantly higher growth rates of production and value added. For instance, in the first regression, the coefficient of 1.368 implies that the total production of an average PE industry grows at an annual rate that is 1.368% higher than a non-PE industry. The average growth rate is 5.9%. When we include country-year fixed effects, the coefficient is still statistically significant but declines to 0.541; i.e., the excess growth in PE industries is 0.541% per year. This drop in the magnitude of the effect may indicate that PE investors invest in countries at times when they are growing faster than average.

We report the significance of a statistical test for differences between high- and low-PE industries and differences between the four quartiles of PE activity (reported as $PE_L = PE_H$). Without country-year FEs we find some evidence that the effect is stronger for industries with more PE activity. With country-year FEs, the effect appears stronger for industries with less PE activity, although the difference is not statistically significant. The large number of country-year FEs reduces the statistical power and statistical significance, as indicated in the table. Similarly, the data do not appear to contain sufficient information to separate the effects when the level of PE activity is broken down by quartile. All coefficients are positive, but not statistically significantly different.

For value added, we also find that the PE investments are associated with faster growth. Without country-year FEs, the relation is particularly striking, with industries with lower levels of PE activity growing 1.008% faster per year than industries without PE activity, and industries with more PE activity growing 1.764% faster on average. These coefficients remain positive, but muted, when including country-year FEs. Statistical significance also declines, although the loss in statistical power is a potential reason, as mentioned above.

A natural concern is the direction of causality. It is possible that PE investors pick industries that are anticipated to start growing, and our results may reflect this industry choice rather than the causal effect of the investments on the industry. To mitigate this concern, we change our definition of the PE industry measure to only include investments during the period from two to five years prior to the observation, called the twice-lagged measure (the original PE measure included all five years prior to the observation). The results are reported in Table 7. We find that the results are very similar, indicating that the effect that we find is unlikely to be driven by PE investors entering countries and industries where they expect stronger immediate growth.

Table 8 considers measures of employment. PE industries appear to grow significantly faster in terms of labor costs and the number of employees. In the specifications without country-year fixed effects, the annual growth rate of total labor cost is 0.779 percentage points greater for PE industries, and the number of employees grows at an annual rate that is 0.845 percentage points greater. With country-year fixed effects, these estimates decline to 0.16 percentage points for total labor cost, which is not statistically significant, and to 0.4 percentage points for the number of employees, which is statistically significant.

These findings may be surprising, since a common concern is that PE investors act aggressively to reduce costs with little concern for employees. This concern is not necessarily inconsistent with our results. Despite initial employment reductions at PE-backed firms (see Davis et al. (2009)), the greater subsequent growth in total production, observed in Table 6, may lead to subsequent employment growth in the industry overall. Considering the specifications with PE activity quartiles, the growth rate of labor costs and number of employees is fastest in industries with moderate levels of PE activity. This may suggest that the increase in employment is not primarily driven by increases at the PE-backed firms themselves but driven by the spillover effects at other firms.

As above, we are concerned about the direction of causality. Table 9 repeats the analysis using the twice-lagged PE measure. The magnitudes in Tables 8 and 9 are largely similar, suggesting that the effect we find is not mainly driven by PE investors picking industries with expectations of immediate employment growth. If anything, the results of the twice-lagged measure may suggest that the growth in the number of employees is more robust than the growth in labor costs.

Finally, in Table 10 we examine measures of fixed capital formation and consumption of fixed capital. These measures appear much more volatile than the production and employment measures, with substantially larger standard errors, making it difficult to discern any relationship between PE investments and capital formation. If anything, the results may suggest that PE investments reduce the gross fixed capital formation and the consumption of fixed capital, but these results are more tentative, and we focus on the productivity and employment variables below.[7]

B. Cyclical Patterns

We next analyze how PE relates to industry cycles. For each industry and year, we calculate the average growth by averaging the growth rate of the productivity and employment measures across countries. This measures the annual aggregate shock in these variables (e.g., production output in the steel industry fell by 2% on average in 2002 across the nations in our sample). We then investigate whether PE industries are more or less exposed to this shock by including the PE measure interacted with this average growth measure in the regressions. In particular, we estimate the specification

$$y_{ciy} - \bar{y}_{iy} = PE_{ciy}\beta + (PE_{ciy} \times \bar{y}_{iy})\gamma + \eta_{ci} + \varepsilon_{ciy}$$

where, again, y_{ciy} is the endogeneous variable of interest, e.g., the growth rate of employment; $\bar{y}_{iy}$ is the mean of the endogenous variable across countries (e.g., the average growth rate of employment in industry i during year y); PE_{ciy} is an indicator for whether the industry is a PE industry; η_{ci} is a country-industry fixed effect; and ε_{ciy} is the residual error term. For the cyclicality analysis, instead of including $\bar{y}_{iy}$ on the right hand side, we demean the endogenous variable, which is equivalent to including the average industry growth rate with a coefficient fixed to one, to impose consistency on the specification. It ensures that if an industry is observed to grow by x% in a given year, on average, then the estimated specification also predicts that the average growth rate is x%. Note that this specification does not permit us to include year or year-industry fixed effects, since demeaning removes the year-industry variation. To capture any remaining serial correlation and cyclicality, we also estimate specifications that allow the error

[7] Using twice-lagged PE activity gives qualitatively similar results to those in Table 10.

terms to follow AR(1) processes, as indicated.

If PE- and non-PE industries were equally sensitive to economic conditions, we would expect the coefficient on the interaction term, γ, to be zero. For example, if the average growth rate of employment first increases by two percent and this increase is equally prevalent for PE and non-PE industries and then decreases by two percent and this decrease is also equally prevalent, then γ is zero. However, as a simple example, if the growth rate of employment increases by two percent on average, but this increase is distributed such that PE industries grow by three percent and non-PE industries grow by only one percent; followed by a two percent decline in growth rate, but this decline is distributed such that PE industries decline by three percent and non-PE industries only decline by one percent, we would think that PE investments amplify the exposure to the aggregate shocks, the coefficient γ would be positive and we would say that the PE industries are more sensitive to economic conditions.

In Tables 11 and 12, we examine the impact on production and employment. Across all the regressions, the interaction terms are negative, which suggests that PE industries are less exposed to industry shocks than non-PE industries. To interpret the coefficients, using the estimates in the first regression in Table 12, if an industry on average experiences a 5% increase in total labor costs in a given year (the aggregate shock), a PE industry will experience, on average, a 5.576% increase (5% + 1.992% + 5% x -0.214 = 5.922%). Conversely, following a 5% decrease in labor costs, a PE industry will only experience, on average, a 2.394% decline (-5% + 1.591% + (–5%) x –0.203 = –1.938%). Hence, an aggregate swing from +5% to –5% (a 10% difference) in aggregate growth rates translates into a swing from 5.9% to –1.9% (a 7.8% difference) in the growth rates for PE industries. For the productivity and employment analyses (not value added), the coefficients are significantly negative in the simple specification and many of the coefficients in the employment analysis remain statistically significant when high and low PE industries are included separately. Overall, it appears that PE activity translates into smaller employment fluctuations than average, but industries with a higher amount of PE activity may follow a growth pattern that is closer to that of the industry as a whole.

C. Geographic Patterns

One concern is that the impact of PE is different in Continental Europe than in the US and UK. Not only is the level of PE activity higher in the US and UK than in most other nations, but the industry is more established, having begun in these two nations. Thus, we repeat the analysis, separating Continental Europe from US and UK.

In unreported results, we repeat the base specifications reported in Tables 6 and 8 with the sample restricted to Continental European countries. All the main effects remain largely unchanged for the Continental Europe sample, suggesting that the effects are not primarily driven by the US and UK. Moreover, we find that that the effects are not statistically different for Continental Europe and the US/UK, although the US/UK subsample is naturally a smaller sample with reduced statistical power to distinguish the effect of PE investments.

D. Addressing Causality Concerns

One natural concern relates to the interpretation of these results. While it appears that PE is associated with more rapid growth at an industry level in our analyses, it is natural to wonder which way the causation runs. Does the presence of PE lead to better performance, or do PE investors invest where they anticipate the industries to grow? We respond to this question in several ways.

First, we look in our base analysis at PE investments during the five years prior to the observation. As discussed above, we also narrowed our measure to only include deals in the second through fifth year prior to the investment. If our effects are due to PE investors anticipating growth in particular sectors, they would have to be quite prescient to anticipate future growth two years in advance.

Second, we address this concern using an instrumental variables technique. To identify exogenous variation, we use the size of the private pension and insurance company asset pool in the nation and year, expressed as a percentage of GDP. This kind of identification strategy has been employed in other papers in the venture capital literature, such as Kortum and Lerner (2000) and Mollica and Zingales (2007). In nations with larger pension and insurance pools, domestic PE funds are more likely to raise capital and invest it locally.[8] This is an attractive instrumental variable, because pension policy and insurance regulation are typically driven by broader socio-economic considerations, rather than a desire to impact the local PE industry.

For this analysis, we supplement the dataset with data on financial assets held by domestic autonomous pension funds and insurance corporations from the OECD.[9] Table 13 presents the distribution of financial assets across countries. The instruments for the PE variable we employ are financial assets normalized with the country's GDP, along with country and industry fixed effects. The results of this analysis are shown in Table 14, which also includes regular OLS estimates for comparison. With the exception of number of employees, the previous results of a positive impact of PE investment on industry performance are robust. The

[8] While groups are certainly able to raise capital internationally as well, limited partners appear to have a strong 'home bias' (Lerner et al. (2007)). The consequence of this relationship is that countries with better developed pension systems are likely to have more private investing (Jeng and Wells (2000)).
[9] Financial assets are defined by the OECD as currency and deposits, securities other than shares such as bills and bonds, loans, equities and other financial assets. We collect the data from the OECD's "Annual Statistics on Institutional Investors" database.

coefficients on the PE investment variable actually increase substantially in magnitude. Interpreting the estimate as a local average treatment effect (LATE), this finding might suggest that local PE investors, which are more affected by the instrument, have a particularly large effect on growth rates. One potential concern with our instrument, however, is that the growth in pension and insurance assets may be affected by economic conditions that also affect industry performance. In unreported analyses, we therefore repeat the exercise using a lagged and twice lagged assets-to-GDP instrument. Also in this case, the results remain consistent with the rest of the analysis.

Third, we address the endogeneity issue using Granger causality (Granger (1969)). This empirical approach investigates the relative timing of related time series, in our case PE investments, relative to productivity and employment growth. PE investments will Granger-cause productivity growth (or employment growth) if a previous increase in PE investments are associated with a subsequent increase in productivity, but a previous increase in productivity growth is unrelated with subsequent changes in PE investments. Granger causality has been widely studied and applied in macroeconomics, and there has been substantial debate over the interpretation of the causality concept. The concerns and caveats are well understood. Since we have separate time series for each country-industry pair, we adopt a panel Granger analysis. This is a more recent extension of the traditional approach and, currently, less established (see discussion in Hartwig (2009)). We do not attempt to extend this methodology, and we adopt a natural parsimonious empirical specification.

We estimate a three-equation system of linear equations. The endogenous variables are the productivity and employment growth rates and an indicator of PE activity (we use an indicator for PE activity in each year, not the past five years as used above). The exogenous variables are lags of the endogenous variables, in addition to country and industry fixed effects. We estimate the system using GLS (SUR), taking into account cross-equation correlations in the error terms.

Estimated coefficients using two different specifications of the lags are reported in Table 15. Note that the coefficients from the system regressions are identical to the coefficients one would obtain from estimating single-equation OLS regressions. The reported standard errors, however, adjust for cross-equation correlations in the error terms. In the first equation, we see evidence that PE investments Granger-cause productivity and employment growth. In the third equation, however, we find no evidence that increases in productivity or employment growth are associated with subsequent PE investments. Indeed, the individual coefficients are all insignificant and Wald tests for the joint significance of either the productivity or labor coefficients do not reject the hypothesis that they are zero. Combined, this evidence indicates that the direction of causality likely flows from PE investments to productivity and employment growth.

It is well known that including fixed effects in dynamic panel models can lead to biased and inconsistent estimators (Nickell (1981)). Given our long panel — from 1991 to 2007 — we suspect that this problem is small. Nevertheless, Table 16 reports estimates of the system-GMM procedures proposed by Arellano and Bond (1991) and Blundell and Bond (1998) to overcome this problem. These procedures involve first-differencing of the endogenous variables, which is similar to including country-industry fixed effects. The table reports joint significance tests of the lagged PE indicators, lagged labor growth, and lagged productivity growth. In addition, we report tests for first- and second-order serial correlation in the error terms. First differencing, by construction, generates first-order autocorrelation, as reported, and this is fully consistent with the specification. We find some evidence of higher-order autocorrelation for labor growth, however, but not for productivity growth and the PE indicator. The Blundell and Bond specification (Table 16, columns (4) to (6)) provides particularly consistent evidence of Granger causality. In this specification, the lagged PE indicator is significant for predicting future labor and productivity growth. However, the joint tests suggest that lagged labor- and productivity-growth are not statistically significant predictors of future PE investments. The one remaining concern is that the labor growth process may include higher-order autocorrelation, which may exaggerate the statistical significance and introduce biases in the coefficients. As a remaining general concern, our PE indicator is discrete, and estimating dynamic models with lagged endogenous discrete variables may introduce additional complications for shorter panels (see Honoré and Kyriazidou (2000)). Addressing these technical econometric issues is beyond the scope of this analysis.

IV. CONCLUSIONS

The growth of the PE industry has spurred concerns about its potential impact on the economy more generally. In this analysis, we look across nations and industries to assess the impact of private equity on industry performance.

The key results are, first, that industries where PE funds have invested in the past five years have grown more quickly, using a variety of measures. There are few significant differences between industries with low and high PE activity, suggesting that the results are at least partly driven by spillover effects from PE-backed firms to other firms in the industry. Second, it is hard to find support for claims that economic activity in industries with PE backing is more exposed to aggregate shocks. Various approaches suggest that the results are not driven by reverse causality. Finally, these patterns are not driven solely by common law nations such as the United Kingdom and United States, but also hold in Continental Europe.

These findings suggest a number of avenues for future research. First, it would be interesting to look at finer data on certain critical aspects of industry performance, such as the rates of layoffs, plant closings and openings, and product and process innovations. Second, it is important to understand the mechanisms by which the presence of private equity-backed firms affects their peers. While Chevalier's (1995b) study of the supermarket industry during the 1980s was an important first step, much more remains to be explored here. Finally, we are limited by the available data. The buyout boom of the mid 2000s was so massive, and the subsequent crash in activity so dramatic, that the consequences may have been substantially different from other economic cycles (see Kosman (2009)). The impact of the recent cycle will be an important issue to explore in the future.

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Table 1: Descriptions of OECD STAN industry variables

Industry variable	Description
Production (gross output)	Value of goods and/or services produced in a year, whether sold or stocked, measured at current prices
Value added	Industry contribution to national GDP. Value added comprises labor costs, consumption of fixed capital, taxes less subsidies, measured at current prices
Labor costs (compensation of employees)	Wages and salaries of employees paid by producers as well as supplements such as contributions to social security, private pensions, health insurance, life insurance and similar schemes
Number of employees	Persons engaged in domestic production excluding self-employed and unpaid family workers
Gross fixed capital formation	Acquisitions, less disposals, of new tangible assets (such as machinery and equipment, transport equipment, livestock, constructions) and new intangible assets (such as mineral exploration and computer software) to be used for more than one year, measured at current prices
Consumption of fixed capital	Reduction in the value of fixed assets used in production resulting from physical deterioration, normal obsolescence or normal accidental damage

Source: OECD, STAN database, 2003

Table 2: Distribution of deals by industry. The sample consists of 8,596 country-industry-year observations of OECD countries between 1991 and 2007. *Observations* is the number of observations in the industry. *PE industries* contains the number of observations classified as *PE industries*. An industry is a *PE industry* if it had at least one PE investment during the previous five years. *Deals* is the number of deals, and *Deal volume* is the combined size of the deals (normalized to 2008 US$ billions). *Imputed deal volume* imputes the size for deals with missing size information.

Industry	Observations	PE industries	Deals	Deal volume	Imputed deal volume
Agriculture, hunting, forestry and fishing	432	84	52	6.18	9.88
Basic metals and fabricated metal products	431	234	740	67.06	116.43
Chemical, rubber, plastics and fuel products	431	223	724	112.28	161.18
Community, social and personal services	430	216	1,124	311.70	378.35
Construction	430	173	318	28.20	47.07
Electrical and optical equipment	431	229	837	138.14	180.80
Electricity, gas and water supply	431	84	109	100.90	123.29
Financial intermediation	426	232	551	150.24	201.25
Food products, beverages and tobacco	431	221	548	66.33	106.60
Hotels and restaurants	426	171	436	132.45	155.52
Machinery and equipment	431	255	1,256	124.90	204.62
Manufacturing and recycling	431	166	367	29.74	54.62
Mining and quarrying	429	98	148	28.12	39.85
Other non-metallic mineral products	431	131	160	18.78	29.39
Pulp, paper, paper products, printing, publishing	431	216	520	111.22	141.51
Real estate, renting and business activities	426	284	2,662	369.24	512.65
Textiles, textile products, leather	431	213	425	30.42	63.45
Transport equipment	431	113	106	14.74	21.94
Transport, storage and communications	430	231	578	247.70	286.87
Wholesale and retail trade – repairs	426	279	1,605	328.07	441.77
Total	8,596	3,853	13,266	2,416.42	3,277.05

Table 3: Distribution of deals by year. *Observations* is the number of country-industry-year observations per year. *PE industries* contains the number of observations classified as *PE industries*. An industry is a *PE industry* if it had at least one PE investment during the previous five years. *Deals* is the number of deals, and *Deal volume* is the combined size of the deals (normalized to 2008 US$ billions). *Imputed deal volume* imputes the deal size for deals with missing size information.

Year	Observations	PE industries	Deals	Deal volume	Imputed deal volume
1986	n/a	n/a	95	19.56	27.15
1987	n/a	n/a	109	18.51	27.43
1988	n/a	n/a	157	42.83	60.77
1989	n/a	n/a	137	59.75	68.07
1990	n/a	n/a	120	21.41	32.47
1991	456	116	158	13.29	21.88
1992	469	139	178	15.73	26.80
1993	509	177	197	16.44	29.61
1994	516	191	262	15.57	25.68
1995	520	202	347	35.05	49.86
1996	520	204	431	43.53	57.30
1997	520	206	655	55.41	86.12
1998	520	202	871	94.46	144.40
1999	520	217	824	86.41	131.17
2000	520	228	780	105.44	138.76
2001	520	251	687	80.83	102.62
2002	520	269	722	93.28	122.11
2003	520	276	945	145.73	178.78
2004	520	293	1,217	203.73	278.14
2005	520	293	1,428	258.58	368.21
2006	520	316	1,788	404.54	552.20
2007	406	273	1,776	748.42	963.42
Total	8,596	3,853	13,884	2,578.48	3,492.93

Table 4: Distribution of deals by country. The sample consists of 8,596 country-industry-year observations of OECD countries between 1991 and 2007. *Observations* is the number of observations in each country. *PE industries* contains the number of observations classified as *PE industries*. An industry is a *PE industry* if it had at least one PE investment during the previous five years. *Deals* is the number of deals, and *Deal volume* is the combined size of the deals (normalized to 2008 US$ billions). *Imputed deal volume* imputes the size for deals with missing size information.

Country	Observations	PE industries	Deals	Deal volume	Imputed deal volume
Australia	320	125	122	14.64	18.55
Austria	340	77	53	1.78	3.93
Belgium	340	129	117	13.00	22.56
Canada	340	218	292	98.98	117.12
Czech Republic	300	158	37	5.06	5.89
Denmark	340	94	142	9.79	17.30
Finland	340	161	192	7.66	16.06
France	339	274	1,273	121.04	176.37
Germany	340	220	598	109.79	187.06
Greece	324	30	7	4.45	6.14
Hungary	320	142	18	1.15	3.39
Ireland	340	104	4	0.00	0.01
Iceland	339	6	46	19.09	20.69
Italy	340	210	335	42.21	57.69
Japan	328	70	73	20.79	26.71
Netherlands	340	204	320	84.87	125.66
Norway	340	73	71	5.00	9.53
Poland	286	171	41	2.33	2.61
Portugal	320	63	27	0.25	0.33
Slovakia	300	111	13	0.18	0.93
South Korea	340	47	20	4.81	4.81
Spain	320	171	217	38.93	42.58
Sweden	340	186	267	43.07	57.60
Switzerland	340	158	111	17.66	31.46
United Kingdom	340	318	2,194	377.13	423.60
United States	340	333	6,676	1,372.78	1,898.46
Total	8,596	3,853	13,266	2,416.42	3,277.05

Table 5: Industry growth variables. The sample consists of 8,596 country-industry-year observations of OECD countries between 1991 and 2007. An industry is considered as a *PE industry* if it had at least a single PE deal in the previous five years. *P-value* provides the p-value of a test of equality of the means of PE and non-PE industries. See Table 1 for variable definitions.

	All industries			PE industries			Non-PE industries			
	Observations	Average growth	Std. dev.	Observations	Average growth	Std. dev.	Observations	Average growth	Std. dev.	P-value
Production (gross output)	7,351	5.9	8.8	3,318	6.2	8.5	4,033	5.7	9.1	0.03
Value added	8,238	5.6	10.2	3,635	5.8	9.8	4,603	5.5	10.5	0.17
Labor costs (compensation of employees)	7,831	5.1	7.5	3,398	5.3	7.4	4,433	5.0	7.6	0.18
Number of employees	6,269	0.0	5.0	2,862	0.3	4.1	3,407	-0.3	5.6	0.00
Gross fixed capital formation	7,004	7.1	76.6	3,223	6.8	27.6	3,781	7.5	101.1	0.67
Consumption of fixed capital	7,351	5.9	8.8	3,318	6.2	8.5	4,033	5.7	9.1	0.03

Table 6: PE activity and growth rate of productivity. The table contains OLS panel regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the growth rate of production or value added (as defined by OECD). The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level (*PE_5*), indicators for whether the measured PE activity is below or above the median activity level (*PE_5 Low* and *PE_5 High*), and indicators for quartiles. The omitted base category is no PE activity over the previous five years. Country-industry (*C-I FE*), industry-year (*I-Y FE*), and country-year (*C-Y FE*) fixed effects are included as indicated. Robust standard errors are in parentheses. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or all the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1) Production (gross output)	(2) Production (gross output)	(3) Production (gross output)	(4) Production (gross output)	(5) Production (gross output)	(6) Value added	(7) Value added	(8) Value added	(9) Value added	(10) Value added
PE_5	1.368***	0.541**				1.259***	0.448			
	(0.292)	(0.251)				(0.324)	(0.286)			
PE_5 Low			1.197***	0.615**				1.008***	0.450	
			(0.298)	(0.258)				(0.332)	(0.300)	
PE_5 High			1.712***	0.381				1.764***	0.445	
			(0.371)	(0.328)				(0.407)	(0.377)	
PE_5 Q1					0.522*					0.436
					(0.301)					(0.332)
PE_5 Q2					0.723**					0.463
					(0.297)					(0.370)
PE_5 Q3					0.447					0.430
					(0.335)					(0.391)
PE_5 Q4					0.351					0.492
					(0.404)					(0.472)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I-Y FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
$PE_L = PE_H$			0.091*	0.405	0.734			0.025**	0.988	0.998
Observations	6,976	6,976	6,976	6,976	6,976	7,013	7,013	7,013	7,013	7,013

Table 7: Twice-lagged PE activity and growth rate of productivity. The table contains OLS panel regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the growth rate of production or value added (as defined by OECD). The exogenous variables are an indicator for positive PE activity over the previous four years -2 to -5, i.e. *not* including the year prior to the year where the growth in the endogenous variable is measured ($PE_{2\text{-}5}$), indicators for whether the measured PE activity is below or above the median activity level (PE_5 *Low* and PE_5 *High*), and indicators for quartiles. The omitted base category is no PE activity over the previous five years. Country-industry (*C-I FE*), industry-year (*I-Y FE*), and country-year (*C-Y FE*) fixed effects are included as indicated. Robust standard errors are in parentheses. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or all the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Production (gross output)	Production (gross output)	Production (gross output)	Production (gross output)	Production (gross output)	Value added	Value added	Value added	Value added	Value added
PE_5	1.208***	0.449*				1.247***	0.506*			
	(0.269)	(0.238)				(0.299)	(0.278)			
PE_5 Low			1.076***	0.454*				0.974***	0.416	
			(0.273)	(0.244)				(0.313)	(0.295)	
PE_5 High			1.434***	0.441				1.715***	0.670*	
			(0.354)	(0.318)				(0.398)	(0.388)	
PE_5 Q1					0.334					0.309
					(0.281)					(0.336)
PE_5 Q2					0.587*					0.527
					(0.306)					(0.377)
PE_5 Q3					0.514					0.686*
					(0.339)					(0.404)
PE_5 Q4					0.413					0.732
					(0.370)					(0.466)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I-Y FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
$PE_L = PE_H$			0.233	0.964	0.854			0.046*	0.502	0.819
Observations	6,976	6,976	6,976	6,976	6,976	6,976	7,013	7,013	7,013	7,013

Table 8: PE activity and growth rate of employment. The table contains OLS panel regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the annual growth rate of labor costs or total employment (as defined by OECD). The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level (PE_5), indicators for whether the measured PE activity is below or above the median activity level (PE_5 *Low* and PE_5 *High*), and indicators for quartiles. The omitted base category is no PE activity over the previous five years. Country-industry (*C-I FE*), industry-year (*I-Y FE*), and country-year (*C-Y FE*) fixed effects are included as indicated. Robust standard errors are in parentheses. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or all the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Number of employees	Number of employees	Number of employees	Number of employees	Number of employees
PE_5	0.779***	0.160				0.845***	0.400**			
	(0.269)	(0.197)				(0.210)	(0.181)			
PE_5 Low			0.575**	0.241				0.954***	0.469**	
			(0.270)	(0.211)				(0.214)	(0.193)	
PE_5 High			1.192***	-0.016				0.605**	0.241	
			(0.337)	(0.244)				(0.272)	(0.232)	
PE_5 Q1					0.080					0.415*
					(0.249)					(0.217)
PE_5 Q2					0.424*					0.545**
					(0.230)					(0.230)
PE_5 Q3					0.047					0.347
					(0.266)					(0.246)
PE_5 Q4					0.045					0.069
					(0.298)					(0.289)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I-Y FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
$PE_L = PE_H$			0.016**	0.247	0.231			0.123	0.285	0.393
Observations	6,743	6,743	6,743	6,743	6,743	5,771	5,771	5,771	5,771	5,771

Table 9: Twice-lagged PE activity and growth rate of employment. The table contains OLS panel regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the annual growth rate of labor costs or total employment (as defined by OECD). The exogenous variables are an indicator for positive PE activity over the previous four years -2 to -5, i.e. *not* including the year previous to the year where the growth in the endogenous variable is measured ($PE_{2\text{-}5}$), indicators for whether the measured PE activity is below or above the median activity level (PE_5 *Low* and PE_5 *High*), and indicators for quartiles. The omitted base category is no PE activity over the previous five years. Country-industry (*C-I FE*), industry-year (*I-Y FE*), and country-year (*C-Y FE*) fixed effects are included as indicated. Robust standard errors are in parentheses. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or all the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1) Labor costs (compensation of employees)	(2) Labor costs (compensation of employees)	(3) Labor costs (compensation of employees)	(4) Labor costs (compensation of employees)	(5) Labor costs (compensation of employees)	(6) Number of employees	(7) Number of employees	(8) Number of employees	(9) Number of employees	(10) Number of employees
PE_5	0.594**	-0.038				0.781***	0.341**			
	(0.251)	(0.193)				(0.190)	(0.170)			
PE_5 Low			0.359	-0.038				0.860***	0.344*	
			(0.258)	(0.204)				(0.201)	(0.181)	
PE_5 High			1.007***	-0.038				0.630***	0.336	
			(0.302)	(0.243)				(0.243)	(0.221)	
PE_5 Q1					-0.179					0.261
					(0.233)					(0.212)
PE_5 Q2					0.134					0.464**
					(0.226)					(0.206)
PE_5 Q3					0.128					0.525**
					(0.259)					(0.231)
PE_5 Q4					-0.217					0.028
					(0.309)					(0.275)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I-Y FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
$PE_L = PE_H$			0.006***	0.999	0.263			0.285	0.969	0.078*
Observations	6743	6743	6743	6743	6743	5771	5771	5771	5771	5771

Table 10: PE activity and growth rate of capital formation. The table contains OLS panel regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the annual growth rate of gross fixed capital formation or consumption of fixed capital (as defined by OECD). The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level (PE_5), indicators for whether the measured PE activity is below or above the median activity level (PE_5 *Low* and PE_5 *High*), and indicators for quartiles. The omitted base category is no PE activity over the previous five years. Country-industry (*C-I FE*), industry-year (*I-Y FE*), and country-year (*C-Y FE*) fixed effects are included as indicated. Robust standard errors are in parentheses. $PE_L = PE_H$ contains the significance level of a Wald test of equality of the *PE Low* and *PE High* coefficients or all the quartile coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1) Gross fixed capital formation	(2) Gross fixed capital formation	(3) Gross fixed capital formation	(4) Gross fixed capital formation	(5) Gross fixed capital formation	(6) Consumption of fixed capital	(7) Consumption of fixed capital	(8) Consumption of fixed capital	(9) Consumption of fixed capital	(10) Consumption of fixed capital
PE_5	-0.103	-3.499				0.165	-0.494			
	(2.463)	(3.346)				(0.415)	(0.323)			
PE_5 Low			-0.092	-3.565				-0.353	-0.435	
			(2.550)	(3.653)				(0.469)	(0.367)	
PE_5 High			-0.124	-3.362				1.096**	-0.611*	
			(2.665)	(3.044)				(0.467)	(0.357)	
PE_5 Q1					-1.190					-0.657**
					(3.256)					(0.328)
PE_5 Q2					-6.172					-0.181
					(4.718)					(0.520)
PE_5 Q3					-4.792					-0.568
					(3.258)					(0.382)
PE_5 Q4					-2.965					-0.468
					(4.070)					(0.490)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
I-Y FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes
$PE_L = PE_H$			0.985	0.918	0.301			0.001***	0.619	0.739
Observations	6,074	6,074	6,074	6,074	6,074	4,712	4,712	4,712	4,712	4,712

Table 11: PE activity and productivity cycles. The table contains OLS panel regression coefficients. An observation is the annual growth rate of the indicated productivity measure (subtracting its average growth rate across countries) at the country-industry-year level. The exogenous variable *PE_5 x Avg growth* contains the interaction between *PE_5* and the average growth rate of the endogenous variable, averaged over countries. *PE_5* is an indicator for positive PE activity in the country-industry during the previous five years. The variables *PE_5 Low x Avg* growth and *PE_5 High x Avg growth* are constructed similarly, where *PE_5 Low* and *PE_5 High* are indicators for below or above median PE activity. The regressions contain country-industry (*C-I FE*) fixed effects. Standard errors in parentheses are robust and calculated allowing for AR(1) serial correlation as indicated along with the autocorrelation coefficient. *$PA_L = PA_H$* contains the significance level of a Wald test of equality of the *PE_5 Low x Avg growth* and *PE_5 High x Avg growth* coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1) Production (gross output)	(2) Production (gross output)	(3) Production (gross output)	(4) Value added	(5) Value added	(6) Value added
PE_5 x Avg growth	-0.059**			-0.066		
	(0.029)			(0.043)		
PE_5 Low x Avg growth		-0.088	-0.080*		-0.132	-0.133**
		(0.057)	(0.042)		(0.103)	(0.063)
PE_5 High x Avg growth		-0.025	-0.040		0.008	0.008
		(0.052)	(0.039)		(0.075)	(0.059)
PE_5	1.417***			1.567***		
	(0.315)			(0.389)		
PE_5 Low		1.572***	1.522***		1.673***	1.761***
		(0.407)	(0.397)		(0.620)	(0.514)
PE_5 High		1.562***	1.349***		1.662***	1.474***
		(0.378)	(0.394)		(0.425)	(0.485)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	Yes	No	Yes	Yes	No	Yes
	0.206		0.206	0.099		0.097
PA_L=PA_H		0.344	0.476		0.234	0.094*
Observations	6,499	6,976	6,999	6,536	7,013	6,536

Table 12: PE activity and employment cycles. The table contains OLS panel regression coefficients. An observation is the annual growth rate of the indicated employment measure (subtracting its average growth rate across countries) at the country-industry-year level. The exogenous variable *PE_5 x Avg growth* contains the interaction between *PE* and the average growth rate of the endogenous variable, averaged over countries. *PE_5* is an indicator for positive PE activity in the country-industry during the previous five years. The variables *PE_5 Low x Avg growth* and *PE_5 High x Avg growth* are constructed similarly, where *PE_5 Low* and *PE_5 High* are indicators for below or above median PE activity. The regressions contain country-industry (*C-I FE*) fixed effects. Standard errors in parentheses are robust and calculated allowing for AR(1) serial correlation as indicated along with the autocorrelation coefficient. $PA_L = PA_H$ contains the significance level of a Wald test of equality of the *PE_5 Low x Avg growth* and *PE_5 High x Avg growth* coefficients. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Number of employees	Number of employees	Number of employees
PE_5 x Avg growth	-0.214***			-0.131***		
	(0.045)			(0.048)		
PE_5 Low x Avg growth		-0.280***	-0.297***		-0.145**	-0.215***
		(0.057)	(0.060)		(0.061)	(0.063)
PE_5 High x Avg growth		-0.098*	-0.130**		-0.021	-0.067
		(0.055)	(0.061)		(0.067)	(0.062)
PE_5	1.992***			0.601***		
	(0.326)			(0.194)		
PE_5 Low		2.097***	2.493***		0.890***	0.864***
		(0.324)	(0.417)		(0.188)	(0.217)
PE_5 High		1.562***	1.539***		0.465**	0.301
		(0.318)	(0.407)		(0.218)	(0.237)
C-I FE	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	Yes	No	Yes	Yes	No	Yes
	0.288		0.287	0.207		0.207
PA_L=PA_H		0.008***	0.036**		0.105	0.061*
Observations	6,286	6,743	6,286	5,358	5,771	5,358

Table 13: Distribution of financial assets by country. *Observations* is the number of country-year pairs for which financial assets data is available (since 1990). *Financial Assets* is the value of assets held by domestic autonomous pension funds and insurance corporations (in 2008 US$ billions). *Financial Assets to GDP ratio* is the fraction of financial assets normalized by country's GDP.

		Financial Assets (2008 US$ billions)		Financial Assets to GDP ratio	
Country	Observations	Average	Std. Dev.	Average	Std. Dev.
Australia	18	480.14	269.90	0.72	0.18
Austria	18	86.32	37.07	0.28	0.09
Belgium	18	152.77	93.40	0.40	0.19
Canada	18	809.71	296.95	0.77	0.11
Switzerland	9	725.27	136.57	1.84	0.12
Czech Republic	13	12.45	7.87	0.10	0.03
Germany	17	1,493.70	465.62	0.49	0.13
Denmark	14	260.46	76.98	1.00	0.15
Spain	18	233.03	143.10	0.23	0.09
Finland	13	45.13	15.38	0.23	0.05
France	14	1,456.34	600.87	0.66	0.18
United Kingdom	18	3,062.95	1,075.63	1.49	0.28
Greece	13	10.49	4.62	0.05	0.01
Hungary	17	8.65	9.12	0.08	0.06
Ireland	7	253.39	102.63	1.15	0.21
Iceland	7	19.25	7.95	1.14	0.20
Italy	13	473.46	246.79	0.26	0.10
Japan	18	3,327.69	374.91	0.59	0.08
South Korea	6	368.09	87.98	0.42	0.04
Netherlands	18	899.32	319.63	1.48	0.28
Norway	13	105.06	38.10	0.39	0.03
Poland	16	26.21	32.77	0.08	0.07
Portugal	13	62.29	27.26	0.33	0.09
Slovakia	12	3.02	2.37	0.06	0.02
Sweden	13	302.44	95.06	0.80	0.15
United States	18	12,900.00	3,246.92	1.08	0.14

Table 14: Instrumental variables analysis. The table contains OLS and 2SLS regression coefficients. An observation is a country-industry-year pair. The endogenous variable is the deviation of the annual growth rate of production, value added, labor costs, and total employment (as defined by OECD) relative to the average rate in the same industry and year. The exogenous variables are an indicator for positive PE activity over the previous five years at the country-industry level (PE_5), and industry- and country-fixed effects as indicated. The 2SLS specifications use the fraction of assets held by domestic institutional investors to GDP to instrument PE, along with country and industry fixed effects in the first stage. Standard errors in parentheses are calculated with clustering at the country-year level (both at first and second stage) and are presented in parentheses. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Production (gross output)	Production (gross output)	Value added	Value added	Labor costs (compensation of employees)	Labor costs (compensation of employees)	Number of employees	Number of employees
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
PE_5	0.906***	2.414**	1.117***	2.838**	0.684***	2.309**	0.546***	0.102
	(0.241)	(1.167)	(0.270)	(1.108)	(0.253)	(1.079)	(0.177)	(0.892)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	6,976	5,918	7,013	5,951	6,743	5,745	5,771	5,098
R-squared	0.177	0.186	0.130	0.134	0.225	0.259	0.067	0.082

Table 15: Granger causality (SUR). The table contains coefficients from two specifications of a linear SUR/VAR model, each with three equations. Columns 1-3 contain estimates of the first specification; columns 4-6 contain the second one. Endogenous variables are productivity growth (deviation from annual industry average), labor growth (deviation from annual industry average), and a PE indicator (equals one for each country-industry-year with any PE activity). Exogenous variables are lagged endogenous variables with the lag in parentheses and industry- and country-fixed effects. Note that the coefficients, but not the standard errors, are identical to those obtained from six single-equation OLS regressions. Reported standard errors allow for cross-equation correlations. Significance levels of Wald tests of the joint significance of the PE, productivity, and labor coefficients are reported. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Prod.(%)	Labr.(%)	PE(0/1)	Prod.(%)	Labr.(%)	PE(0/1)
PE_1 (1)	0.918***	0.562***	0.096***	0.894***	0.607***	0.098***
	(0.297)	(0.218)	(0.015)	(0.312)	(0.217)	(0.015)
PE_1 (2)	0.000	-0.051	0.115***	0.126	0.012	0.115***
	(0.307)	(0.225)	(0.015)	(0.321)	(0.224)	(0.015)
PE_1 (3)	-0.433	-0.007	0.144***	-0.342	0.015	0.151***
	(0.312)	(0.228)	(0.016)	(0.327)	(0.228)	(0.015)
PE_1 (4)	0.213	-0.287	0.136***	0.210	-0.281	0.133***
	(0.323)	(0.237)	(0.016)	(0.339)	(0.236)	(0.016)
PE_1 (5)	-0.221	0.039	0.101***	-0.151	-0.000	0.102***
	(0.333)	(0.244)	(0.017)	(0.349)	(0.244)	(0.016)
Prod. Growth (1)	0.137***	0.161***	0.000	0.154***	0.166***	0.000
	(0.015)	(0.011)	(0.001)	(0.015)	(0.011)	(0.001)
Prod. Growth (2)	-0.110***	0.041***	-0.000	-0.051***	0.055***	-0.000
	(0.016)	(0.011)	(0.001)	(0.016)	(0.011)	(0.001)
Prod. Growth (3)	0.093***	0.076***	-0.000	0.086***	0.065***	-0.001
	(0.015)	(0.011)	(0.001)	(0.015)	(0.011)	(0.001)
Prod. Growth (4)	0.005	0.006	-0.000			
	(0.015)	(0.011)	(0.001)			
Prod. Growth (5)	0.145***	0.065***	0.001			
	(0.015)	(0.011)	(0.001)			
Labor Growth (1)	0.071***	0.089***	-0.000	0.068***	0.088***	-0.001
	(0.022)	(0.016)	(0.001)	(0.022)	(0.016)	(0.001)
Labor Growth (2)	-0.008	-0.032**	-0.000	-0.014	-0.026*	-0.000
	(0.022)	(0.016)	(0.001)	(0.022)	(0.015)	(0.001)
Labor Growth (3)	-0.007	-0.054***	-0.001	0.009	-0.032**	-0.001
	(0.021)	(0.015)	(0.001)	(0.020)	(0.014)	(0.001)
Labor Growth (4)	-0.065***	-0.025*	-0.002*			
	(0.020)	(0.014)	(0.001)			
Labor Growth (5)	-0.036**	-0.026**	0.000			
	(0.016)	(0.012)	(0.001)			
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Prob[PE = 0]	0.040*	0.181	0.000***	0.028**	0.043*	0.000***
Prob[Prod. = 0]	0.000***	0.000***	0.813	0.000***	0.000***	0.892
Prob[Labor = 0]	0.000***	0.000***	0.413	0.024**	0.000***	0.537
Observations	4,730	4,730	4,730	4,939	4,939	4,939
R-squared	0.228	0.366	0.500	0.227	0.387	0.497

Table 16: System GMM. The table contains coefficients from six single-equation GMM specifications, using first differences to eliminate country-industry fixed effects. Specifications 1-3 use moments and instruments suggested by Arellano and Bond (1991); specifications 4-6 follow Blundell and Bond (1998). Endogenous variables are productivity growth (deviation from annual industry average), labor growth (deviation from annual industry average), and a PE indicator (equals one for each country-industry-year with any PE activity). Exogenous variables are these variables lagged with the lag in parentheses. Robust standard errors are in parentheses. Significance levels of Wald tests of the joint significance of the PE, productivity, and labor coefficients are reported. Significance levels for Arellano-Bond tests for first- and second-order autocorrelation in the error terms are reported. The null hypothesis is no autocorrelation (by construction, first-differencing creates first-order autocorrelation as reported and fully consistent with the specification). Statistical significance at the 1%, 5% and 10% levels are indicated by ***, **, and *, respectively.

	(1) Prod.(%)	(2) Labr.(%)	(3) PE(0/1)	(4) Prod.(%)	(5) Labr.(%)	(6) PE(0/1)
PE_1 (1)	5.680***	1.954*	0.104***	4.369***	1.748*	0.174***
	(1.441)	(1.007)	(0.038)	(1.441)	(0.920)	(0.021)
PE_1 (2)	-1.210	-0.536	0.127***	-3.481***	-1.557*	0.186***
	(1.363)	(1.042)	(0.031)	(1.279)	(0.920)	(0.021)
PE_1 (3)	1.277	2.000**	0.157***	-0.317	0.789	0.201***
	(1.368)	(1.014)	(0.027)	(1.309)	(0.911)	(0.022)
PE_1 (4)	-1.497	-3.217***	0.153***	-2.731**	-3.664***	0.185***
	(1.456)	(1.105)	(0.026)	(1.333)	(1.040)	(0.023)
PE_1 (5)	0.350	-0.310	0.113***	-0.112	-0.082	0.140***
	(0.498)	(0.298)	(0.021)	(0.396)	(0.256)	(0.020)
Prod. Growth (1)	0.120**	0.267***	0.001	0.154***	0.239***	-0.001
	(0.049)	(0.046)	(0.002)	(0.043)	(0.043)	(0.002)
Prod. Growth (2)	-0.086	-0.002	0.002	-0.067	-0.020	0.001
	(0.060)	(0.034)	(0.002)	(0.054)	(0.031)	(0.002)
Prod. Growth (3)	0.144***	0.141***	0.006***	0.147***	0.128***	0.003*
	(0.036)	(0.039)	(0.002)	(0.034)	(0.034)	(0.002)
Prod. Growth (4)	0.075**	0.076**	0.002	0.054*	0.047	-0.000
	(0.035)	(0.034)	(0.002)	(0.031)	(0.030)	(0.002)
Prod. Growth (5)	0.171***	0.075***	0.003***	0.175***	0.076***	0.002
	(0.029)	(0.019)	(0.001)	(0.028)	(0.017)	(0.001)
Labor Growth (1)	-0.019	-0.085	-0.005	-0.010	0.025	-0.002
	(0.093)	(0.052)	(0.003)	(0.087)	(0.042)	(0.003)
Labor Growth (2)	-0.120	-0.089**	-0.006**	-0.115	-0.044	-0.003
	(0.088)	(0.036)	(0.003)	(0.084)	(0.033)	(0.003)
Labor Growth (3)	-0.158*	-0.131***	-0.010***	-0.127*	-0.098***	-0.006**
	(0.082)	(0.033)	(0.003)	(0.077)	(0.029)	(0.003)
Labor Growth (4)	-0.189**	-0.097***	-0.005**	-0.114*	-0.061**	-0.002
	(0.075)	(0.031)	(0.002)	(0.066)	(0.030)	(0.002)
Labor Growth (5)	-0.018	-0.032	0.002*	-0.022	-0.026	0.001
	(0.026)	(0.025)	(0.001)	(0.023)	(0.023)	(0.001)
Prob[PE = 0]	0.001***	0.014**	0.000***	0.000***	0.000***	0.000***
Prob[Prod. = 0]	0.000***	0.000***	0.039**	0.000***	0.000***	0.316
Prob[Labor = 0]	0.001***	0.001***	0.007***	0.010**	0.001***	0.234
Prob[AR(1)]	0.000***	0.000***	0.000***	0.000***	0.000***	0.000
Prob[AR(2)]	0.302	0.005***	0.774	0.317	0.001***	0.933
Observations	4,309	4,301	4,432	4,766	4,758	4,889