Labor Regulations and European Industrial Specialization: Evidence from Private Equity Investments*

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January 2008
HBS Working Paper 08-043

Abstract

European nations empirically substitute between employment protection regulations and labor market expenditures like unemployment insurance benefits in the provision of labor market insurance to workers. While perhaps substitutes from a worker's perspective, employment regulations more directly tax firms making frequent labor force adjustments. These labor adjustments are especially important for the portfolio companies of both venture capital and buy-out investors. European nations providing worker insurance through labor market expenditures developed stronger domestic private equity markets over the 1990-2004 period than those nations favoring employment protection. These patterns are further evident in US-sourced private equity investments into Europe. Moreover, tests for industry specialization suggest that countries with more flexible labor markets tend to specialize in sectors characterized by high labor volatility. These results are relevant to the literatures examining the impact of labor market regulations on entrepreneurship and productivity growth due to reallocations across firms and sectors.

JEL Classification: G24, J21, J65, L26, M13, O31, O32, O52.

Key Words: employment protection regulations, dismissal costs, unemployment insurance benefits, private equity, venture capital, buy-outs, entrepreneurship.

*Comments are appreciated. The authors are particularly grateful to Björn Brügemann for comments on this work; to the European Private Equity and Venture Capital Association for providing data; to David Autor, Eric Bartlesman, Lewis Branscomb, Marco da Rin, Shihe Fu, Thomas Hellmann, Joshua Lerner, Mika Maliranta, Ramana Nanda, Sari Pekkala, Petri Rouvinen, Bruno van Pottelsberghe, Niels Westergård-Nielsen, and seminar participants at the European Productivity Conference, European Regional Science Association, Harvard University, NBER, and Universite Libre de Bruxelles for helpful comments; and to Harvard Business School and the Innovation Policy and the Economy group for financial support. The research in this paper was conducted while the authors were Special Sworn Status researchers of the U.S. Census Bureau at the Boston Census Research Data Center (BRDC). Support for this research from NSF grant (ITR-0427889) is gratefully acknowledged. Research results and conclusions expressed are our own and do not necessarily reflect the views of the Census Bureau or NSF. This paper has been screened to insure that no confidential data are revealed.

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1 Introduction

This study examines how labor market insurance policies impact industrial specialization in Europe. This specialization is predicted by recent theoretical models (e.g., Saint-Paul 1997, 2002a; Samaniego 2006), but relatively limited empirical evidence has accumulated (e.g., Micco and Pagés 2007, Cunat and Melitz 2007). We use the lens of European private equity (PE) markets for our study, comprised of venture capital and buy-out investors. These investments provide a unique platform for studying labor market rigidities; moreover, they are of interest in their own right. Many European leaders want to replicate the innovation and economic growth spurred by PE firms in the US. Both the European Union and OECD are urging member states to promote the availability of risk capital financing for entrepreneurs (e.g., OECD 2004a). A number of European governments are also investigating which policies best facilitate the development of home-grown PE markets and the companies in which they invest.[1] The methodology and estimations developed in this study inform these policy choices.

Our study builds on two simple observations. First, it is well known that Continental European nations generally seek to provide higher levels of worker security than the US or UK.[2] European countries differ, however, in the mechanisms used to provide this worker insurance — empirically substituting between employment protection regulations (EPRs) and labor market expenditures (LMEs) like unemployment insurance benefits. Figure 1 shows the basic cross-sectional relationship between EPRs and LMEs from 1998. The vertical axis documents the average LMEs per capita for 1998-2001 taken from the OECD Social Expenditures database. LMEs include both active and passive policies designed to facilitate job creation and transitions. The horizontal axis provides an EPR index for 1998 developed by the OECD. Higher EPR scores indicate more heavily regulated labor markets, factoring in a wide variety of legislation concerning the individual and collective dismissals of both temporary and regular workers.

This plot illustrates two important features. First, Anglo-Saxon countries provide lower worker insurance on both dimensions than Continental Europe, as noted above. Second, the trend line, calculated only for Continental European nations, indicates that economies with higher LMEs per capita have weaker EPRs. Denmark provides the highest LMEs per capita but has the second-lowest EPR rating in Continental Europe. This reflects the well-publicized Danish 'flexicurity' approach that stresses high job mobility facilitated by generous out-of-work benefits and active labor market programs to promote worker re-entry. Portugal, on the other hand, provides strong security to the employed but weaker benefits to the unemployed.

[1] Several European politicians, however, have voiced strong reservations about PE. A prominent example is the April 2005 branding of PE as "locusts" by Franz Müntefering of Germany's Social Democratic Party. These concerns are more focused on buy-out investors than VC.

[2] The determinants of this cross-sectional pattern have been a frequent and lively political-economy topic since at least de Toqueville. See Alesina *et al.* (2001) and Kerr (2007) for references.

While EPRs and LMEs are perhaps substitutes for providing worker security, they have different implications for the costs firms face. EPRs have a stronger impact on the adjustment margins of firms, especially those undertaking substantial restructurings. Even if general corporate or payroll taxation is higher to support LMEs, the direct incidence on the labor adjustments that firms wish to make is weaker in regimes favoring LMEs than in strict EPR regimes. Our second observation is that PE, by its very nature, thrives in dynamic industries that require frequent labor adjustments. This PE focus on high-growth opportunities and rapid restructuring is necessary for achieving sufficient returns when portfolio companies offer the potential for exceptional investment returns but also carry a high risk of failure.

Combining these two observations, nations emphasizing LMEs over EPRs should be more attractive for the development of PE financing. Even though labor market regulations do not specifically target the portfolio companies of PE investors, these investors are seeking opportunities that are generally more sensitive to these taxes on labor adjustment. Our research investigates this hypothesis using PE surveys provided by the European Private Equity and Venture Capital Association (EVCA) and Venture Economics (VE). Figures 2 and 3 show that choices between EPRs and LMEs are correlated with PE placement (trend lines are still for Continental Europe). European countries with stricter EPR regimes have lower 1998-2004 PE investments per capita, while those favoring LMEs are more attractive to these financial forms.[3]

The remainder of this paper investigates these observations and their conclusion more rigorously. Figures 2 and 3 warn, however, that we should proceed cautiously. These graphs highlight that Anglo-Saxon economies do not conform well to the relationships evident within Continental Europe. Univariate, and often multivariate, estimations of the role of EPRs or LMEs will vary dramatically based upon sample composition. These differences relate, in part, to Figure 1. Direct inclusion of EPR and/or LME variables into regressions simultaneously captures both the *level* of labor market insurance provided and the *mechanism* or technique used to provision the insurance. These two objects are distinct from a policy perspective, however, and it is important to distinguish their individual effects as much as possible.

Section 2 therefore begins by proposing a simple transformation of the EPR and LME variables into metrics of 1) a level index of the aggregate labor market insurance provided through EPRs and LMEs, and 2) a mechanism index that captures the trade-off between EPRs and LMEs used in the provision. Roughly speaking, the level index is calculated as the average provision of EPRs and LMEs for each nation, while the mechanism index is the radian slope of a ray from the origin of Figure 1 to the nation's position in (EPR, LME) space. This second section also reviews theoretical rationales for why EPRs dampen firm labor adjustments.

[3]Estimated PE per capita includes both domestic-sourced and US-sourced investments from the EVCA and VE databases, respectively. The construction of these metrics is further discussed below.

Section 3 then describes why labor market regulations may have a substantial impact for PE investors. The basic economics of venture capital and buy-out firms are outlined, with an emphasis on the need of these firms to reallocate resources, often with the dismissal of workers, from underperforming investments to those delivering higher returns. The interaction of this required restructuring with dismissal costs gives labor market regulations a heavier bite. This section also introduces this study's EVCA data and documents the 1990-2004 growth of European PE markets. One advantage of studying entrepreneurship and industrial specialization through PE placements is their fairly consistent measurement across European countries and industrial sectors through these surveys. A second advantage is that the rapid emergence of European PE within the last fifteen years also allows us to view many other country characteristics as predetermined. How the deal money was allocated within Europe is informative for where these investors found the entrepreneurial and restructuring opportunities most attractive.

Section 4 presents empirical results that use cross-country variation. We find that a one standard deviation change in the mechanism used to provide labor market insurance to favor LMEs over EPRs correlates with a 0.3-0.4 standard deviation increase in PE investments in the country. This estimate is statistically significant and economically important in magnitude. We also show that this effect is robust to including other country characteristics like legal origins, financial market structures and the strength of IPO markets, and corporate taxation. We further study venture capital and buy-out investments separately, finding relatively similar effects for the two investment categories. We do not find consistent evidence for how the level of labor market insurance provided, as opposed to the mechanisms employed, affects PE investments.

Earlier studies of entrepreneurial finance tend to find a negative cross-sectional relationship between labor market rigidities and PE formation (e.g., Jeng and Wells 2000, Da Rin *et al.* 2006, Romain and van Pottelsberghe 2004). While these negative effects can be quite large, they also tend to be inconsistent across specifications and studies. Our analysis builds upon this nascent literature in three ways. Most importantly, we show in Section 4 how the transformed insurance mechanism index delivers more consistent estimations of the role of labor market regulations than modeling EPRs or LMEs individually. We further demonstrate how our mechanism index is approximated by the elasticity differences between EPRs and LMEs when they are modeled directly. Our contrast of EPRs and LMEs also identifies policy choices that lie behind intermediate outcomes like mean job tenure or employer perceptions.

A second contribution is a dual analysis of US-based PE investments into Europe. These international placements are calculated from the Venture Economics database. The pattern of these US-based investments are interesting in that they are less influenced by unmodeled conditions that promote or discourage domestic PE formation. Most importantly, governments may seek to compensate for heavily regulated labor markets with additional industrial policy

support for affected industries. US-based investors are less likely to be influenced by these corrective actions than domestic funds. The cross-border results mirror domestic findings on most dimensions, thus providing new confidence on the role of labor policies.

Section 5 provides our third contribution, where we document the industry-level specialization of PE that results from labor market regulations. We first calculate the mean annual labor volatility for establishments in different sectors using US data from the Census Bureau. Ordering the sectors, theory would suggest that the growth of PE investments in highly-volatile sectors will be more sensitive to the insurance mechanism than in less-volatile sectors. This prediction is confirmed, and the sector-level findings further demonstrate that the results are robust to including country fixed effects. The sector-level elasticity differentials are 0.1-0.2, smaller than those estimated with cross-country variation, and are evident on both the extensive margin of PE entry and the intensive margin of PE market size conditional on entry.

This industry-level analysis offers both a descriptive and methodological contribution. On the descriptive front, recent theoretical models by Saint-Paul (1997, 2002a) and Samaniego (2006) consider how greater firing costs may reduce incentives to engage in very innovative activities. Our study provides the first evidence of how different labor insurance policies influence this specialization for PE. On the methodology front, previous evidence on the role of labor market rigidities for PE formation comes mostly through cross-sectional regressions; within-country longitudinal estimates are not generally possible due to limited adjustment of labor policies over the horizons studied. Our industry specifications demonstrate the underlying rationale is true after controlling for total PE development by country.[4]

Policy choices regarding the optimal levels and mechanisms of labor market insurance are complex and should consider many economic and non-economic factors. While it is well beyond this paper's scope to determine how labor market insurance should be provisioned, we highlight one factor that should influence this decision given the desire of many European leaders to promote risk capital financing. This work also contributes more broadly to a growing body of academic and policy research examining how labor market regulations influence entrepreneurship and productivity growth. Many observers, both within and outside of academia, believe strict European labor policies hinder economic restructuring and subsequent productivity growth. The PE funds studied here support firm creation and restructuring. As such, they provide a complementary measure to studies considering entrepreneurship rates or reallocation directly.

[4]In terms of methodology, our work is most similar to Micco and Pagés (2007). These authors find that EPR reduces the sizes and employment fluctuations of intrinsically volatile sectors. Cunat and Melitz (2007) further relate more flexible labor markets to comparative advantages in trade for industries with high labor volatility. Our work differs from these studies in its focus on separating mechanisms from labor insurance levels.

The closest study to ours in the PE literature is Da Rin *et al.* (2006), who find within-country variation of manager's perceptions of hiring and firing conditions catalogued in the *World Competitiveness Yearbook* can explain greater shares of high-tech investments in PE sectors; they do not find similar evidence for the ratio of early-stage investments. Unlike their indices based upon management surveys, the policies modelled in this paper do not exhibit sufficient longitudinal variation for panel analysis.

2 Theoretical Considerations and Index Design

This section reviews several theoretical considerations regarding employment protection regulations and firm costs for labor adjustments. We then describe how our level and mechanism indices of labor market insurance are designed.

2.1 Employment Protection Regulations

Theoretical models of EPRs differ in their predictions for many dimensions — especially their impact for total employment levels and technical efficiency — but share a common finding that EPRs should dampen labor fluctuations by firms. In the standard competitive model of the labor market, EPRs are economically equivalent to mandated employment benefits. Benefit mandates raise the cost of employing workers, leading to a decline in labor demand by firms for a given wage rate. To the extent that workers value the mandate, they will increase their labor supply at a given wage. If workers value the mandated benefit at its marginal cost of provision, then equilibrium employment levels are unchanged and wages fall to cover exactly the cost of the benefit. In this scenario, the mandate is efficient and the Coase theorem applies (e.g., Summers 1989, Lazear 1990).

EPRs can potentially improve efficiency when workers value the protections above their cost of provision. EPRs may be under-provided by the private market due to adverse selection (e.g., Aghion and Hermalin 1990, Levine 1991) and risk aversion (e.g., Bertola 2004). Agell (1999) discusses why eliminating EPRs may not be desirable when labor markets are subject to fairness considerations and market imperfections, while Wasmer (2006) and Macleod and Nakavachara (2007) focus on human-capital investment. In the Coasean model, these factors would lead to higher employment levels after the mandates are imposed.

Other common deviations, however, can yield efficiency costs. First, workers may value the mandates at less than their marginal cost of provision, leading to a weaker growth in labor supply. Equivalently, some of the termination benefit may accrue to a third party, such as an attorney. Collective bargaining could also restrict the adjustments. In these cases, EPRs drive a wedge between the private and social cost of job separations and thereby create a deadweight loss. Because dismissal costs are only paid when workers and firms separate, EPRs result in labor adjustment costs to firms (i.e., a tax on separations). Consequently, EPRs that workers value at less than their cost will inhibit efficient job separations. These firing costs, in turn, can reduce efficient hiring as well for forward looking firms. The net effect of reduced hiring and firing is ambiguous for total employment levels and technical efficiency.[5]

[5]While many labor economists use this competitive model as a benchmark, much of the macroeconomic

Within these theoretical models is a common prediction for declining firm-level labor fluctuations with the passage of EPRs. The existing empirical evidence, while small, mostly supports this prediction. Autor *et al.* (2007) find that US firms reduce their annual and quarterly labor turnover when state-level EPRs are passed. Moreover, a substantial decline in the entry of new firms and establishments is evident. Wolfers (2007) also finds EPRs impact high-frequency, seasonal labor adjustments, and Blanchard and Portugal (2001) suggest more rigid EPRs can explain differences in labor market flows between the US and Portugal. Micco and Pagés (2007) show that stringent EPRs most reduce fluctuations in sectors characterized by high intrinsic labor volatility. Addison and Teixeira (2003) survey the industry-level evidence of slower labor adjustment speeds under EPRs.[6]

This labor adjustment cost feature of EPRs motivates our comparison to LMEs. To some extent, EPRs and LMEs may be substitutes for insuring workers against labor market risks. And more generally, it is beyond the scope of this paper to determine either the optimal level of labor market insurance or the most appropriate technique for implementing a chosen insurance level. The political economy of employment protection is complex (e.g., Saint-Paul 2002b), countries may have constraints on their policy choices (e.g., Algan and Cahuc 2007, Brügemann 2007), and optimal design likely involves both policies to a degree (e.g., Blanchard and Tirole 2005, Boeri *et al.* 2003). It is clear, however, that EPRs are likely to have a stronger impact on the adjustment margins of firms. Even if general corporate taxation is higher to support LMEs, the direct incidence on firm labor adjustments should be weaker than in strict EPR regimes. Quantifying the economic impact of these different mechanisms is a first-order empirical concern.

2.2 Level and Mechanism Indices of Labor Market Insurance

The graphical discussion in the introduction highlights that incorporating EPRs and/or LMEs directly into regressions captures differences across nations in the level of labor insurance governments sought to provide and the technique employed. The ideal estimation would separate these two, as they are distinct from a policy perspective. While both variables are unobservable, we develop estimations defined as $LbrInsLevel_{ct}$ and $LbrInsMech_{ct}$. We begin with a more complete description of the data for these two policies and then outline the transformation procedures.

literature views EPRs through the lens of the Diamond-Mortensen-Pissarides (DMP) equilibrium unemployment model (e.g., Mortensen and Pissarides 1994; Kugler *et al.* 2003). Autor *et al.* (2007) discuss how the basic findings regarding dampened labor adjustment by firms extends to the DMP framework too. Hamermesh and Pfann (1996) survey the theory of factor adjustments. Nickell and Layard (1999), Baker *et al.* (2002), Nickell *et al.* (2005), and Di Tella and MacCulloch (2005) provide cross-country empirical studies of labor institutions and macroeconomic performance (e.g., unemployment).

[6] Miles (2000) and Autor (2003) find stricter employment regulations account for substantial growth in US temporary help agencies. These help agencies provide firms a mechanism for adjusting short-term labor inputs without adjusting long-term employees.

LMEs are taken from the OECD Social Expenditures database and include unemployment insurance benefits and active labor market policy expenditures. Unemployment insurance comprises approximately 60% of the total, with this share declining somewhat in recent years. Active labor market programs include all social expenditures, excepting education, that are designed to improve the beneficiaries' prospects for finding employment or increasing earnings. Examples include labor market training, school-to-work transition assistance for youth, and labor market programs to promote employment for the unemployed. The first pair of columns in Table 1 document each country's average annual LMEs expressed as nominal ECUs/Euros per capita. Denmark provides the highest LMEs per capita (1482) in 1998-2001, over 50% larger than the next highest observation of Sweden (865). Greece provides the lowest level (67), the only European economy lower than the US (140, not listed). The unweighted average of nominal LME per capita is roughly constant across the 1990-1997 and 1998-2001 periods, with a mixture of countries increasing or decreasing.[7]

The EPR index of employment protection is sourced from the OECD (2004b) with a theoretical range from 0 to 5. Higher EPR scores indicate more heavily regulated labor markets, factoring in a wide variety of legislation concerning the individual and collective dismissals of both temporary and regular workers. In practice, the lowest score in 1998 is the US at 0.2, while Turkey is judged to have the most stringent restrictions at 3.8. Switzerland (1.1), Denmark (1.4), Greece (3.5), and Portugal (3.7) are the extreme values for 1998 within the Continental Europe sample mapped to the EVCA. The UK (0.6) and Ireland (0.9) provide intermediate levels between the US and the most flexible Continental labor markets. Most countries either receive the same EPR rating in 1990 and 1998 or move toward more flexible labor markets, especially for temporary workers. Only France increases its protection (from 2.7 to 3.0).

The EPR index is calculated for 1990 and 1998, which we pair with the mean annual LMEs per capita for 1990-1997 and 1998-2001. As such, we have two observations per country for the country-level analysis. In both periods, the weakest EPR and LME provisions are the US and Greece, respectively. As our indices are calculated as normalized deviations from these OECD minimums, we exclude Greece in subsequent analyses. Additionally, the EVCA and covariate data for Greece are incomplete. The remaining fifteen EVCA countries listed in Table 1 form our sample and represent the vast majority of European PE investment.[8]

To calculate $LbrInsLevel_{ct}$ and $LbrInsMech_{ct}$, we first transform EPR_{ct} and $\ln(LME/Cap_{ct})$

[7]Population estimates are from the OECD Labour Force Statistics. We find similar results when examining LMEs per unemployed worker. We prefer population-based estimates as unemployment definitions are difficult to compare across countries and unemployment levels are endogenous to labor market institutions.

[8]The PE levels are calculated below for 1990-1997 and 1998-2004. The OECD Social Expenditures LME average for 1998-2001 is used for 1998-2004. We have confirmed that extending the data through 2003 via the Eurostat database produces similar results, although modest changes in the definitions for LMEs occur. The OECD EPR index is also calculated in 2003. Similar results are obtained when grouping the data by the 1990-1995, 1996-2000, and 2001-2004 periods.

to have zero mean and unit standard deviation. The resulting metrics are less dependent upon the scale through which they are originally measured. We then measure the single-dimension distance for each country-period observation to the US or Greece minimums. Both of these distances have a maximum of less than four standard deviations. We calculate $LbrInsLevel_{ct}$ as the average of these distances for each observation. This level index estimates in standard deviations the distance from a country's joint provision of (EPR, LME) to the lowest observed values in the OECD. Table 1 documents these values, and the vertical axis of Figure 4 plots these distance metrics. The UK provides the weakest labor market insurance measured through this technique, while Belgium, Denmark, and Sweden are among the highest levels.

The second metric, $LbrInsMech_{ct}$, describes the mechanism employed for providing this labor market insurance. It is a radian measure of the LME distance divided by the EPR distance. $LbrInsMech_{ct}$ can be thought of as the slope of a ray extending from the origin of Figure 1 to the nation's position in (EPR, LME) space. The radian measure is a simple monotonic transformation of the base distance ratio that is bounded by $[0, \pi/2]$. This transformation eliminates the asymmetry that arises with a simple ratio. Larger values of $LbrInsMech_{ct}$ indicate greater reliance on LMEs than EPRs for providing worker insurance. Portugal, Italy, and Spain are the lowest values, indicating very strong dependency on EPRs, while Denmark, Switzerland, Ireland, and the UK most emphasize LMEs. The values are again listed in Table 1 and are plotted as the horizontal axis of Figure 4.

The trend line for Continental Europe in Figure 4 is very flat, illustrating better than Figure 1 the empirical substitution of European economies between LMEs and EPRs for the provision of labor insurance. This approximate orthogonality of the two indices for Continental Europe is not by construction but instead the result of selected policy levels. Including Ireland and the UK results in a negative correlation of about -0.4. In words, countries providing higher levels of labor market insurance tend to employ more stringent EPRs when the Anglo-Saxon economies are incorporated. Within Continental Europe itself, however, there is no clear relationship between the estimated level of labor insurance provided and the mechanisms employed.

The empirical estimations in Sections 4 and 5 find that using $LbrInsLevel_{ct}$ and $LbrInsMech_{ct}$ versus EPR_{ct} and $\ln(LME/Cap_{ct})$ aids in identifying the importance of techniques for providing labor market insurance in PE formation. After viewing the cross-county results in Section 4, we further discuss the properties of these metrics and consider alternative index designs.

3 Private Equity Firms and EVCA Data

This section further motivates how policies regarding labor market insurance can impact the development of PE markets. We discuss venture capital and buy-out firms in greater detail,

emphasizing their sensitivity to these regulations. We then describe our PE data and the growth of European investments over the 1990-2005 period.

3.1 Venture Capital (VC) Firms

Young entrepreneurial firms often struggle with financing the pursuit of their innovations or business concepts. These start-ups have few tangible assets that can be pledged for a bank loan, and traditional financial institutions typically lack the expertise to assess the creditworthiness of the proposed ventures. VCs screen entrepreneurial projects, structure financing deals, and monitor the performance of their portfolio companies in which they take equity stakes. VCs also provide non-financial resources like customer and supplier contacts, technical expertise, employee recruitment, and so on. Without these value-added intermediaries, many entrepreneurs would not attract the resources required to achieve commercial success.

The individual success stories of VC-backed companies from Fairchild Semiconductors to Google are well known; moreover, the economic benefits of the VC-supported innovation system extend deep. VC-backed firms contribute substantially to US technology formation, an area traditionally dominated by the research and development efforts of large corporations. Moreover, they do so very efficiently with a greater quantity of innovations per dollar invested (Kortum and Lerner 2000). Second, VC-backed firms often promote the emergence of new high-growth sectors like information technology and biotech.

Characteristic of entrepreneurial endeavors, however, the majority of a VC's portfolio companies still fail despite the assistance extended (e.g., Huntsman and Hoban 1980, Cochrane 2005). For example, Sahlman (1990) finds that more than one-third of the 383 investments made by 13 VC firms between 1969 and 1985 resulted in an absolute loss of invested capital. Moreover, the majority of investments do not return the cost of capital invested. On the other hand, less than 10% of the investments returned ten times the invested funds and yielded over half of the profits derived from the portfolio. Thus, a successful VC needs to maintain a portfolio of projects and to allocate aggressively resources to high-performing investments while withdrawing support from failing ventures. This staged approach yields option values for investments, and an important role of VCs is to close under-performing ventures for the sake of better opportunities.[9]

Thus, there are two general ways that strict labor regulations can affect the development of a VC industry. First, significant dismissal costs can reduce the attractiveness of industries where substantial technical change occurs relative to more stable industries, *ceteris paribus*, as

[9]These economics also underlie many of the legal and structural features of this PE industry. Examples include the co-investment of several VCs into single firms (i.e., syndication); the staging of investments based upon the start-ups reaching specified milestones; the convertible debt-to-equity financing instrument; and the control rights and board seats VCs take in their portfolio companies.

a given job match becomes obsolete faster (e.g., Saint-Paul 2002a, Samaniego 2006, Bartelsman and Hinloopen 2006). These rapid-growth settings, however, are the most attractive to VC investors as they create opportunities for the rapid development of portfolio companies along with the markets.

The skewness of a VC's portfolio returns highlights a second reason why strict labor market regulations can have accentuated impacts for these investors. VCs focus on young firms during their high-growth phase. Tremendous uncertainty exists about these firms' prospects, however, and labor adjustments are frequently required. Strict EPRs increase the costs of these adjustments and the closure of under-performing ventures.[10]

Note, however, that a higher level of labor insurance is not necessarily detrimental for the development of a VC industry. A higher provision of public insurance can aid high-growth, volatile firms by reducing the compensating differentials required for employees to accept the greater uncertainty. To some degree, stronger unemployment insurance benefits paid for through general taxation could even subsidize volatile sectors. The central question is how the insurance mechanisms employed shape the costs firms bear when adjusting employment.[11]

Despite these theoretical linkages, our understanding of how labor regulations shape VC development is still developing. Much of the early literature focuses on the role of flexible labor markets in the emergence of the US VC industry, linking local labor regulations to US geographic differences in VC intensity (e.g., Saxenian 1994, Gilson 1997, Hyde 1998).[12] Jeng and Wells (2000) first empirically evaluated VC's development across countries using multivariate analyses. In cross-sectional analyses, they find strict labor regulations (modeled using labor market tenures) hindered early-stage VC investment but not later-stage investments. In a subsequent study of the cyclicality of the VC industry, Romain and van Pottelsberghe (2004) find that labor market rigidities (modeled through EPR indices) reduce the impact of a country's expansions in GDP or technical knowledge for concomitant growth in its VC industry. Da Rin *et al.* (2006) find some evidence that hiring and firing costs (modeled through IMD management surveys) reduce the ratio of high-tech funding to total PE investments. They do not find consistent evidence for an effect on the ratio of early-stage investments.[13]

[10] Hopenhayn and Rogerson (1993) model how labor regulations can slow sector reallocation, a dampening that would also discourage VC placement. Heavy labor market regulations may also reduce the demand for VC funds, versus its supply, by weakening incentives for entrepreneurship. Channels include greater benefits during employment (e.g., extended vacation periods, paid pregnancy leave), greater difficulty or loss of social standing should the venture fail, and so on.

[11] An Experience Rating system links employer unemployment insurance contributions to the dismissal history of the firm. This system is employed by the US but otherwise fairly rare. The adjustment costs to firms here are only a partial incidence that remains weaker than EPR regimes.

[12] See Gompers and Lerner (2001, 2002) for further details about the development of the US VC industry.

[13] A second literature strand considers the impact of labor market policies on entrepreneurship directly. Examples include Davidsson and Henrekson (2002), Heckman (2003), Ilmakunnas and Kanniainen (2001), Kanniainen and Leppamaki (2000), Kanniainen and Vesala (2005), Kugler and Pica (2004), and Autor *et al.* (2007). Fonseca *et al.* (2001), Djankov *et al.* (2002), Botero *et al.* (2004), and Klapper *et al.* (2006) discuss broader entry and labor regulations. Nicoletti *et al.* (2000) discuss product market regulations and employment protection.

Several other determinants figure prominently in the literature, including the strength of exit markets (e.g., Black and Gilson 1998, Ritter 2003), taxation policy (e.g., Poterba 1989, Gompers and Lerner 1998), and active government intervention (e.g., Lerner 2002, Leleux and Surlemont 2003).[14] Jeng and Wells (2000), Romain and van Pottelsberghe (2004), and Da Rin *et al.* (2006) are among the most comprehensive multivariate analyses of these determinants. This literature guides the design of our empirical specifications below.

3.2 Buy-Out Investors

A second class of PE investors are buy-out firms. Buy-out firms frequently acquire inefficient companies or subsidiaries with the expectation of restructuring poor operations and making a profit from better management. To purchase the target company's equity, buy-out firms often undertake substantial debt burdens and use the acquired company's existing assets as collateral for the loans. This debt financing and rigorous loan repayment schedules discipline the target's management to be more efficient in operations, often with an emphasis on cost minimization. In many cases, the firm's labor force is restructured to facilitate these leaner operations, and non-core or underperforming divisions may be sold to third parties. The buy-out investors profit in these turnaround projects if the value of the acquired firm increases with better performance. The academic literature on the US buy-out industry highlight some of the beneficial aspects of this market for corporate control and the more efficient reallocation of resources (e.g., Holmstrom and Kaplan 2001).[15]

Strict EPRs are likely to hinder the development of buy-out investors too, but for somewhat different reasons than VC investments. Buy-out investments are much more concentrated in manufacturing and industrial products and services than VC investments; high-tech sectors account for only 10% of European buy-out investments in 2000. Moreover, buy-out investors do not target rapid growth for their portfolio firms like VC firms. Nevertheless, buy-out investors seek opportunities that frequently require labor restructurings (e.g., Davis *et al.* 2007). Past employment obligations generally transfer to new owners (e.g., a transfer of undertaking). If EPRs increase the cost of these existing contracts and their duties, the gap between current valuations and potential worth must be larger to induce a takeover and restructuring.[16]

[14] Several studies examine the institutional and legal factors influencing VC development, including strong and transparent legal systems and accounting standards (La Porta *et al.* 1997, 1998, Shleifer and Wolfenzon 2002), property rights (Johnson *et al.* 2002), and legal forms available for VCs (Lerner 2001). These studies closely relate to the financial market development studies (e.g., Carlin and Mayer 2003) as legal systems influence the growth of external financing.

[15] Several differences exist between US and European buy-outs. First, buy-outs of publicly-traded companies are rare in Europe; efforts instead focus on divested subsidiaries, private businesses, and family-owned companies. Many European buy-outs also begin as auctions, and unsolicited bids by buy-out firms to companies are less common than in the US. Finally, European buy-outs tend to be less leveraged than US buy-outs and of smaller deal sizes.

[16] Whether total employment increases or decreases following the buy-out depends upon the strategies of the

As part of this research, we undertook semi-structured interviews of PE fund managers in ten European countries in the summer and fall of 2006. A couple of key themes emerged in these discussions that were generally consistent across the respondent countries and fund types. First, every investment manager believed labor regulations to be an important factor in the development of both VC and buy-out markets. Most respondents further rated local labor regulations as a first-order concern when evaluating investment candidates, although several noted that they are willing to enter heavily regulated markets if other advantages exist like high quality labor. It was even mentioned that past concern over labor regulations may have hidden some high-quality opportunities in countries with heavily-regulated labor markets. Second, most managers felt turnaround investment funds to be the most susceptible to the EPR versus LME choice, followed by early-stage VC and then expansion-stage VC investments.[17]

3.3 European Private Equity Data - EVCA

Our PE data are taken from annual EVCA surveys conducted by PriceWaterhouse Coopers and Thomson Financial. The EVCA provided us statistics on fifteen European nations from 1990 to 2004. Table 1 documents country-level PE investments by domestic investors over the fifteen years. The largest European PE community, in both absolute and per capita investment terms, is the UK. Continental European countries with high per capita investment levels are Sweden and the Netherlands, while France, Germany, Italy, and Spain also maintain significant investment levels due to their large country sizes. In examining Table 1, it should be noted that a number of zeros are small investment levels that appear zero on a per capita basis.

Significant differences exist between the PE-supported entrepreneurship studied here and entrepreneurship defined through self employment (e.g., Blanchflower *et al.* 2001). The survey by Addison and Teixeira (2003) notes a consistent empirical finding of a positive association between employment protection and self employment. Table 1 suggests that this relationship is unlikely to hold in estimations of cross-country PE differences within Europe. Southern European countries (e.g., Portugal, Greece) rank very high on self-employment scales but have smaller PE per capita markets. On the other hand, Scandinavian countries rank low on self-employment indices, but have been among the most successful European countries in attracting VC and buy-out investments.[18]

investors. EVCA (2001) reports that 61% of sampled buy-outs increased employment afterwards concomitant to growth, while 26% decreased employment. See Bacon *et al.* (2004), Bruining *et al.* (2005), and Harris *et al.* (2005) for recent evidence.

[17] Interview quotes from European private equity practitioners: "We want our early stage investments to grow quickly to 50-100 employees, but they may also need to fall back to 25 workers. Strict employment regulations make it less attractive for starting these risky businesses." Also, "National differences in labor regulations are an important factor for where pan-European funds place their resources, particularly for turnaround investors."

[18] Glaeser and Kerr (2007) discuss different entrepreneurship metrics in the US context.

PE placements in the US were several times larger than aggregate European investments in the early and mid 1990s, but this gap diminished over the last decade. Figure 5 illustrates the annual European growth. The graph also highlights how VC and buy-out investments increased together in Europe, although buy-out funds have become more prominent since 2000. In general, buy-out funds and later-stage VC investments account for a greater percentage of European investments than US investments (relative to early-stage investments). The fifth pair of columns in Table 1 shows that PE investments, expressed as nominal ECUs/Euros per capita, increased in most European countries from their 1990-1997 levels to 1998-2004, although substantial variations exist. This study of labor market insurance regimes attempts to explain, in part, the features of these data.[19]

Drivers of this strong European growth include the more favorable treatments of PE financing by European governments, policy deregulations to encourage entrepreneurship, the opening of several stock markets emulating the US NASDAQ, and so on. The Commission of the European Communities also adopted the Risk Capital Action Plan in 1998, and the European Investment Fund has been converted into an investor in VC funds. Of course, the formation of the technology bubble in the US played a role in the late 1990s' increase. Europe's increase and decline were less dramatic than the US, however, and European investment levels remain significantly higher than they were a decade ago.

While pension funds, insurance companies, and endowments contribute nearly two-thirds of US VC funds, these institutional investors account for less than one-third of European funding sources. European PE firms are instead more dependent upon funds controlled by financial or corporate entities (i.e., 'captive' funds). Government funding is also more prominent in Europe. This contrast in fund sources reflects different capital market structures. Banks remain more central to Europe's financial structure, and these financial institutions further control large portions of the mutual funds industry and the nascent pension funds industry. Bottazzi *et al.* (2004) further describe the current state of European VC firms.

The central advantage of the EVCA data are their fairly consistent measurement of PE markets across European countries and industrial sectors during the 1990-2004 period. This panel consistency is generally not feasible when grouping together VC or buy-out data across multiple countries. There are, however, two liabilities that directly influence our empirical approach. First, VC and buy-out investments are separately reported at the aggregate level but not within sectors. While theory predicts strict labor regulations negatively impact both investment classes, we would prefer to study VC and buy-out investments more independently

[19] The term "venture capital" in Europe often encompasses more later-stage investments than in the US parlance. In the empirical exercises, our division follows the European definition. A distinction is also made in Europe between "buy-outs" and "buy-ins" depending upon whether the target company's management participates. We use the term "buy-outs" for both investment types.

than we are able to. Second, the EVCA data do not allow us to consider cross-border investments within Europe. Approximately 75% of European PE investments recorded by the EVCA are raised within the investing country (an unweighted average). The data report the amounts invested abroad by European countries, but the destination countries are not identified. Again, this distinction is not made at the sector level either. We focus on the investment amounts for countries in this paper.

3.4 European Private Equity Data - VE

US-based firms also invest into Europe. The final pair of columns in Table 1 documents investments by US-based firms into Europe taken from Thomson Financial's Venture Economics (VE) database. The EVCA surveys all PE firms with a physical presence in Europe, regardless of EVCA membership status. VE contains deal-level data for US PE firms that allow us to tally investments originating in the US for European portfolio firms. In some cases, the US PE firms may have opened offices in Europe, although this practice was less common until recently. The US data are thus important for providing a comprehensive view of emergence and growth of European PE markets.

Deal amounts are missing from about 30% of VE's reported deals. We impute these missing values through a two-step procedure (done separately for VC and buy-out investments). We first regress available deal amounts on vectors of fixed effects for countries, EVCA industries, years, and number of investors. We then predict deal values for missing observations using the estimated parameters. The predictions take negative values for a small fraction of the observations, which we replace in the second step with the minimum deal amount by industry and type for these cross-border transactions in VE.

This imputation is mainly for descriptive purposes and of limited analytical consequence. Estimations without imputing the missing deal amounts are very similar to the results with imputed data — coefficients usually differ by less than 10% and statistical significance is not affected. We further find similar outcomes when testing other imputation procedures. In general, the distribution of these missing values is relatively uniform to deals with reported levels. We do not believe this VE data limitation is a first-order concern given these checks and the general robustness of our findings across the EVCA and VE data.

Moreover, the US-sourced investments provide several methodological advantages exploited below. Most importantly, aggregating from individual deals allows us to separate VC and buy-out investments by country and sector for US investments into Europe, a joint disaggregation not feasible with the EVCA data, that is exploited in Section 5. Second, these cross-border

investments are less influenced than domestic investors by unmodeled factors like public venturing. Finally, these cross-border investments are a recent phenomena, largely coming about during the last decade after policies regarding labor market insurance have been devised, and thus aid in assigning causal directions to the analyses.

4 Cross-Country Estimations

We now turn to empirical evidence regarding the development of PE markets in the face of EPR versus LME regimes. Our hypothesis is that nations favoring LMEs for the provision of labor market insurance are more conducive to PE formation. This section considers aggregate country-level PE investments, with particular emphasis on interpreting the transformed labor market insurance level and mechanism indices, while the next section examines sector-level differences within countries.

4.1 Labor Market Insurance Levels and Mechanisms Indices

We commence with pooled cross-sectional estimations of the relative size of PE markets in Europe for 1990-1997 and 1998-2004, combining both domestic placements and US-sourced investments. Our estimations take the form,

$$\ln(PE/Cap_{ct}) = \beta_{Level} LbrInsLevel_{ct} + \beta_{Mech} LbrInsMech_{ct} + \lambda X_{ct} + \tau_t + \varepsilon_{ct}, \qquad (1)$$

where $LbrInsLevel_{ct}$ and $LbrInsMech_{ct}$ are the labor insurance level and mechanism indices constructed in Section 2. The dependent variables are log measures of PE investments per capita in country c and period t developed from the EVCA and VE databases. We employ per capita metrics to make PE investment relative to country size; we prefer population denominators to GDP-based denominators as the latter are endogenous to labor institutions and PE investments. Estimations are weighted by country populations, and a vector of period fixed effects τ_t are included in the regressions. These fixed effects remove aggregate changes like inflation and the overall growth in European PE documented in Figure 5. X_{ct} is a vector of country-level covariates discussed below.

Table 2 documents the main results where the dependent measure includes both VC and buyout investments. The first two columns separately estimate (1) with just the $LbrInsLevel_{ct}$ or $LbrInsMech_{ct}$ regressors. All variables are transformed to have unit standard deviation for interpretation. β_{Level} in Column 1 has a coefficient of -0.24 that is statistically significant. In words, the estimation calculates that a one standard deviation increase in the estimated level of labor market insurance provided is correlated with a quarter of a standard deviation decline in

PE per capita levels. This negative univariate correlation is not too surprising given that the UK has the highest level of European PE investment per capita and provides the least estimated worker insurance.

The second column presents the univariate relationship for $LbrInsMech_{ct}$, the focus of this study. This estimation finds that a one standard deviation increase in the mechanism used to provision labor market insurance — towards favoring LMEs over EPRs — is correlated with a 0.46 increase in PE per capita investment levels. Column 3 of Table 2 estimates (1) with both regressors. The insurance level coefficient is now very small in magnitude and not statistically different from zero. The mechanism coefficient, however, remains very similar to its individual estimation. In words, we find that the importance of the technique used to provision labor market insurance is robust to controlling for the overall level provided. This result holds without the specification weights in Column 4 as well.

The most basic cut of the data is thus consistent with the hypothesis that LME-based regimes are more conducive to PE investments than EPR-based regimes. We want to test, however, whether other factors varying across countries can better explain this observed pattern. Labor regulations are generally slow moving instruments, with most European countries making only minor changes during the sample period around their long-run levels. As such, there is insufficient longitudinal variation to include country fixed effects, although we are able to do so with the upcoming sector-level estimations. We thus test several other prominent explanatory variables often presented in the literature.

Most importantly, Column 5 and 6 account for differences across countries in their legal origins. A number of studies conclude that the legal origins of countries are important for their modern institutions and concomitant economic development. These institutions and legal regimes impact the development of PE markets beyond the labor insurance policies we explicitly model. Botero *et al.* (2004) find that legal origins explain more of existing differences in labor regulations across countries than recent political outcomes. Given these deep antecedents, we include indicator variables for whether countries are of Germanic, Scandinavian, or UK legal origin, with the reference category being French/Spanish. The legal origin dummies partly act as regional fixed effects too. The insurance level is now positively correlated with PE per capita investments, as the legal origin effects now separately control for the higher investments and lower insurance provision in Anglo-Saxon economies. The estimated role of $LbrInsMech_{ct}$ remains, however, consistent in this augmented specification.[20]

[20] These classifications follow La Porta *et al.* (1997). French/Spanish countries include Belgium, France, Italy, Netherlands, Portugal, and Spain. Germanic countries include Austria, Germany, and Switzerland. Scandinavian countries include Denmark, Finland, Norway, and Sweden. The UK origin countries include Ireland and the UK. For this sample, the common versus civil law distinction overlaps entirely with the UK origin.

Countries of Germanic or Scandinavian origins have smaller per capita PE markets conditional on controlling for the labor market policies identified. Unconditionally, Germanic countries have very similar PE per capita markets to French/Spanish, while Scandinavian countries have somewhat larger per capita markets.

Column 7 and 8 further incorporate three country-level factors commonly cited in the literature on PE development: GDP per capita, the strength of IPO markets, and the corporate tax rate. We include GDP per capita to control for the overall economic development of countries; its coefficients are positive and statistically significant. The second metric, the log value of IPOs relative to country GDP, models the exit opportunities available to PE investors for harvesting value from their portfolio companies. This metric is taken from La Porta *et al.* (2006) as an average across the 1996 to 2000 period. The IPO metric's coefficients again conform to expectations, with better exit opportunities being linked to stronger PE market development. Finally, we include measures of average corporate taxation rates for 1990-1997 and 1998-2004 catalogued by the accounting firm KPMG. While we find slight evidence that higher tax rates weaken investment levels, these results are not well measured.[21]

The positive correlation of $LbrInsLevel_{ct}$ with PE investments further strengthens with these additional covariates. The importance of $LbrInsMech_{ct}$ weakens only slightly for the weighted specification, but becomes substantially smaller in the unweighted regression. This is not too troubling given the number of regressors employed and lack of weights, and we have performed a variety of additional tests to confirm the role of $LbrInsMech_{ct}$. Estimations with the additional three covariates, but dropping the legal origin effects, find elasticities of 0.44 and 0.28 for the weighted and unweighted specifications, respectively, that are both statistically significant. Further specifications verify the robustness of the results to including metrics of product market regulations, collective bargaining, government ownership of banks, total government expenditures per capita, average education levels, technology opportunities modeled through patents issued by the European Patent Office, and the level of public-sector venturing or captive investments.[22]

Appendix Table 1 further disaggregates the total PE markets studied in Table 2 to consider buy-out versus VC investments, as well as separating domestic-sourced and US-sourced investments. For each, it repeats (1) with and without the covariates of the Full Regression (i.e., Columns 3 and 7 from Table 2). The correlations evident for total PE investments extend to both domestic VC and buy-out placements, and we are generally not able to reject to the null hypothesis that the responses are the same for the two investment categories. We likewise find similar elasticities for the US-sourced investments, which is encouraging as these cross-border investments are less likely to be subsidized or directed by European government programs to sponsor industry formation. They are also less influenced by the size or characteristics of local

[21] We include these covariates as robustness checks, but are clearly concerned about their endogeneity with labor policies and PE development. GNP per capita has stronger explanatory power for unemployment benefits than for firing costs (e.g., Botero *et al.* 2004).

[22] The EVCA data combine public and private venturing investments in most statistics, although they are separately reported at the aggregate country level. As we are unable to extract public venturing investments when distinguishing VC versus buy-out or when looking at sector-level placements, we keep the combined private and public totals as our baseline. We have also confirmed that the results are robust to using just private-sector investments where available.

financial markets for either financing investments or exiting investments through public offerings.[23] The stability across the EVCA and VE data sources is also comforting.

Taken as a whole, we conclude from these cross-country specifications that how labor market insurance is provisioned has an important relationship with PE formation. The level of insurance, on the other hand, has a less consistent effect that depends substantially on the covariates included in the specifications. We return to this conclusion below.

4.2 Comparison to EPR and LME Estimations

It is worthwhile to compare Table 2's outcomes with a specification that includes EPRs and LMEs directly,

$$\ln(PE/Cap_{ct}) = \beta_{EPR} EPR_{ct} + \beta_{LME} \ln(LME/Cap_{ct}) + \lambda X_{ct} + \tau_t + \varepsilon_{ct}. \quad (2)$$

The first two columns of Table 3 separately estimate (2) with just the EPR_{ct} or $\ln(LME/Cap_{ct})$ regressors. These policy variables are again transformed to have unit standard deviation for interpretation. Column 1 finds a large, negative univariate relationship between employment rigidities and PE investments. This negative elasticity is stronger than that evident in Figure 2. On the other hand, Column 2 finds a very weak univariate relationship for LMEs and PE investment in the full EVCA sample, contrasting sharply with its strong, positive counterpart in Figure 3. These differences between Columns 1 and 2 and Figures 2 and 3 are easily traced, however, to the inclusion of the UK and sample weighting in (2). Columns 3 and 4 of Table 3 estimate (2) with both regressors. The β_{EPR} coefficient is negative and economically important in both regressions, although the weighting by country population does approximately double the estimated elasticity. The β_{LME} coefficient strengthens somewhat, but remains only marginally distinguishable from no effect statistically.

Columns 5 and 6 further introduce the legal origins fixed effects. Introducing these basic controls has a substantial effect on the β_{EPR} and β_{LME} coefficients. The estimated role of employment protections remains negative, but it is substantially smaller in economic size compared to Columns 1-4 and is no longer statistically significant. β_{LME}, on the other hand, is now much stronger in economic magnitude and statistically important. Unlike Columns 1-4, the β_{EPR} and β_{LME} coefficients in the legal origins regressions now mirror the trend lines from Figures 2 and 3 that are calculated over the Continental European sample only. The legal origins effects remove the substantially different levels of the Anglo-Saxon economies and produce similar within-group relationships. Further adding the additional covariates in Columns 7 and 8 does not change the β_{LME} outcomes much, but the β_{EPR} coefficient now has a positive point estimate.

[23] US-sourced investments do not resolve all potential omitted variable biases, as the US investors could be attracted to the same country-level characteristics (e.g., technology opportunities) as their European counterparts.

Looking across the top two rows of Table 3, it is impossible to draw consistent conclusions about whether a pooled cross-sectional relationship exists between EPRs and PE formation. The point estimates move from negative to positive, and statistical significance is often lost. One might be more willing to draw conclusions for LMEs, but its lack of a univariate relationship is worrisome. This inconsistency is not a product of jointly estimating EPR_{ct} and $\ln(LME/Cap_{ct})$. Their bivariate stability is evident in Columns 1-3, and individual estimations of the two policies are similar to the joint estimations reported. Instead, this lack of robustness relates more to the earlier observation that policies are capturing both the level of labor market insurance provided and the mechanism employed.

The bottom of Table 3 helps reconcile these inconsistent outcomes with the stability evident in Table 2. For the joint estimations, we report the linear combination of $\beta_{LME} - \beta_{EPR}$ and its standard error. Columns 3-8 show that the linear differences of the β_{LME} and β_{EPR} are much more stable than their individual elasticity estimates, especially across the introduction of the legal origins effects. While not exact, this linear combination approximates the mechanism index that displays similar robustness in Table 2.

In fact, the linear combinations $\beta_{LME} - \beta_{EPR}$ in Columns 5-8 are particularly close to their corresponding $LbrInsMech_{ct}$ elasticities in Table 2. This similarity is because the legal origins effects are mostly controlling for the level of labor insurance provisioned. The inconsistency in the individual estimations of β_{LME} and β_{EPR} in Table 3 is analogous the inconsistency of the labor insurance level effect β_{Level} in Table 2. Moreover, the positive progression in average coefficient size for β_{LME} and β_{EPR} in Table 3 mirrors the negative-to-positive coefficient progression of β_{Level} in Table 2. On the other hand, the consistency of the linear combinations $\beta_{LME} - \beta_{EPR}$ in Table 3 is analogous to the consistency of the mechanism effect β_{Mech} in Table 2.

One can understand this linear $\beta_{LME} - \beta_{EPR}$ difference better through a model in which the level of insurance is determined by $g(EPR, LME) = \alpha_{EPR} EPR_{ct} + \alpha_{LME} LME_{ct}$. This function assumes the two policies are additive and separable, and the alphas weight the importance of each policy for worker insurance. Consider the scenario where a policy maker seeks to maintain a level of insurance I but move from an EPR-based regime to greater LMEs. Holding I constant and assuming (2) is correctly defined, the comparative static for moving along the insurance mechanism frontier defined in $g(\cdot)$ is $\Delta \ln(PE) = \beta_{LME} - \beta_{EPR} \cdot (\alpha_{LME}/\alpha_{EPR})$. The bottom row of Table 3 presents this static implicitly assuming a $g(\cdot)$ function with $\alpha_{LME} = \alpha_{EPR}$. This equal contribution of EPRs and LMEs to worker insurance is motivated by the policy trade-off within Continental Europe in Figure 1.

4.3 Index Variants

Table 4 tests three variants of the $LbrInsLevel_{ct}$ and $LbrInsMech_{ct}$ indices. The first two columns simply repeat the base specification (i.e., Columns 3 and 4 of Table 2). The next two regressions replace $LbrInsMech_{ct}$, which employs a bounded radian measure of policy ratios, with a simple ratio of policy distances. Likewise, Columns 5 and 6 substitute a measure of Euclidean distance for the linear $LbrInsLevel_{ct}$ metric. The Euclidean distance can be thought of as the length of a ray from the origin of Figure 1 to the nation's position in (EPR, LME) space. The estimated importance of how labor insurance is provisioned is robust to both of these index variants, and this stability holds for the other empirical findings of this paper.

One natural question is whether EPRs and LMEs should be weighted equally in determining the labor insurance level. We are only aware of one study that attempts to estimate α_{LME} and α_{EPR} directly. Clark and Postel-Vinay (2005) empirically evaluate whether EPRs or unemployment insurance benefits (UIBs, the largest portion of LME) better promote job security as measured through the European Community Household Panel (ECHP) surveys. Strikingly, these authors find that EPRs do not raise worker perceptions of security; if anything, Clark and Postel-Vinay's (2005) estimates imply stricter EPRs lower perceived labor market insurance by private-sector workers. On the other hand, UIBs robustly increase perceived insurance.

Columns 7 and 8 of Table 4 use Clark and Postel-Vinay's coefficients to weight an alternative $g(.)$ function that replaces $LbrInsLevel_{ct}$. The importance of $LbrInsMech_{ct}$ continues to hold, whereas the level of insurance proxied by the worker security perception is not as powerful of a predictor. This heavy weighting of the LMEs versus EPRs does, however, make it more difficult to separate the two effects when many covariates are included. This nonetheless reinforces the emphasis, both here and in Clark and Postel-Vinay (2005), on insurance mechanisms.

Ultimately, there is no single approach for estimating the level of labor market insurance. While EPRs and LMEs are likely the two most important policy levers for providing labor insurance, other techniques do exist. Moreover, the outcome measures could be extended from policy views and worker security perceptions to other forms (e.g., worker income stability, job loss and gains rates). To some degree, the weighting employed will always involve normative values as well as positive models, and these values will differ within society.

Nevertheless, we believe $LbrInsMech_{ct}$ captures a meaningful, first-order policy trade-off that is evident empirically and that can be grounded in theory (e.g., Pissarides 2001, Blanchard and Tirole 2005). The conclusion of this study, including the upcoming sector-level results, is that the mechanism used to provision labor market insurance is important for PE formation. We are unable to draw consistent conclusions regarding the level of insurance provided. The

transformed variables demonstrate the mechanism's importance in an intuitive manner. We hope that future research will further refine our understanding of the $g(.)$ function's structure.

5 Sector-Level Estimations

The cross-country correlations present a clear picture that European nations favoring LME regimes have been more successful in attracting PE investments, both domestically and from the US. Table 1 highlights how these PE investments exhibit strong growth over the 1990-2004 period, while the labor market insurance policies have much more localized movements around longer-term positions from 1990. In this sense, it is not that labor regulations became important and therefore influenced PE investments already being made. Instead, labor market insurance policies played an important role in shaping how PE developed within Europe. We turn now to sector-level entry and market size regressions to characterize this process.

In addition to describing the phenomena in greater detail, sector-level exercises also yield an important methodology gain. While displaying remarkable stability for a pooled cross-sectional analysis with thirty observations, the outcomes in Table 2 are likely biased by omitted variables not accounted for in the regressions. Lacking an instrumental variable or natural experiment for causal identification, further confidence can be developed by looking at investment differences across sectors. This approach allows us to control fully for the overall PE development and labor insurance policies of each country. Quantifying the within-country role of labor regulations in PE formation is an important contribution to the entrepreneurial finance literature and for studies of European employment protection and industrial specialization.

From establishment-level data housed at the US Census Bureau, we calculate characteristics of the labor volatility for each sector. Mapping these US characteristics into the European PE data, we then test whether the differential PE investments due to EPR-oriented versus LME-oriented schemes are more pronounced in more-volatile sectors. In many respects, our approach mirrors the financial dependency tests utilized by Rajan and Zingales (1998). We take the labor volatility of firms in the US to be the most unconstrained. In a hypothetical industry with no labor volatility, we would not expect significant differences across European regimes. The EPR dismissal costs are likely to be more binding, however, in sectors where the US demonstrates substantial labor churn.

5.1 US Labor Volatility Metrics

US labor volatility metrics are calculated from the Longitudinal Business Database (LBD). Sourced from US tax records and Census Bureau surveys, the LBD provides annual observations

for every private-sector establishment with payroll from 1976 to 1999. Approximately 3.9m establishments, representing over 68m employees, are included each year. Each establishment is given a unique, time-invariant identifier that can be longitudinally tracked. Second, the LBD assigns firm identifiers that facilitate the linkages of establishments.[24]

Our primary measure of labor volatility is the absolute year-to-year employment change of an establishment f in year t from $t-1$,

$$ABS_{ft} = \frac{|E_{ft} - E_{ft-1}|}{\left[\frac{(E_{ft}+E_{ft-1})}{2}\right]},$$

where E is the employment count of the establishment. We calculate ABS at the establishment level, versus the firm level, to allow the most accurate sector assignments possible. This measure is bounded between zero and two and reduces the impact of outliers. Autor *et al.* (2007) further motivate the ABS metric of labor volatility and relate it to the reallocation metrics developed by Davis *et al.* (1996). After calculating ABS_{ft} at the establishment-year level, we take mean and variance across establishments within each sector over the 1977-1999 period (denote this sector-level mean as $Labor_s^{US}$). We also calculate a second version of ABS at the sector level from 1992-1999 (i.e., net employment changes at the sector-year level). These two metrics have a 0.73 correlation across industries.[25]

As the LBD classifies establishments with the SIC4 framework, we develop concordances (available upon request) that link the EVCA sectors, VE technology codes, and the US SIC system. Table 5 lists the 17 EVCA sectors and the two volatility calculations. The Computer-Related (0.52) and Energy (0.49) sectors have the largest mean US labor turnover, while Chemicals and Materials (0.28) and Industrial Products and Services (0.31) have the lowest. Appendix Table 2 provides the EVCA's sector definitions. The LBD cannot support accurate calculations for the Agriculture, Construction, and Other sectors. These sectors are small in terms of PE investment and are excluded below.

5.2 Country-Sector Empirical Results

Our first specification examines the entry margin for country-sector pairs that attracted PE investments. We define $Entry_{cs}$ as a dichotomous indicator variable for PE investment in country c and sector s in the 1990-2004 period. The entry estimation takes the form,

$$\begin{aligned} Entry_{cs} &= \gamma_{Level} LbrInsLevel_c \cdot Labor_s^{US} + \gamma_{Mech} LbrInsMech_c \cdot Labor_s^{US} + \\ &\quad \phi_c + \phi_s + \varepsilon_{cs}. \end{aligned} \tag{3}$$

[24] Jarmin and Miranda (2002) describe the construction of the LBD. Dunne *et al.* (1989), Kerr and Nanda (2007), and Ellison *et al.* (2007) provide additional descriptive statistics of the Census Bureau data.

[25] The 1977-1999 period employs the full LBD data available, while the 1990s grouping more closely approximates the period for this study. This choice is generally not very important.

This specification interacts the country-level regressors, $LbrInsLevel_c$ and $LbrInsMech_c$, with the sector-level US labor volatility metric $Labor_s^{US}$.[26] Our attention will focus on the interaction of the mechanism index γ_{Mech}, where the theory predicts a positive response. We interact the level index, as in the previous section, but we do not have a clear prediction for γ_{Level} conditional on controlling for the mechanism index.

The vectors ϕ_c and ϕ_s are country and sector fixed effects, respectively. Country effects absorb the main effects of the labor market policies (along with our earlier legal origins fixed effects and additional covariates), while sector effects absorb the main effects of $Labor_s^{US}$. As these fixed effects also control for overall PE entry by country and sector, we only exploit the unexplained residual variation for identification. Estimations are weighted by an interaction of country population with total sector size across countries. In comparison to the earlier section, these weights are more important given the greater scope for country-sector outliers.

Multiple country-sector observations receive very small investments (e.g., one deal over the fifteen-year period). Accordingly, we define an entry threshold as a mean annual PE investment of one Euro/ECU per capita. 56% and 40% of domestic-sourced and US-sourced PE observations at the country-sector level achieve this investment level, respectively. Within the US-sourced PE investments, 21% of VC and 23% of buy-out observations reach this level. This threshold mainly influences the domestic-sourced entry calculation, as every country-sector combination has at least a trace amount of investment over the 1990-2004 period in the EVCA data. The results presented below are generally robust to adjusting this threshold amount so long as a meaningful degree of variation remains.[27]

The data allow a sector-level study of total domestic-sourced investment and US-sourced investment, but only the latter can be disaggregated into VC and buy-out investment. A pair of columns is presented in Table 6 for each of these four investment types. The first column of each pair uses the establishment-level calculation of US labor volatility ABS_{ft}; the second column employs the sector-level calculation. While some minor differences emerge within these pairs, the results are generally robust to the volatility calculation employed.

The first pair of columns find a positive and statistically significant entry elasticity for domestic-sourced investments in (3). The coefficient magnitude estimates that a joint standard deviation increase in the labor volatility of the industry and the mechanism index of labor insurance to favor LMEs is associated with a 0.14 standard deviation greater probability of PE

[26] We recalculate $LbrInsLevel_c$ and $LbrInsMech_c$ over the 1990-2004 period for these sector-level exercises, but one could just as easily have taken the mean of the earlier regressors instead.

[27] A second rationale exists for establishing a threshold level for domestic-sourced investments. Public venturing is frequently used to seed VC industries (e.g., Lerner 2002). European governments with stricter labor regulations may provide additional venture support in highly-volatile sectors as compensation. Unfortunately, we are unable to separate public venturing from private investments at the sector level using the EVCA data. Establishing a threshold level makes estimations of the extensive margin less sensitive to this government intervention.

entry. In words, countries favoring the provision of labor market insurance through LMEs versus EPRs tend to specialize in industries where labor volatility is typically higher. This specialization is of smaller economic magnitude than the cross-sectional estimates, but that is not surprising given the aggregate nature of the earlier results and the many determinants of industrial concentration. Some evidence also exists for a positive interaction with the level index of labor insurance, γ_{Level}, but this result is not found to be robust below.

Columns 3 and 4 of Table 6 also find evidence for entry effects of the mechanism index for US-sourced PE investments, although the calculation using establishment-level volatility is well measured statistically. The last four columns disaggregate the US-sourced investments. We find fairly consistent evidence that the entry of US-sourced VC is sensitive to these labor insurance policies, but that buy-out investors are not. The effect on the entry margin of VC investors is responsible for the aggregate US-sourced entry response measured. A consistent role for the levels of labor market insurance is not evident. While this VC versus buy-out disaggregation is informative for US-sourced PE investments, it is not clear that a similar result would necessarily hold for a domestic-sourced PE disaggregation.

Appendix Table 3 repeats the entry specification (3) using the EPR and $\ln(LME/Cap)$ regressors instead of the level and mechanism indices. These estimations again find measurable entry effects for both domestic-sourced and US-sourced investments, with VC entry being especially important for the latter. As in the pooled cross-sectional analyses, the individual coefficients for the two policy regressors are more difficult to interpret than their difference.

To complement Table 6's analysis of the PE entry margin, Table 7 presents a second test of the intensive margin of sector size. These specifications mirror the country-sector entry regression (3) but instead consider the log value of PE investments per capita in the country-sector over the 1990-2004 period as the dependent variable.[28] For the US-sourced estimations, we drop observations where no investments are evident. The outcomes of the intensive margin estimations in Table 7 are similar to the entry results of Table 6. Effects are evident for both the domestic-sourced and US-sourced investments; within US-sourced investments, VC investors are affected but not buy-out investors. The estimated point elasticities for the intensive market size are somewhat smaller than those for the entry estimates, but it cannot be rejected statistically that these elasticities are the same. Appendix Table 4 again confirms these results using the EPR and $\ln(LME/Cap)$ regressors directly.

Taken as a whole, we interpret these sector-level estimations as supportive of the earlier results. Not surprisingly, the sector-level elasticity estimates are substantially smaller than

[28] We continue with per capita estimates for the sector level. An alternative approach would employ sector size as the baseline. While such a metric would clearly be too endogenous for VC estimations, it might be more appropriate for buy-out investments. Unfortunately, we are unable to construct consistent sector-size estimates for the industries identified by the EVCA across European countries.

those evident with cross-country variation, but nonetheless important. These differentials indicate that the labor market insurance regime choice matters more for sectors with greater labor volatility, measured through the relatively unconstrained US case, than those with weaker labor turnover. We hope to further explore these sector differences in future research, ideally considering how the specific investment terms of PE deals differ across labor market insurance regimes in a vein similar to the rule-of-law analysis by Lerner and Schoar (2005).

6 Conclusions

European economies empirically substitute between employment protection regulations (EPRs) and labor market expenditures (LMEs) like unemployment insurance benefits and job transition assistance as mechanisms for providing worker security. A growing body of theoretical and empirical evidence finds EPRs act as a tax on firm adjustments, while the incidence of LMEs on this margin is less direct. Many European policy makers and business leaders want to replicate the growth stimulus provided to the US economy through its VC and buy-out communities. Both of the PE groups, however, operate in dynamic environments that require frequent adjustments of the labor forces of their portfolio companies. This business model makes PE investors particularly sensitive to stricter labor market regulations. This sensitivity is evident in the levels of PE investments made and in the industrial specialization that occurs. Policy choices regarding the optimal levels and mechanisms of labor market insurance are complex and should consider many economic and non-economic factors. This study highlights one factor that should influence the trade-off between EPRs and LMEs.

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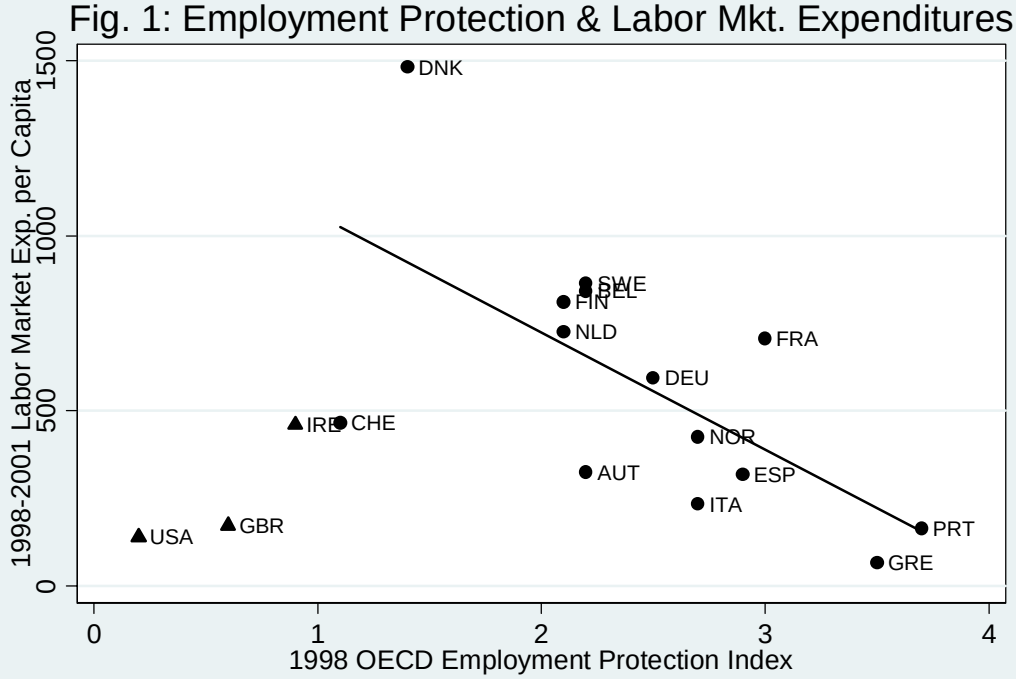
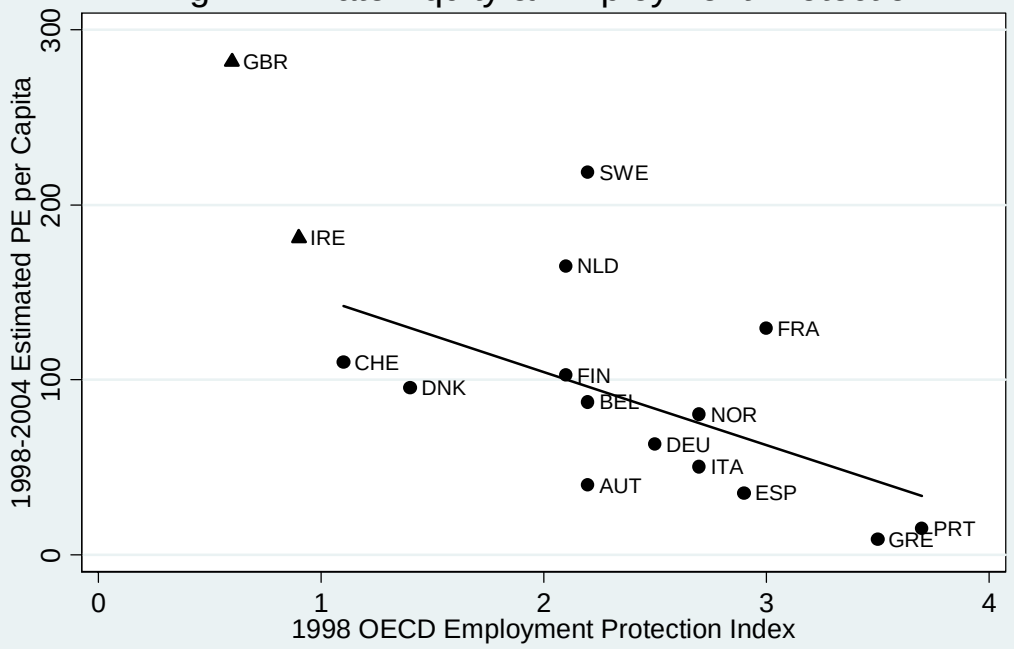
Fig. 1: Employment Protection & Labor Mkt. Expenditures



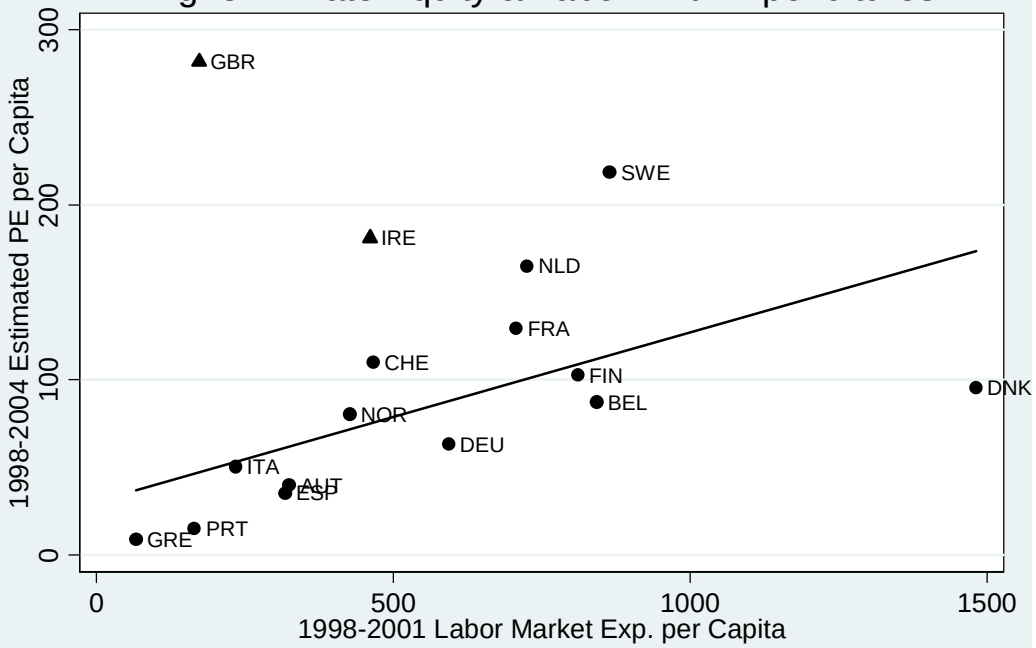
Notes: Trend Line Estimated for Continental Europe

Fig. 2: Private Equity & Employment Protection



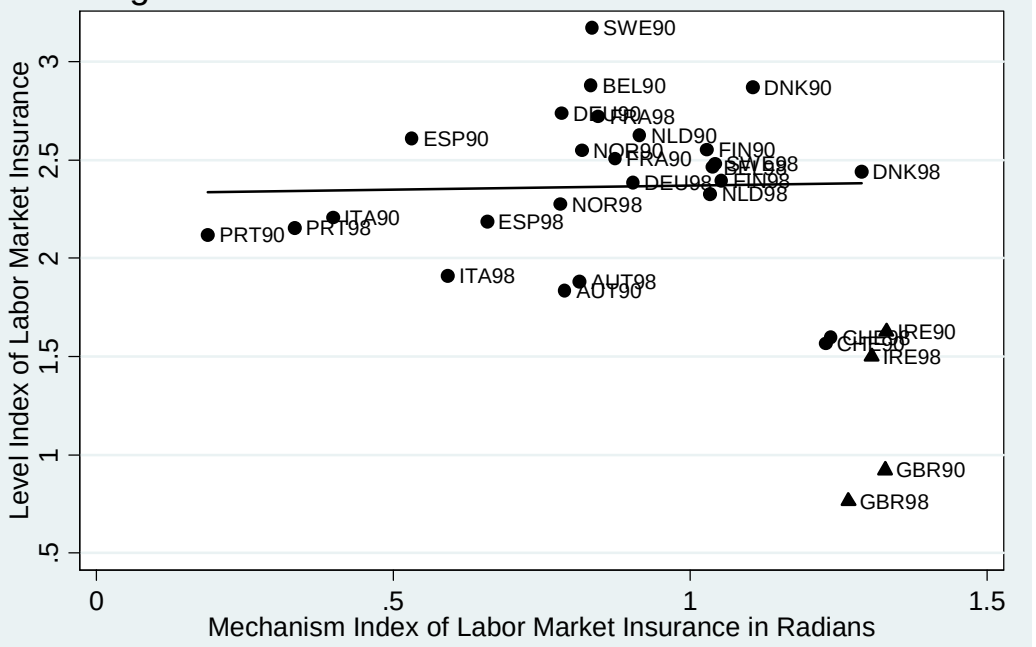
Notes: Trend Line Estimated for Continental Europe

Fig. 3: Private Equity & Labor Mkt. Expenditures



Notes: Trend Line Estimated for Continental Europe

Fig. 4: Level & Mechanism Indices of Labor Insurance



Notes: Trend Line Estimated for Continental Europe

Fig. 5: European PE Investment

Excludes Investments Originating Outside of Europe

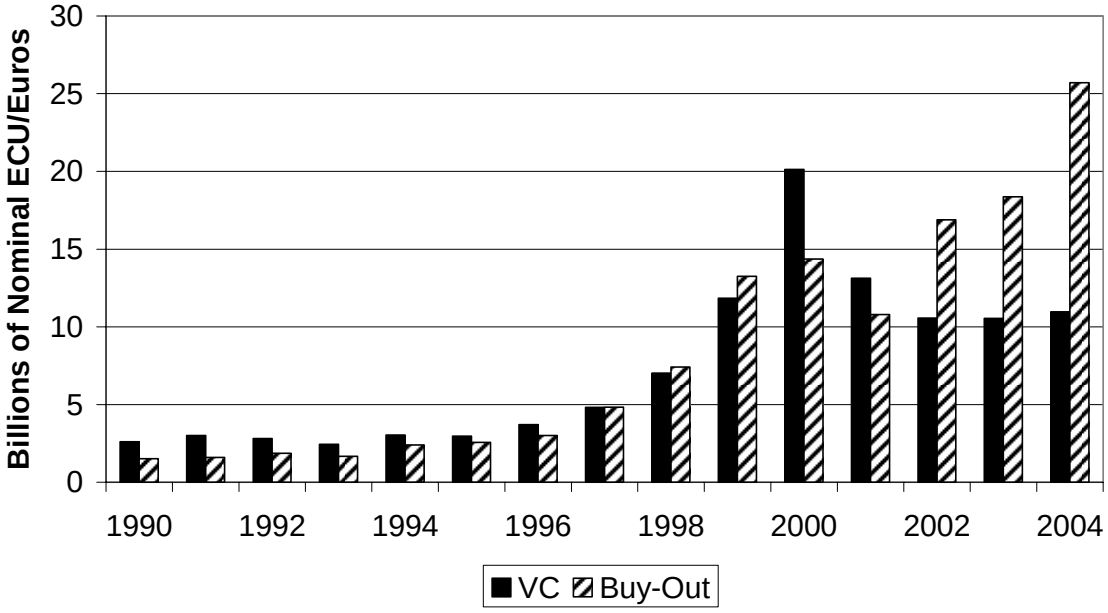


Table 1: Descriptive Statistics for European Private Equity Sample

	Annual Labor Mkt. Expenditures per Capita		OECD Employment Protection Index		Level Index of Labor Market Insurance		Mechanism Index of Labor Market Insurance		Annual Domestic Private Equity Inv. per Capita		Annual US-Sourced Private Equity Inv. per Capita	
	90-97	98-01	90	98	90-97	98-04	90-97	98-04	90-97	98-04	90-97	98-04
Austria	290	325	2.2	2.2	1.8	1.9	0.8	0.8	0	15	0	25
Belgium	760	842	3.2	2.2	2.9	2.5	0.8	1.0	11	40	3	48
Denmark	1469	1482	2.3	1.4	2.9	2.4	1.1	1.3	4	48	0	47
Finland	873	811	2.3	2.1	2.6	2.4	1.0	1.1	7	61	0	42
France	600	707	2.7	3.0	2.5	2.7	0.9	0.8	17	69	2	61
Germany	602	593	3.2	2.5	2.7	2.4	0.8	0.9	9	40	0	23
Ireland	548	461	0.9	0.9	1.6	1.5	1.3	1.3	8	35	2	146
Italy	188	234	3.6	2.7	2.2	1.9	0.4	0.6	7	37	1	13
Netherlands	732	726	2.7	2.1	2.6	2.3	0.9	1.0	25	99	10	67
Norway	554	427	2.9	2.7	2.5	2.3	0.8	0.8	17	57	0	24
Portugal	112	165	4.1	3.7	2.1	2.2	0.2	0.3	5	11	0	4
Spain	313	318	3.8	2.9	2.6	2.2	0.5	0.7	4	27	0	9
Sweden	983	865	3.5	2.2	3.2	2.5	0.8	1.0	19	159	2	59
Switzerland	425	466	1.1	1.1	1.6	1.6	1.2	1.2	9	46	2	64
UK	216	173	0.6	0.6	0.9	0.8	1.3	1.3	42	197	6	84
EUR (unwtd)	578	573	2.6	2.2	2.3	2.1	0.9	0.9	12	63	2	48
Greece	64	67	3.6	3.5	n.a.	n.a.	n.a.	n.a.	2	6	0	3

Notes: Domestic and US-sourced private equity (PE) investments are taken from the EVCA and Venture Economics (VE) databases, respectively. US-sourced PE placements impute some deal-level values as discussed in the text. PE includes buy-out funds and venture capital placements. The Employment Protection Regulations (EPR) Index has a theoretical range of 0 to 5; higher scores indicate stronger employment protection. Labor market expenditures (LME) and populations are taken from the OECD Social Expenditures and Labour Force databases. Investments and expenditures are in nominal ECUs/Euros per capita.

Level and Mechanism Indices of Labor Market Insurance are transformations of the EPR and LME policies. The Level Index estimates the joint insurance provided through these two policies; higher values indicate greater worker insurance provision. The Mechanism Index estimates the relative importance of the two policies; higher values indicate greater reliance on LMEs versus EPRs in the provision. EPRs and the log value of LMEs per capita are transformed to have zero mean and unit standard deviation. Univariate distances are measured from the lowest provision of each variable (US EPR, Greece LME). The Level Index averages these univariate distances. The Mechanism Index is the radian measure of the transformed LME to EPR ratio. The text provides additional details.

Table 2: Regressions of PE Investments with Level and Mechanism Indices of Labor Market Insurance

	Base Level Regression	Base Mechanism Regression	Base Joint Regression	Column 3 Without Weights	Legal Origins Regression	Column 5 Without Weights	Additional Covariates Regression	Column 7 Without Weights
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Log Value of PE Investments per Capita							
Level Index of Labor Mkt. Insurance	-0.235		-0.040	0.063	0.194	0.104	0.335	0.270
	(0.091)		(0.070)	(0.137)	(0.138)	(0.159)	(0.177)	(0.182)
Mechanism Index of Labor Mkt. Insurance		0.464	0.437	0.353	0.424	0.382	0.370	0.159
		(0.067)	(0.080)	(0.104)	(0.101)	(0.126)	(0.132)	(0.141)
Scandinavian Legal Origin Dummy					-0.119	-0.100	-0.215	-0.198
					(0.102)	(0.107)	(0.112)	(0.117)
Germanic Legal Origin Dummy					-0.160	-0.245	-0.202	-0.245
					(0.052)	(0.137)	(0.073)	(0.124)
UK Legal Origin Dummy					0.222	0.047	0.195	0.098
					(0.159)	(0.171)	(0.127)	(0.164)
Log GDP per Capita							0.180	0.239
							(0.123)	(0.139)
Log IPO Value Divided by Country GDP							0.268	0.317
							(0.149)	(0.126)
Log Corporate Tax Rate							0.014	-0.040
							(0.082)	(0.112)
Period Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Pooled cross-sectional estimations consider PE investments in Europe from 1990-1997 and 1998-2004. The dependent variable is the log nominal value of PE investments in the country converted to ECUs/Euros taken from the EVCA and VE databases. The Level and Mechanism Indices of Labor Market Insurance are transformations of country-level employment protection (EPR) and labor market expenditures (LME) policies. The Level Index estimates the joint insurance provided through these two policies; higher values indicate greater worker insurance provision. The Mechanism Index estimates the relative importance of the two policies; higher values indicate greater reliance on LMEs versus EPRs in the provision. The construction of these indices is detailed in the text and Table 1.

Germanic legal origin countries include Austria, Germany, and Switzerland. Scandinavian legal origin countries include Denmark, Finland, Norway, and Sweden. UK legal origin countries include UK and Ireland. The reference category is French/Spanish countries that include Belgium, France, Italy, Netherlands, Portugal, and Spain. Data sources and construction for the other covariates are identified in the text. Variables are transformed to have unit standard deviation for interpretation. Regressions have 30 observations, include period fixed effects, are weighted by country populations, and report robust standard errors.

Table 3: Comparison Regressions of PE Investments with Base EPR and LME Policies

	Base EPR Regression	Base LME Regression	Joint EPR-LME Regression	Column 3 Without Weights	Legal Origins Regression	Column 5 Without Weights	Additional Covariates Regression	Column 7 Without Weights
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Log Value of PE Investments per Capita							
OECD Employment Protection Index	-0.395		-0.423	-0.225	-0.120	-0.140	0.096	0.169
	(0.057)		(0.063)	(0.115)	(0.157)	(0.173)	(0.170)	(0.194)
Log Labor Market Expenditures per Capita		0.020	0.131	0.146	0.354	0.222	0.430	0.253
		(0.165)	(0.076)	(0.124)	(0.102)	(0.135)	(0.158)	(0.146)
Scandinavian Legal Origin Dummy					-0.120	-0.070	-0.245	-0.210
					(0.106)	(0.109)	(0.113)	(0.120)
Germanic Legal Origin Dummy					-0.147	-0.208	-0.161	-0.231
					(0.050)	(0.133)	(0.066)	(0.123)
UK Legal Origin Dummy					0.357	0.155	0.345	0.166
					(0.158)	(0.181)	(0.115)	(0.165)
Log GDP per Capita							0.208	0.279
							(0.123)	(0.133)
Log IPO Value Divided by Country GDP							0.280	0.322
							(0.154)	(0.130)
Log Corporate Tax Rate							-0.033	-0.063
							(0.077)	(0.114)
Linear Combination: $\beta_{LME}-\beta_{EPR}$			0.555	0.371	0.474	0.361	0.335	0.084
			(0.097)	(0.119)	(0.138)	(0.166)	(0.165)	(0.165)
Period Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: See Table 2. Comparison regressions substitute the base EPR and LME policies for the Level and Mechanism Indices of Labor Market Insurance employed in Table 2. Variables are again transformed to have unit standard deviation for interpretation. The bottom row presents the linear difference βLME-βEPR and its standard error. This difference approximates the Mechanism Index.

Table 4: Regressions with Alternative Insurance Index Design

	Base Indices		Mechanism Ratio		Euclidean Distances		Worker Security Index	
	Base Regression	Without Weights	Base Regression	Without Weights	Base Regression	Without Weights	Base Regression	Without Weights
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Log Value of PE Investments per Capita							
Level Index of Labor Mkt. Insurance	-0.040	0.063						
	(0.070)	(0.137)						
Mechanism Index of Labor Mkt. Insurance	0.437	0.353						
	(0.080)	(0.104)						
Level Index of Labor Mkt. Insurance			0.126	0.176				
			(0.102)	(0.173)				
Simple Ratio for the Labor Mkt. Insurance			0.544	0.400				
			(0.106)	(0.153)				
Euclidean Index for Insurance Levels					-0.040	0.056		
					(0.074)	(0.151)		
Mechanism Index of Labor Mkt. Insurance					0.436	0.351		
					(0.083)	(0.106)		
Worker Security Index Estimate							-0.060	0.011
							(0.069)	(0.131)
Mechanism Index of Labor Mkt. Insurance							0.473	0.326
							(0.054)	(0.106)
Period Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: See Table 2. Columns 1 and 2 repeat the base specification given in the third and fourth columns of Table 2. Columns 3 and 4 substitute a linear ratio of LME to EPR policies for the Mechanism Index of Labor Market Insurance. Columns 5 and 6 substitute Euclidean distance measures for the Level Index of Labor Market Insurance. Columns 7 and 8 substitute estimated worker security using LME and EPR policies with estimates from Clark and Postel-Vinay (2005).

Table 5: Sector-Level Descriptive Statistics

	US Calculations of Sector-Level Labor Volatility		Domestic Total Private Equity Investments		US-Sourced Total Private Equity Investments	
	Establishment	Sector	1990-1997	1998-2004	1990-1997	1998-2004
Communications	0.3425	0.0317	3.7%	12.7%	10.3%	17.2%
Computer-Related	0.5216	0.0794	5.8%	9.0%	3.2%	12.0%
Others Electronics-Related	0.3599	0.0211	3.9%	2.4%	0.6%	4.1%
Biotechnology	0.4252	0.0397	2.1%	2.8%	11.4%	4.1%
Medical/Health-Related	0.3475	0.0190	4.2%	6.6%	13.4%	4.6%
Energy	0.4947	0.0520	1.4%	1.4%	0.2%	1.2%
Consumer-Related	0.4054	0.0334	21.2%	19.4%	26.3%	16.9%
Industrial Products and Services	0.3063	0.0285	13.6%	9.7%	1.4%	2.7%
Chemicals and Materials	0.2751	0.0263	3.5%	3.6%	4.8%	6.4%
Industrial Automation	0.3265	0.0507	1.1%	1.2%	0.1%	0.2%
Other Manufacturing	0.3670	0.0311	10.0%	8.0%	10.6%	8.4%
Transportation	0.3499	0.0214	4.7%	2.8%	4.4%	7.0%
Financial Services	0.3953	0.0334	4.0%	2.7%	3.0%	4.9%
Other Services	0.4126	0.0354	11.0%	8.9%	1.9%	3.8%
Agriculture	n.a.	n.a.	1.4%	0.5%	1.7%	0.5%
Construction	n.a.	n.a.	4.1%	2.8%	4.9%	4.4%
Other	n.a.	n.a.	4.4%	5.5%	1.8%	1.6%
Average (Unwtd)	0.3817	0.0359				

Notes: US labor volatility metrics are calculated for establishments from US Census Bureau data for 1977-1999. Volatility is defined as the mean absolute change in establishment employment from the previous year divided by the average employment in the current and previous year. The sector-level employs the same formula using industry-level data from 1992-1999. Further details on the construction of the metrics are included in the text. Domestic private equity investments are taken from the EVCA database. US-sourced private equity investments are taken from the Venture Economics database. Private equity includes buy-out funds and venture capital placements. Values are presented as shares of total investments over the 1990-1997 and 1998-2004 sample periods.

Table 6: Entry Regressions for PE Investments in Europe at Sector Level (Extensive Margin)

	Domestic Total Investment		US-Sourced Total Investment		US-Sourced VC Investment		US-Sourced Buy-Out Investment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Indicator for PE Investment Above One Euro per Capita in Country-Sector							
Level Index of Labor Mkt. Insurance Interacted with US Industry Labor Volatility	0.080	0.095	-0.009	0.087	-0.044	0.032	-0.171	-0.107
	(0.061)	(0.047)	(0.082)	(0.056)	(0.076)	(0.070)	(0.069)	(0.056)
Mechanism Index of Labor Mkt. Insurance Interacted with US Industry Labor Volatility	0.135	0.147	0.075	0.103	0.136	0.162	-0.042	-0.018
	(0.079)	(0.062)	(0.067)	(0.045)	(0.066)	(0.053)	(0.069)	(0.053)
Volatility Metric Employed	Establish.	Sector	Establish.	Sector	Establish.	Sector	Establish.	Sector
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	210	210	210	210	210	210

Notes: Country-sector entry estimations consider PE investments in Europe from 1990-2004. The dependent variable is an indicator variable for investments above one Euro per capita in the country-sector for the PE type indicated by the column headers. The Level and Mechanism Indices of Labor Market Insurance are transformations of country-level employment protection (EPR) and labor market expenditures (LME) policies. The Level Index estimates the joint insurance provided through these two policies; higher values indicate greater worker insurance provision. The Mechanism Index estimates the relative importance of the two policies; higher values indicate greater reliance on LMEs versus EPRs in the provision. The construction of these indices is detailed in the text and Table 1. The Level and Mechanism Indices are interacted with the sector-level labor volatility of establishments in the US given in Table 5. Main effects are demeaned prior to interactions and are absorbed by country and sector fixed effects. Variables are transformed to have unit standard deviation for interpretation. Regressions have 210 observations, include country and sector fixed effects, are weighted by country populations interacted with aggregate sector size, and report robust standard errors.

Table 7: Market Size Regressions for PE Investments in Europe at Sector Level (Intensive Margin)

	Domestic Total Investment		US-Sourced Total Investment		US-Sourced VC Investment		US-Sourced Buy-Out Investment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Log Value of Indicated PE Investment in Country-Sector							
Level Index of Labor Mkt. Insurance Interacted with US Industry Labor Volatility	0.035	0.072	0.033	0.045	0.060	0.087	-0.072	-0.048
	(0.042)	(0.030)	(0.057)	(0.060)	(0.057)	(0.052)	(0.051)	(0.046)
Mechanism Index of Labor Mkt. Insurance Interacted with US Industry Labor Volatility	0.090	0.083	0.106	0.095	0.170	0.158	-0.077	-0.083
	(0.046)	(0.042)	(0.090)	(0.100)	(0.087)	(0.086)	(0.062)	(0.060)
Volatility Metric Employed	Establish.	Sector	Establish.	Sector	Establish.	Sector	Establish.	Sector
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	193	193	186	186	151	151

Notes: See Table 6. The dependent variable is the log value of PE per capita in the country-sector for the PE type indicated by the column headers. Observations without 1990-2004 PE investments in the country-sector for the PE type are dropped in US-sourced estimations.

App. Table 1: Disaggregated European Domestic-Sourced and US-Sourced PE Investments

	Domestic-Sourced Investments (EVCA)				US-Sourced Investments (VE)			
	Buy Out		Venture Capital		Buy Out		Venture Capital	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Log Value of Indicated PE Investments per Capita							
Level Index of Labor Mkt. Insurance	-0.136	0.276	0.022	0.313	0.000	-0.084	0.056	0.430
	(0.090)	(0.179)	(0.062)	(0.291)	(0.100)	(0.215)	(0.042)	(0.168)
Mechanism Index of Labor Mkt. Insurance	0.396	0.457	0.403	0.402	0.415	0.759	0.471	0.380
	(0.109)	(0.189)	(0.075)	(0.177)	(0.148)	(0.185)	(0.040)	(0.157)
Scandinavian Legal Origin Dummy		-0.305		-0.119		-0.201		-0.101
		(0.152)		(0.153)		(0.153)		(0.067)
German Legal Origin Dummy		-0.210		-0.200		-0.497		0.031
		(0.118)		(0.095)		(0.139)		(0.061)
UK Legal Origin Dummy		0.007		0.121		-0.404		0.272
		(0.227)		(0.206)		(0.209)		(0.122)
Log GDP per Capita		0.156		0.095		0.190		-0.043
		(0.145)		(0.168)		(0.159)		(0.123)
Log IPO Value Divided by Country GDP		0.485		0.219		0.162		0.191
		(0.110)		(0.238)		(0.116)		(0.158)
Log Corporate Tax Rate		0.062		0.039		0.289		-0.104
		(0.132)		(0.098)		(0.152)		(0.068)
Period Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: See Table 2. Total PE investments are disaggregated into domestic-sourced v. US-sourced investments and buy-out v. venture capital investments.

App. Table 2: EVCA Sector Definitions

Communications - Internet Technology: browsers, portals, search engines and other internet enabling technologies, website design and consultancy, ISPs. Telecommunications (Hardware): voice and data communications equipment, cable/mobile/satellite network equipment excluding telecommunications carriers. Telecommunications (Carriers): cable/mobile/satellite telecommunications carriers. Communications (other): TV and radio broadcasting, media houses, publishing.

Computer-Related - Computer (Hardware): computer mainframes, laptops, minicomputers, PDA/hand-held devices, optical scanning equipment, voice synthesis/recognition equipment. Computer (Semiconductors): semiconductors, electronic components (e.g., integrated circuits, transistors), semiconductor fabrication equipment. Computer (Services): data processing, hardware maintenance, IT consulting, IT training. Computer (Software): application software products, operating systems and systems related software for all types of hardware, systems integration, software development. Includes manufacturers, resellers, and distributors.

Other Electronics Related - batteries, power supplies, fibre optics, analytical and scientific instrumentation.

Biotechnology - agricultural/animal biotechnology (e.g., plant diagnostics), industrial biotechnology (e.g., derived chemicals), biotechnology related research and production equipment

Medical/Health-Related - Medical (Healthcare): health institutions, hospital management, handicap aids & basic healthcare supplies. Medical (Instruments/Devices): technologically advanced diagnostic & therapeutic products and services. Medical (Pharmaceuticals): drug development, manufacture and supply.

Energy - oil and gas exploration and production, exploration and drilling services and equipment, coal related, energy conservation related, alternative energy.

Consumer-Related - Consumer (Retail): retailing of consumer products and services (including leisure and recreational products). Consumer (Other): manufacture and supply of consumer products.

Industrial Products and Services - industrial equipment and machinery, pollution and recycling related, industrial services.

Chemicals and Materials - agricultural chemicals, commodity chemicals, specialty or performance chemicals/materials, coating and adhesives, membranes and membrane-based products.

Industrial Automation - industrial measurement and sensing equipment, process control equipment, robotics, machine vision systems, numeric and computerized control of machine tools.

Other Manufacturing - business products and supplies, office furniture, textiles, hardware and plumbing supplies, pulp and paper, printing and binding, packaging products and systems.

Transportation - airlines, railways, buses, airfield and other transportation services, mail and package shipment.

Financial Services - banking, insurance related, real estate, securities and commodities brokers.

Other Services - engineering services, advertising and public relations, distributors, importers and wholesalers; consulting services (excluding IT consulting – see Computer: Services).

Agriculture - animal husbandry, crop cultivation, fishing, forestry.

Construction - construction services, manufacture of building materials, manufacture of pre-fabricated buildings and systems.

Other - mining, utilities, conglomerates.

Source: Compiled from EVCA Private Equity Survey Guidance Notes and Glossary by EVCA, Thomson Venture Economics, and PriceWaterhouseCoopers (2005), Brussels, Belgium.

App. Table 3: Comparison Regressions of Extensive Margin with Base EPR and LME Policies

	Domestic Total Investment		US-Sourced Total Investment		US-Sourced VC Investment		US-Sourced Buy-Out Investment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Indicator for PE Investment Above One Euro per Capita in Country-Sector							
OECD Employment Protection Index Interacted with US Industry Labor Volatility	-0.061	-0.070	-0.087	-0.034	-0.158	-0.119	-0.107	-0.082
	(0.052)	(0.039)	(0.064)	(0.033)	(0.058)	(0.039)	(0.050)	(0.039)
Log Labor Market Expenditures per Capita Interacted with US Industry Labor Volatility	0.115	0.131	0.021	0.097	0.036	0.109	-0.133	-0.084
	(0.067)	(0.053)	(0.070)	(0.052)	(0.075)	(0.067)	(0.069)	(0.058)
Linear Combination: $\beta_{LME}-\beta_{EPR}$	0.175	0.201	0.109	0.131	0.193	0.227	-0.026	-0.002
	(0.102)	(0.081)	(0.083)	(0.059)	(0.084)	(0.065)	(0.087)	(0.067)
Volatility Metric Employed	Establish.	Sector	Establish.	Sector	Establish.	Sector	Establish.	Sector
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	210	210	210	210	210	210

Notes: See Table 6. Comparison regressions substitute the base EPR and LME policies for the Level and Mechanism Indices of Labor Market Insurance employed in Table 6. Variables are again transformed to have unit standard deviation for interpretation. The bottom row presents the linear difference βLME-βEPR and its standard error. This difference approximates the Mechanism Index.

App. Table 4: Comparison Regressions of Intensive Margin with Base EPR and LME Policies

	Domestic Total Investment		US-Sourced Total Investment		US-Sourced VC Investment		US-Sourced Buy-Out Investment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable is Log Value of Indicated PE Investment in Country-Sector							
OECD Employment Protection Index Interacted with US Industry Labor Volatility	-0.054	-0.026	-0.084	-0.066	-0.117	-0.087	0.011	0.028
	(0.036)	(0.024)	(0.052)	(0.055)	(0.058)	(0.050)	(0.043)	(0.040)
Log Labor Market Expenditures per Capita Interacted with US Industry Labor Volatility	0.058	0.085	0.061	0.067	0.092	0.116	-0.080	-0.061
	(0.041)	(0.035)	(0.072)	(0.078)	(0.072)	(0.067)	(0.058)	(0.059)
Linear Combination: $\beta_{LME}-\beta_{EPR}$	0.112	0.110	0.145	0.133	0.209	0.204	-0.091	-0.089
	(0.059)	(0.053)	(0.120)	(0.130)	(0.121)	(0.115)	(0.084)	(0.087)
Volatility Metric Employed	Establish.	Sector	Establish.	Sector	Establish.	Sector	Establish.	Sector
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	193	193	186	186	151	151

Notes: See Table 7. Comparison regressions substitute the base EPR and LME policies for the Level and Mechanism Indices of Labor Market Insurance employed in Table 7. Variables are again transformed to have unit standard deviation for interpretation. The bottom row presents the linear difference βLME-βEPR and its standard error. This difference approximates the Mechanism Index.