The Effect of Employment Protection Legislation and Financial Market Imperfections on Investment: Evidence from a Firm-Level Panel of EU countries*

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1.1. INTRODUCTION

A large literature has established that Employment Protection Legislation (EPL) affects job flows by reducing both workers' hiring and firing. The implication is that EPL represents an obstacle to the reallocation of resources and it might have a bearing on firms' investment decisions, on the capital-labour ratio and, eventually, on productivity. A further question, to our knowledge not addressed by the literature so far, concerns the impact of financial market imperfections on firms' response to more stringent employment protection provisions: is the effect of EPL stronger in financially constrained firms? The ability to adjust the capital stock

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or to adopt new technologies in the face of stricter EPL is likely to be different in firms that have access to credit with respect to those facing restrictions. Financially constrained firms may, for example, be unable to channel all their internal resources to productive investments when an increase in EPL raises labour costs and workers' bargaining power.

The purpose of this paper is to understand how EPL and financial constraints influence firms' behaviour. We analyze the joint effect of EPL and financial market imperfections on investment, capital-labour substitution, labour productivity and job reallocation in a cross-country framework. Differently from previous work, we use Amadeus data which is the only available source of comparable firm-level information on balance sheets across countries. In our case, the use of firm-level data is crucial because we measure financial market imperfections at the firm level either with measures of availability of internal liquidity – such as operating cash-flow and net liquid assets – or with alternative proxies such as firm size.

While there is an established consensus in the empirical literature around the idea that employment protection regulations have important effects on employment adjustment, relatively little is known about the effects of employment protection on investment, capital deepening and labour productivity.[1] One reason for the lack of studies on the effects of EPL on investment and capital deepening is that, while theoretical models offer clear predictions regarding the effects on job turnover (see the theory box), they provide little guidance on the expected effects of employment protection laws on capital investment, the capital-labour ratio and productivity. Moreover, both the theoretical and empirical literature are virtually silent on the interaction between financial markets and EPL, as discussed in the literature section.

In principle, the effect of EPL on capital-labour ratios and investment is ambiguous. Typically, the presence of dismissal costs raises firms' adjustments costs. For this reason firms may have incentives to distort their production choices toward the more flexible input, thus substituting labour for capital. However, EPL may also strengthen workers' bargaining power and exacerbate the "hold-up" problem typical of investment decisions, resulting in less investment per worker. Hence, for a given technology, stringent firing costs might result in a lower capital stock per worker. In the longer run, however, when firms can adapt their production techniques, higher EPL should favour the adoption of more capital-intensive technologies. The final result on investment (and consequently on the long-run capital-labour ratio) is therefore ambiguous and may depend on workers' bargaining power and on the time span of the data.

EPL will also typically have an ambiguous effect on labour productivity: if dismissal protections induce firms to retain (some) unproductive workers, this causes a decline in labour productivity, *ceteris paribus*. Offsetting this factor, employment protection favours long term employment relations, thus inducing human capital accumulation which might result in pro-

[1] Only recently have these issues received attention. Bassanini et al. (2009) look at the effect of EPL on job reallocation and TFP, using industry-level data (EUKLEMS) and find a negative effect of EPL on TFP. Autor *et al.* (2007) study the US case and find that, after an increase in EPL, capital deepening increases and TFP declines.

ductivity gains (Belot et al. 2007). Furthermore, firms may screen new hires more stringently, leading to a favourable compositional shift in the productivity of the employed workforce.

The paper first assesses the average effect of EPL on investment, the capital-labour ratio and labour productivity. Following Rajan and Zingales (1998), our estimates exploit both variation in the regulation across countries and the different relevance of the constraints imposed by regulation on firms in different sectors. We estimate the role of EPL looking at whether its impact is greater in industries where, in the absence of regulations, job reallocation would be higher. Exploiting the possibility to calculate job flows in different countries and industries from firm-level data, the "intrinsic" degree of volatility at the industry level is measured computing industry job reallocation in a hypothetical frictionless country with no employment regulation and facing world-average reallocation shocks (Ciccone and Papaioannou, 2006). The analysis on firms' choices of capital and labour inputs shows that, on average, EPL reduces investment per worker (at least along the intensive margin). EPL also reduces capital per worker and measured labour productivity (value added per worker) in high reallocation sectors relative to low reallocation sectors.

Once the average effects of EPL are established, we put to test whether financial market imperfections affect firms' responses to shocks in countries and sectors that are differently affected by EPL. We use two popular – albeit imperfect – firm-level measures of financial liquidity to proxy for financial constraints, one based on flows (cash-flow) and one based on stocks (net liquid assets). These measures may be criticized on several grounds. First, cash-flow may proxy for unobserved profit opportunities; additionally, constrained firms with profitable investment opportunities may accumulate liquid resources precisely because they know that they may have little or no access to the credit market. For these reasons, we also use firm size, within firms belonging to the same cohort, as an alternative proxy for financial constraints. This choice is in line with the results of previous literature (Almeida et al., 2004; Cabral and Mata, 2003), which finds that smaller firms of the same age have lower internal resources and are more likely to be financially constrained.

Our analysis shows that EPL reduces the capital-labour ratio, but less so in firms with higher internal resources (as measured either by cash-flow or net liquid assets).[2] This finding is confirmed when using firm size as a proxy for financial constraints. Using firm size, we also find that stricter EPL reduces value added per worker (labour productivity) relatively more in financially constrained firms. Analogously, our results show that, after an increase in EPL, the propensity to invest increases only in large firms while decreasing in smaller ones.

2 In these regressions we control for firms' time-invariant unobserved characteristics using firm fixed effects and identify the effects of EPL from contrasts of within-firm changes. In technical terms, fixed-effects indicate dummies for each firm. As the financial variables that measure liquidity (cash-flow or firm size) vary at the firm level, we are able to control for any time-invariant unobserved firm characteristics that may affect our dependent variables and are correlated with the level of firms' internal resources by using firms fixed effects, thus fully exploiting the firm-level dimension of the dataset.

These results favour the interpretation that financial constraints exacerbate the negative effects of EPL on capital deepening and productivity.

The paper is structured as follows: Section 2 reviews the basic theory on the effect of EPL and credit market imperfections on job flows and illustrates the various mechanisms which may link EPL to capital investment and, ultimately, to labour productivity. Section 3 illustrates the research method and discusses the identification strategy, while Section 4 introduces the data used for the study. Section 5 presents the basic results on the average effect of EPL while section 6 discusses the differential effects in financially sound vs. financially fragile firms. Section 7 provides some robustness checks. Section 8 discusses the policy implications and concludes.

2. Theoretical Considerations and Previous Empirical Literature

There is a very large literature on the economic impact of EPL on the employment level and on job flows. In this section we focus on the much shorter literature of the effects on EPL on (1) investment and capital-labour substitution and (2) labour productivity. We refer to the box for a brief introduction of the reader to the basic theory of the effects of EPL and credit market imperfections on the labor market.

Regarding the effects of EPL on job flows it suffices to say that there is a consensus on the negative effects of EPL on job reallocation (the sum of hiring and firing) since the work of Bertola (1990). Among the recent empirical papers, Autor et al. (2007) and Kugler and Pica (2008) study the impact of EPL on employment reallocation at the firm level in the US and Italy, respectively. At the cross-country level, Gómez-Salvador et al. (2004), Micco and Pages (2004) and Haltiwanger et al. (2006) among others exploit cross-country differences in EPL to establish a negative relationship between job flows and firing restrictions.

While the likely effect of EPL on job flows is negative, there are theoretical reasons to expect an ambiguous effect of EPL on both the capital-labour ratio and productivity. Concerning the interactions of EPL with financial frictions, the literature is even scarcer (see the theory box). We discuss below the different arguments put forward regarding the impact of EPL on investment and productivity, and briefly introduce the likely impact of their interaction with financial frictions.

2.1 EPL, investment and capital-labour substitution

In general firing costs are likely to push up labour costs for firms, even though firms may be able to transfer at least part of the EPL cost onto workers via lower wages.[3] However the effects of higher labour costs on investment and capital-labour ratios are ambiguous. While in perfect labour markets an increase in the cost of labour will imply substitution of labour with more capital, in models with wage bargaining between workers and firms the effect may be the opposite.

When there is wage bargaining, workers will use the protection of EPL to claim higher wages (Bentolila and Dolado 1994, and Garibaldi and Violante 2005). EPL will strengthen the outside option of workers and worsen the outside option of firms in the wage bargain. As a result, EPL may lead to higher bargained wages and lower investments: the so-called "hold up" problem. If workers and employers meet in a random and costly process, some investment decisions have to be taken *after* a worker (of a given skill level) has been located and hired. Since replacing that worker would be costly, the worker can in general try and bargain for higher wages if investment increases the job's productivity. The employer is 'held up' by the worker, who lowers the employer's private returns to investment and therefore his/her incentive to invest (Bertola 1994).

A different case arises in the longer run when firms are not held up by irreversible investments and technology adoption becomes an issue. More EPL means that labour is more costly and when adopting new technologies firms will choose more capital intensive technologies i.e. more capital and less labour (see among others Caballero and Hammour, 1998, Alesina and Zeira, 2006 and Koeniger and Leonardi, 2007).

2.2 EPL and labour productivity

The impact of EPL on labour productivity is also, in principle, ambiguous. On the one side, EPL hampers the reallocation of workers and jobs across industries and firms. Therefore, when the importance of reallocation for productivity is large, productivity falls. On the other side, EPL may have a positive effect on productivity via specific investments and learning-by-doing. Empirically, studies that focus on partial EPL reform via the introduction of temporary contracts obtained mixed results. A screening period of temporary contracts may lead to better matches, increasing productivity, but the incentives for specific investments and the period for learning-by-doing may fall, reducing productivity.

3 The literature shows that the transfer of the costs of EPL onto workers is likely to be partial rather than full. Leonardi and Pica (2008) use an Italian reform of severance payments to show that workers partially compensate firms of the increase in government-mandated EPL via lower wages. Also the tax component of firing costs does not necessarily raise labour costs one to one in countries with an experience rating scheme, as the receipts can be used to compensate firms via lower unemployment insurance premiums (as in Blanchard and Tirole, 2004).

a) Considerations suggesting a negative effect of EPL on productivity

More stringent EPL may reduce productivity because of 'sclerosis' in the production structure (i.e. EPL is an obstacle to reallocation of activity across industries and to risk-taking), because higher skill losses during longer periods of unemployment, or because employees, shielded from a possible layoff due to firing costs, tend to shirk on the job more often.

According to Nickell and Layard (1999) '*there seems to be no evidence that either stricter labour standards or employment protection lowers productivity growth rates*'. For their empirical analysis, Nickell and Layard use aggregate data for 20 OECD countries observed in the period 1976-1992. In some specifications they actually find a positive effect of EPL on the growth rate of labour productivity but this effect disappears in other specifications.

Some papers emphasize the effects of EPL on reallocation via entry and exit of firms. Hopenhayn and Rogerson (1993) show how the distortion induced by firing restrictions pushes firms to use resources less efficiently. As a result, employment levels adjust at a lower speed and productivity is reduced. Poschke (2007) emphasises the role of firing costs in the selection of the most efficient firms and the exit decision of low productivity firms, if exiting firms cannot avoid paying them. Samaniego (2006) claims that firing restrictions are more costly in industries characterised by rapid technological change such as ICT. Countries where regulations are more stringent will therefore tend to specialise in industries with a slow rate of technical change.

Other studies emphasize the obstacle of EPL to undertake risky activities. Bartelsman and Hinloopen (2005) find that EPL has a significant negative effect on investments in ICT. Using data for 13 OECD countries for the period 1991-2000, they conclude that EPL reduces the incentive for firms to invest in innovative activities with high returns and a high risk of failure, because firms want to minimize the risk of paying high firing costs. Saint-Paul (2002) argues that high firing costs may induce secondary innovation that improves existing products rather than introducing riskier ones.

Wasmer (2006) suggests that by inducing substitution of specific for general skills, firing restrictions may have a negative effect on productivity when workers need to be reallocated across industries and industry-specific skills become useless. Ichino and Riphahn (2005) and Riphahn (2005) claim that layoff protection (or the lack thereof during the probation period) might also affect productivity by reducing worker effort because there is less threat of layoff in response to poor work performance or absenteeism.

b) Considerations suggesting a positive effect of EPL on productivity

More stringent EPL may also promote specific investments and result in more learning-by-doing, which may increase productivity. EPL also provides insurance against uninsurable labour income risk, and this may allow for better search of jobs.

Belot *et al.* (2007) propose a framework where, by providing additional job security, protection against dismissal may increase workers' incentives to invest in firm-specific human

capital, therefore enhancing productivity. On the other hand, higher firing costs raise separation costs, increase the bargaining power of the worker, and thereby raise wages. Only at low levels of employment protection is an increase in EPL beneficial to productivity-growth, and the positive effects of employment protection are larger in sectors where firm-specific skills matter more.

Lagos (2006) claims that if stringent EPL raises reservation wages, average productivity can increase simply because firms become more selective and less productive matches are not realised. Bertola (2004) shows that the additional insurance via severance pay may also result in a productivity gain if it increases workers' mobility.

c) Previous empirical literature

The empirical part of most of the papers reviewed, if present at all, is based on cross-country regressions on aggregate outcomes. This approach potentially suffers from well-known severe problems. First of all, reverse causality: the strictness of EPL may depend on labour market conditions. Second, omitted variables may bias the results: EPL may pick up the effect of other factors unobserved by the econometrician that drive the cross-country differences in labour market performance.

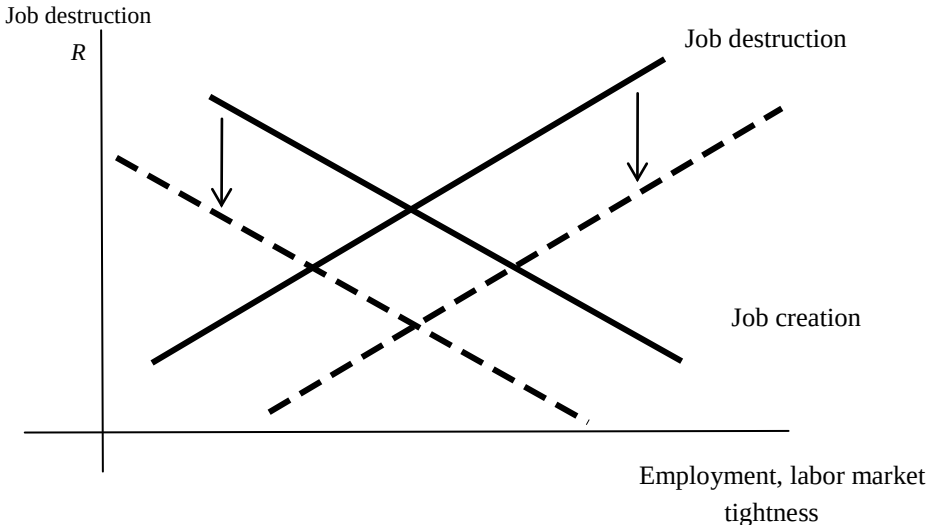
As far as we know, very few studies go beyond country-level data. Scarpetta and Tressel (2004) analyse the effects of EPL and centralized bargaining on firm productivity and firm dynamics using harmonized data for 17 manufacturing industries in 18 countries, over the period 1984-1998. They find that strict EPL has a significant negative impact on productivity only in countries with an intermediate degree of centralisation/coordination in wage bargaining.

Autor *et al.* (2007) study the impact of adoption of wrongful-discharge protection norms in the US, using cross-state differences in the timing of adoption. Exploiting firm level micro-data, they find that capital deepening is increased while TFP is reduced. Quantitatively, they calculate a drop in productivity, with an average elasticity in the order of 0.03 to 0.04. Similar findings are provided by Cingano *et al.* (2008) using Italian data to examine a 1990 reform that raised dismissal costs for firms with fewer than 15 employees only.

Micco and Pagés (2004) analyse the difference in the effects of EPL across sectors within a certain country. They use data for the manufacturing sector for 18 countries during the 1980s and 1990s, and find a negative relationship between layoff costs and the level of labour productivity especially in those sectors with higher needs for flexibility. In a similar vein, Bassanini et al. (2009), uses sectoral harmonized data from EUKLEMS for 17 industries in 18 industrial economies over the past two decades. They consider EPL together with other labour market institutions and the extent to which EPL is binding in particular industries, and find a negative effect of EPL on total factor productivity (TFP).

Box 1: Theory

In this box we provide a brief description of the effects of EPL and capital market imperfections on employment and job flows in models *à la* Mortensen-Pissarides with imperfect markets. For a complete analysis we refer the reader to Pissarides (2000) and Wasmer and Weil (2004). In this paper we are interested in the joint effect of EPL and capital market imperfections on *K/L*, *I/L* and productivity (value added/*L*). The models reviewed below do not actually investigate the direct effect of EPL and credit market imperfections on capital (*K*) and investment (*I*) as they focus on the effects on employment (*L*) and turnover. However, these basic models are key to understand the channels that link EPL and credit market imperfections to the labour market and, consequently, to investment and productivity.

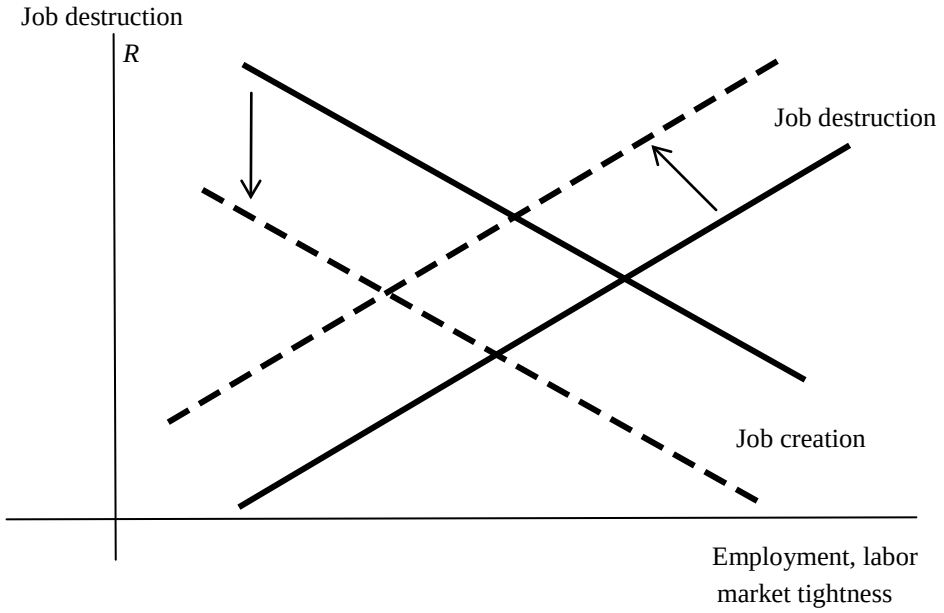


Picture 1: EPL reduces turnover, ambiguous effect on total employment

In labour markets characterized by search frictions, a job is created when workers and firms match together. Since search is costly both for workers and firms, a filled job yields a surplus which is shared through wage negotiation. Rather than on labour demand and supply curves, the theory is based on the analogous concepts of job destruction and job creation. In Picture 1, we put on the vertical axis the level of productivity *R* below which jobs are destroyed and on the horizontal axis the level of market tightness θ (the ratio between open vacancies and unemployed workers: a high θ indicates good economic conditions and high employment). The job destruction (JD) curve is upward sloping because at high θ (i.e. when aggregate conditions are good) workers' outside opportunities improve. Workers can negotiate higher wages and since there is less surplus to share firms destroy jobs more often. The job

creation (JC) curve is downward sloping because firms create jobs until the expected gain from a new job is equal to its cost (keeping an open unfilled vacancy is costly) therefore at higher expected job destruction rate *R* the expected life of a job is shorter and there is less job creation.

EPL reduces both JD and JC (and therefore reduces turnover=JD+JC) because it protects existing jobs. However, firms anticipate that costly job separation will occur (with some probability) in future and also create less jobs. The effect on employment (on the horizontal axis θ=employment) is ambiguous.

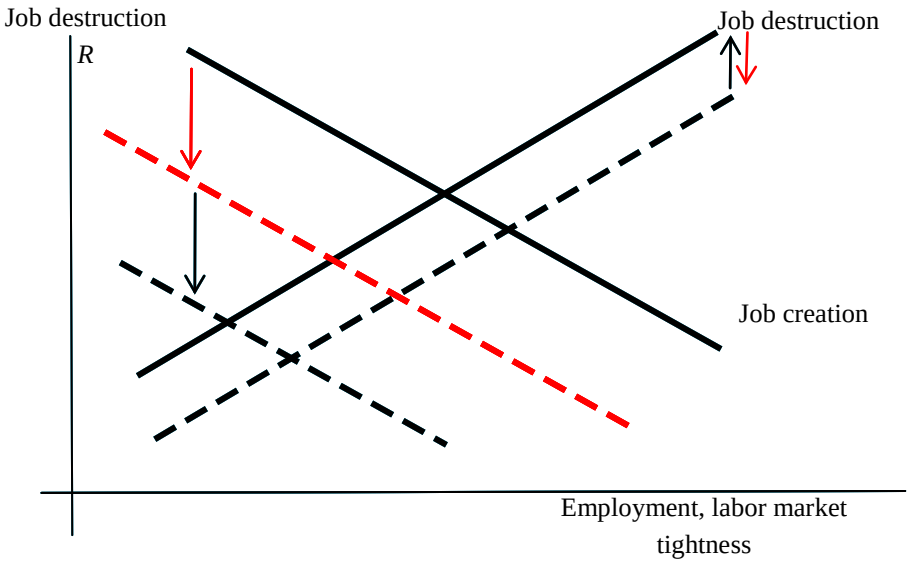


Picture 2: credit market imperfections have ambiguous effect on turnover, negative effect on employment

The effect of capital market imperfections is depicted in Picture 2 (Wasmer and Weil, 2004). In a world where firms have to raise funds in imperfect credit markets before searching for workers, credit markets imperfections reduce the number of financiers and therefore the number of job openings: job creation is reduced. Job destruction is instead increased because imperfect credit markets generate *financial fragility*, i.e. there are states in which the financier has committed to inject new liquidity in the firm — to help it ride out of a temporary negative cash-flow period — because the value of the match between bank and firm is still positive. These states are financially fragile in the sense that the total surplus is still positive but the banker would nevertheless like ex post to close down the firm and is restrained

only by his prior commitment to keep it in operation. In these states, firms' survival hangs solely on the strength of the bank's prior commitments (or on its reputation). Any weakening of these commitments would entail the destruction of some, or all, of these *financially fragile* firms-jobs. In conclusion imperfect credit markets imply lower employment and ambiguous turnover (less JC but more JD).

In Picture 3 we combine the effect of EPL and of credit market imperfections (CMI) under the assumption that the two imperfections are complementary. Many papers show the complementarity between markets imperfections (Wasmer and Weil, 2004 but also Blanchard and Giavazzi, 2003; Ebell and Haefke, 2009 and Kugler and Pica, 2006 on labour and product markets imperfections). "Summing up" the effects of Picture 1 and Picture 2 we obtain that the joint presence of EPL and credit imperfections yields lower employment and lower turnover in Picture 3. Although this theory can provide some guidance on the likely effects of labour and financial markets imperfections on employment and turnover, it does not provide indications as to capital-labour ratios and productivity, for which we refer to the models illustrated in the literature review of section 2.



Picture 3: EPL(↓)+CMI (↓)= lower employment, lower turnover

3. Empirical Framework

In order to describe the identification strategy that allows us estimating the joint effect of labour and financial market imperfections, we proceed in two steps. In section 3.1 we de-

scribe the identification strategy of EPL neglecting credit markets, and in section 3.2 we extend our empirical framework to allow for the presence of (imperfect) capital markets.

3.1 Identification of the average effect of EPL on firm-level outcomes

Our empirical strategy relies on a well-established approach developed in the finance literature by Rajan and Zingales (1998) and recently adopted in labour studies (see Micco et al. 2004, Fonseca and Utrero-González 2005, Haltiwanger et al. 2006 and Bassanini et al. 2009) to estimate the impact of country characteristics (often, measures of regulation) on economic performance accounting for geographic and technology-specific time-invariant unobservables. The basic idea underlying the approach is to exploit the fact that while the *amount* of regulation is given for all firms within a country, its *impact* could be different if, due to technological characteristics or to the incidence of aggregate shocks, firms do differ as to the frequency or amount of required labour reallocation. In this case, the importance of employment protection legislation can be inferred by looking at whether firms requiring more reallocation see a better performance in countries with less restrictive legislation.

The main problem with this approach is recovering a plausible measure of employment reallocation requirements. Job flows are in fact not customarily included among official statistics and even if they were observable at the firm or industry level, they would likely reflect idiosyncratic components endogenous to the level of EPL in each country. This implies they would in general not just reflect the amount of reallocation of a frictionless environment, where the extent of yearly flows only responds to, say, technological differences at the firm or industry level. Hence, using actual labour reallocation as a proxy for frictionless reallocation requirements is likely to yield biased estimates of the impact of EPL on performance. Following the influential study of Rajan and Zingales (1998) on financial development, one popular approach to this problem is to proxy for firms' characteristics in the absence of distortions using data from a flexible market economy. For example, Micco and Pages (2004), Haltiwanger et al. (2006) and Bassanini et al. (2009) use reallocation figures computed for US industries. Their underlying assumption is that such baseline should proxy for technological and market driven employment reallocation across industries in the absence of policy-induced costs of adjustment.

Following this approach implies estimating a standard differences-in-differences specification exploiting cross-country cross-industry data. Since the dependent variables in our data would be measured at the firm level, the model specification would be:

$$Y_{ijt}^{c} = (E_{t}^{c} \times BenchFlow_{j})\delta + E_{t}^{c}\varphi + X_{ijt}^{c}\gamma + \mu_{t} + \mu_{j} + \mu^{c} + D + \varepsilon_{ijt}^{c} \qquad (1)$$

where Y^{c}_{ijt} is the outcome variable of firm i in country c, industry j at time t; E^{c}_{t} is a country-varying index of employment protection legislation; $BenchFlow_{j}$ is the extent of "intrin-

sic" job reallocation in sector *j* (below we describe its construction). The various specifications encompass different sets of year-, industry- and country- effects (respectively μ_t, μ_j, μ^c) and their interactions *D*. The matrix X^c_{ijt} includes firm-level control variables and ε^c_{ijt} is the residual.

Equation (1) allows estimating the average effect of EPL exploiting variability at the country-sector-time level in the relationship between employment legislation and outcomes. At this stage, we do not include firms fixed effects because they would wash away all the industry by country variation making the identification of the effect of interest ($E^c_t \times benchflow_j$) rely only on the (limited) time variation of the EPL index. Note that this interaction term just varies across sectors by country and (albeit limited) time, while the dependent variable is measured at the firm level. We take care of the resulting intra-cluster correlation of the standard errors during estimation.

The coefficient δ in equation (1) captures the effect of employment regulation on the variable of interest. One way to interpret δ is thinking of the average difference in the variable of interest *Y* between two industries characterized by high and low reallocation flows (say, corresponding to the 10th and 90th percentile of the observed distribution, respectively). Then estimates of δ in equation (1) can be thought of as the implied change in such differential as employment protection is increased by an arbitrary amount (say, equivalent to the 10th-90th cross-country difference).

Following the standard benchmark-country approach would require proxying the sectoral intrinsic need for job reallocation using data from the most flexible market economy available (the US or, in our sample, the UK). The appropriateness of the benchmark-country approach can however be questioned along two dimensions. First, the validity of the benchmark hinges on the representativeness of the industry in the benchmark country, within the set of countries covered in the sample.[4] Second, the benchmark-country approach may represent a measure of short- rather than long-term industry-differences (Fisman and Love, 2004). This would imply in our case that the benchmark constitutes a noisy proxy of frictionless (or technological) industry reallocation requirements.

More worryingly, Ciccone and Papaioannou (2006) have shown that if the benchmark reflects, among other factors, idiosyncratic shocks, then the measurement error originating from country-benchmarking can induce both upward and downward biases in the estimates of δ. In our case, if employment reallocation across industries in the benchmark country correlates more closely with reallocation in low-EPL countries than in high-EPL countries, then

4 Even if US reallocation rates in a given industry are a good proxy of the intrinsic needs of reallocation in that sector, it might be the case that within sector heterogeneity across countries limits the comparative exercise. An example illustrates well this problem. If the researcher is using benchmark flows measures at the 2-digit industry level of aggregation, the reallocation in sector 35 "Manufacture of Transport Equipment" in the US, would serve as benchmark reallocation for the remaining countries in the sample. However, going finer in the industry classification one finds that industry 35 is composed, among others, of sub-sectors 3511 "Building and repairing ships and boats", 3530, "Manufacture of aircraft and spacecraft" and 3542 "Manufacture of bicycles". The benchmarking requires that either intrinsic needs of reallocation in the three sub-sectors are similar, or that the average within sector industry mix in every country in the sample is well proxied by the average industry mix in the US. A finer level of aggregation of the benchmark would limit this problem.

one might find significant effects of regulation even if there were not. To circumvent the problem Ciccone and Papaioannou (2006, 2007) proposed a methodology to construct a world-average benchmark measure not reflecting idiosyncratic factors specific to a country or regulatory environment. Exploiting the availability of industry (or firm-) specific figures of job reallocation JR_{jc}, such a measure can be obtained in our case regressing job reallocation measured at a detailed industry level on country dummies interacted with time dummies, industry dummies and industry dummies interacted with country-level EPL:

$$JR_{jt}^{c} = \alpha_j + \lambda_t^c + \theta_j E_t^c + \upsilon_{jt}^c \tag{2}$$

where the interaction term $\theta_j \times E_t^c$ allows to absorb the marginal effect of employment protection on job reallocation in each industry *j*, and λ_t^c accounts for time-varying differences at the country level. Hence $\hat{\alpha}_j$ captures the extent of industry job reallocation in a country not subject to firing restrictions (we are controlling for EPL), which is subject to world average supply and demand shocks. This is the measure of frictionless sectoral reallocation that will be used in the paper (i.e. $BenchFlow_j = \hat{\alpha}_j$). To this purpose, we collapse our firm level data (described below) at country-industry-year cells. The job reallocation rate is defined, following Davis and Haltiwanger (1990), as

$$JR_{jt}^{c} = \sum_{i \in j,c} 2 \frac{\left| e_{ijt}^{c} - e_{jit-1}^{c} \right|}{e_{ijt}^{c} + e_{ijt-1}^{c}}$$

where subscripts are defined as above. In order to preserve a minimal level of representativeness in each cell, we drop all cells where job reallocation was computed for less than 10 firms.[5]

While the Ciccone-Papaioannou methodology allows avoiding country-specific idiosyncrasies, its main limitation is that, since no country in our sample has zero EPL, it computes trustworthy frictionless rates only under the assumption that out-of-sample predictions are reliable. For this reason, we check the robustness of this approach, by using as an alternative benchmark the sectoral job reallocation rates (averaged over time) of the country with the lowest level of EPL in our sample.[6] Comparing the results obtained using the two alternative

5 According to our estimates of job reallocation, 2-digit industries that account for more than 50% of observations in high job-reallocation industries at the 4-digit level include: Construction; Collection, purification and distribution of water; Manufacture of radio, television and communication equipment; Land transport; Post and telecommunications; Computer and related activities. Low job reallocation industries include: Extraction of crude petroleum and natural gas; Manufacture of wearing apparel; Recycling; Forestry, logging and related service activities; Air transport; Manufacture of motor vehicles, trailers and semi-trailers

6 One can argue that the frictionless measure using only within sample countries has an endogeneity problem and that, insofar as the driving variable appears to be EPL on regular contracts, benchmarks based on layoffs would be more pertinent than benchmarks based on turnover (for example services are notoriously high turnover but low layoff industries). To address this problem we also used the sectoral layoff rates from the US (a country external to the sample) taken from Bassanini et al. (2009) as an alternative benchmark. Specifications based on this measure give insignificant but qualitatively similar results. This is likely due to the fact that this measure is available only for 16 sector, rather than for the 446 sectors implied by the Amadeus 4-digit disaggregation.

measures is interesting to assess to what extent the widely used benchmark-country proxies reflect idiosyncratic shocks.

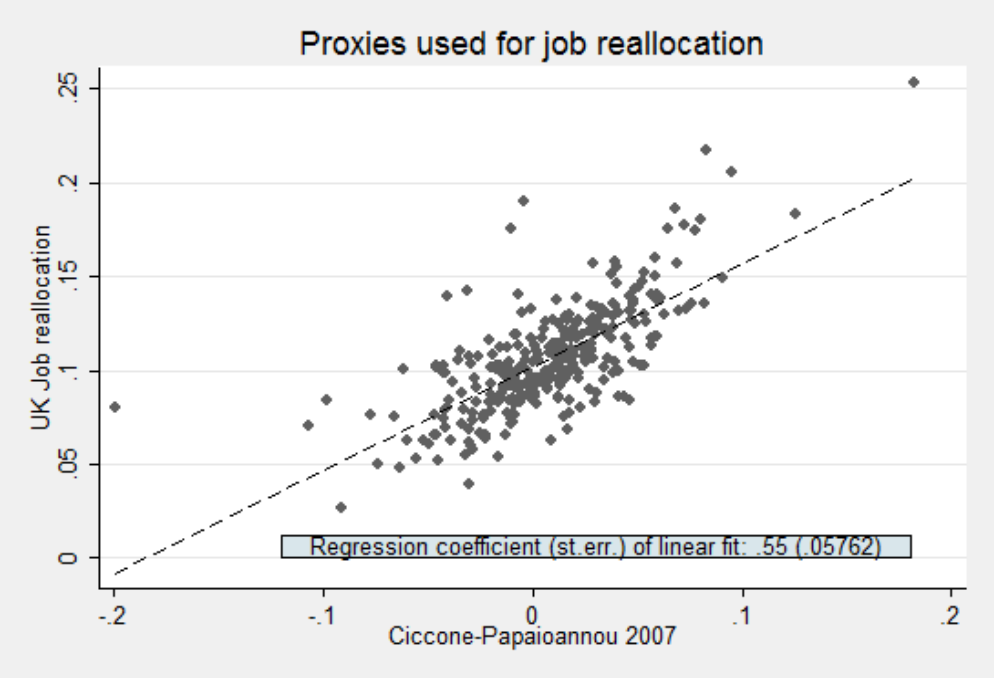


Figure 1. Job reallocation in UK and world-average Ciccone-Papaioannou (2007) measure.

Figure 1 depicts the relationship between actual job reallocation in the UK, the country with the lowest level of EPL in our sample, measured at the 4-digit industry level (446 sectors) with the measure obtained following equation (2). The picture shows that the actual UK job reallocation rate and the Ciccone-Papaioannou (2007) "frictionless" job reallocation measure are strongly positively related. The slope of the linear fit (dotted line) is positive and significant. Although the relationship between both measures is positive and significant, it is different from a hypothetical 45% line, suggesting that UK job flows are a mix of world average and idiosyncratic needs for reallocation.

Finally, one aspect that deserves some discussion is the possible endogeneity of regulations. It is likely, for example, that countries that experience high turnover rates have a high demand for strict employment protection legislation. Alternatively, countries with low employment creation may tend to protect existing jobs. An attempt to address the problem using instrumental variables can be found in Bassanini et al. (2009). Our approach allows us using country (by time) and sector fixed effects to control for all observable and unobservable country and sector characteristics. In particular, it allows controlling for differences in country and sector output volatility, thus alleviating the potential problem of endogeneity of regu-

lations present in cross-country regressions. In fact, in order for endogeneity to be an issue in our approach, one would have to argue that across countries a high level of turnover or low job creation in some sectors determines the level of employment protection in the whole country.

3.2 Identification of the joint effect of EPL and financial market imperfections

The next step aims at studying the *joint* effect of EPL (labour market frictions) and financial constraints on the capital-labour ratio, investment and labour productivity. We therefore relate to the large literature that looks at the determinants of capital investment and finds access to the credit market to be one of the important factors affecting investment.

Most empirical studies of investment and financing constraints, in the tradition of Fazzari, Hubbard and Petersen (1988) typically regress a measure of investment on a measure of investment opportunities (Tobin's *q*) as well as a measure of cash flow, i.e. they estimate the sensitivity of investment to cash flow conditional on Tobin's *q*. These empirical specifications imply that, in the absence of financing constraints, investment is likely to be subject to adjustment costs that prevent the capital stock adapting continuously to maintain equality between the marginal revenue product and the user cost of capital. In the absence of financial frictions, Tobin's *q* is a sufficient statistic for investment opportunities, which means that nothing but Tobin's *q* should matter in investment equations. A positive correlation between investment and liquidity, conditional on Tobin's *q*, is therefore taken as evidence of the presence of financial market imperfections that prevent positive net present value projects to be financed, possibly because of moral hazard problems.

Differently from those works, in this paper we study the joint effect of EPL and financial constraints on the outcome variables i.e. the differential effect of EPL on all outcome variables for financially constrained firms vs. financially sound firms. The impact of credit and labour market imperfections on investment has been theoretically analyzed in Rendon (2004) and in Wasmer and Weil (2004), who showed that job creation is limited by financing constraints even in the presence of a flexible labour market.

There are not many papers that investigate empirically the joint influence of imperfect financial and labour markets on investment, with the notable exceptions of Classens and Ueda (2008) and Calcagnini and Giombini (2008).

The interplay of financial frictions and EPL is evaluated in our cross-country panel data framework exploiting the interaction between labour and financial market imperfections *at the firm-level*. We measure financial constraints with three different measures of internal resources, augmenting our baseline specification (1) as follows:

$$\begin{aligned} Y_{ijt}^{c} = {} & (E_t^c \times BenchFlow_j)\delta_0 + (E_t^c \times IR_{ijt}^c)\delta_1 + (IR_{ijt}^c \times BenchFlow_j)\delta_2 + \\ & + (E_t^c \times IR_{ijt}^c \times BenchFlow_j)\delta_3 + E_t^c\phi_0 + IR_{ijt}^c\phi_1 + \beta ROA_{ijt-1} + \mu_i + D + \varepsilon_{ijt}^c \end{aligned} \tag{3}$$

where IR_{ijt}^{c} is a measure of internal resources in country *c*, firm *i*, industry *j* at time *t* and *D* is a vector of dummy variables including country by year interactions. The coefficient δ_3 of third level interaction term $(E_t^c \times IR_{ijt}^c \times BenchFlow_j)$ captures the effect of EPL on investment – and on the other dependent variables – in firms with different access to credit in sectors with different volatilities of employment. If financial soundness facilitates capital deepening, then this interaction term should positively enter the investment per worker and *K/L* equations.

The first measure of internal resources we use is the most popular in the finance literature: *operating cash-flow* of firm *i* at any observed year *t*-1.[7] The idea is that firms with low levels of cash-flow have little or no access to credit. This is consistent with Holmström and Tirole (1997) who show that in capital markets characterized by moral hazard problems high levels of cash flow alleviate financial constraints. We take the lagged value of cash-flow in order to make sure that we measure liquidity *before* investments are made: this should soften the reverse causality problem that may arise if high investments generate low levels of liquidity. Our cash-flow variable is normalized by fixed assets in the previous accounting year as follows:

$$CF_{ijt-1}^{c} = \frac{Cash\ Flow_{ijt-1}^{c}}{Fixed\ Assets_{ijt-2}^{c}}$$

Although cash-flow is a popular measure in the literature on financial constraints, it has been frequently criticized because of its likely endogeneity: firms may decide to hold more cash not because of a positive shock to profits (orthogonal to future investment opportunities) but because they know they will have an investment opportunity and will have trouble obtaining credit. The literature often uses information on firms' dividends and share issues to identify firms that are more likely to be constrained. Unfortunately this information is missing in Amadeus data. Therefore to partially overcome the endogeneity of cash-flow we use firm size, on the presumption that larger firms are less likely to be financially constrained. Cabral and Mata (2003) indeed show that, conditional on age, firm size is a good proxy for the likelihood of facing financial constraints. The empirical analysis of Almeida et al. (2004) also supports the conjecture that small firms are more likely to be financially constrained and to have low internal resources. Following this literature, our measure of firm size is (the log of) employment. In the regressions analysis we enter the lag of this variable in order to avoid

7 To test the robustness of our results we also use a stock measure of liquidity called *net liquid assets* and defined. as current assets minus current liabilities which equals net working capital (Cleary, Povel and Raith, 2005). The reason for adopting this stock measure is that measuring internal funds by using a flow variable, such as cash-flow, correctly accounts for current changes in internal funds but ignores existing funds carried over from the last period. Of course, measuring internal funds with a stock variable as (lagged) liquid assets, on the other hand, ignores all recent cash flow that is immediately invested and therefore never shows up in the end-of-period stock variable. For this reason, we use both variables.

possible feedback effects. Simultaneously accounting for year dummies and firm level fixed effects in eq. (3) takes care of the age of the firm.

Of course, in our regressions we need to control for firms' investment opportunities. Ideally, one would like to be able to compute Tobin's *q*. However, this requires information on the market value of the firm and the vast majority of firms in our sample are unlisted. For this reason, in this work we will measure investment opportunities with the rate of Return on Assets (ROA in equation 3), which is entered lagged of one period in the regressions.

Note that our specifications now include firm-level fixed effects, since the variable of interest in this case is not an aggregate variable as in the previous specification, but varies over time *within firms*. In this context, it becomes crucial to control for any unobserved factor that remains constant within firms and might be correlated with the measures of financial fragility. One may in fact argue that firms able to produce a higher cash-flow may have easier access to credit but are also likely to behave differently along many (unobservable) dimensions. To the extent that these unobserved factors are time invariant, they are accounted for by firms fixed effects.

4. Data description

Our main source of information is Amadeus, a firm level data set collected by the Bureau van Dijk (BvD) containing balance-sheet data for a sample of European firms.[8] The information is gathered by specialized national service providers and is homogenised applying uniform formats in order to allow accurate cross-country comparisons. We used the largest version of Amadeus in its 2006 DVD format, which covers firms of all sizes for the period 1994-2005, but presents rather limited samples prior to 1997. Taking into account that EPL data is only available up to 2003, we restrict the analysis to the period 1997-2003, but robustness checks adding these additional years are provided in Section 7. The 14 countries under study are: Belgium, the Czeck Republic, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Poland, Portugal, Spain, Sweden and the United Kingdom.[9]

The limitations of this firm-level dataset are well-known. First, accuracy and coverage of the data depend on how demanding the accounting standards of a country are. Therefore, the sample is biased toward countries with more demanding accounting standards and more transparent firms. If anything, this sample selection bias should make it harder to find a significant impact of financial market imperfections on firms' response to stricter EPL. More-

8 See Messina and Vallanti (2007) and Konings et al. (2005) for descriptions of Amadeus in different research contexts. Giannangeli and Gómez-Salvador (2008) use Amadeus to study of the sources of growth in manufacturing productivity in five European countries.

9 We tried to cover all countries in Amadeus for which EPL data from the OECD was available. Austria and Germany constitute special cases in Amadeus. Most firms in these two countries have limited information on their balance sheets, including employment and very few financial items. After data cleaning, this results in insufficient observations in the case of Austria for most of the specifications. Hence, Austria is dropped from the analysis. Slovakia, Ireland and Hungary were also dropped due to small samples. There are very few German firms too in the sample, but sufficient to be present in most country, year and sector cells. The analysis in the paper includes Germany, and robustness checks excluding specific countries are discussed at the end of the paper.

over, in any given country, the sample may not be representative of the underlying population. To get reassured that Amadeus firms does not completely misrepresent the population distribution we aggregated our data to the corresponding Euklems industry-level breakdown and computed correlations between country-industry shares of employment and value added in the two datasets (such information is available in Euklems for all countries in our sample). In 2003, the correlation is 0.44 in the case of employment and 0.35 in the case of value added.[10]

Despite the above described limitations the use of Amadeus is becoming widespread in the economic profession for several reasons. First, the reclassification of the balance sheets appears reliable, since no attempt is made to reconstruct items that are missing from the original balance sheets or difficult to reconstruct. In fact, many variables are missing, especially for firms incorporated in countries where accounting practices are less transparent. Another important advantage of Amadeus is that it covers firms of all sizes in the private sector, which allows focusing on a sample that is more representative than the listed companies typically analysed in studies on credit markets (see Rajan and Zingales, 1995 and Boot, et al., 2001). This naturally entails some shortcomings given that the information available for private firms is less detailed. Moreover, since smaller firms are typically not traded, only book values are available and it is not possible to evaluate the market values of debt ratios, which would provide useful additional information. However, these shortcomings are not likely to hamper the analysis because previous studies (Rajan and Zingales, 1995 and Boot et al., 2001) do not find any significant differences in factors correlated with debt to book and market capital.

For the aims of this paper the advantages of looking at a panel of balance sheet data for firms in different countries largely prevail over the disadvantages. First and foremost, the availability of balance sheet data allows us to study whether and to what extent labour market regulation interacts with financial constraints when firms react to aggregate or idiosyncratic shocks. This analysis simply cannot be performed on sectoral data.[11] Second, even when focusing on the average effects of employment protection, the use of firm-level data is advisable, as one can account for industry and country specific unobserved characteristics in ways that studies based on aggregate data are unable to correct for. This makes our study less subject to miss-specification and omitted variable biases. Finally, the firm-level data in Amadeus is classified at a very detailed industry dimension (4-digit NACE classification). The possibility of constructing the benchmark "frictionless" job flow measure at such a re-

10 This strategy of cross-checking our results (at least those not involving firm-specific measures among the variables of interest) against estimates obtained running the corresponding regressions at a more aggregate level using information from country-industry datasets is harder for investment and capital stocks. The Euklems dataset which assembles industry-level accounts for EU members at a 2-digit level of disaggregation lacks information on capital stock for countries as France, Spain and Belgium. The OECD Stan dataset, a possible alternative source of data with a coarser industry breakdown, also presents a significant fraction of missing values as regards the stock of capital.

11 Few recent papers addressed a similar issue in a totally different framework, i.e. studying the determinants of corporate control (Atanassov and Kim 2009, Pagano and Volpin 2005, Bozcaya and Kerr 2008).

fined level of aggregation helps us limiting possible problems of comparability of industries discussed above.

4.1 Descriptive Statistics

Table 1 reports the average values of our variables of interest, giving a first summary of the descriptive statistics by country and year presented in the Appendix Tables. In our sample period the average levels of capital per worker, value added per worker and investment per worker measured in thousand of euro at 1995 prices are respectively of 30.13, 35.58 and 5.75. More than 8 percent of the investment observations are zero. It is interesting to notice that Germany exhibits the highest values of *K/L*, *I/L* and *VA/L*, followed by Belgium (*K/L*), Italy (*I*/*L*), and The Netherlands (*VA/L*). France and Sweden, differently, rank very low for capital, together with Finland and the Czech Republic. The Czech republic also shows the lowest value of *VA/L* and of investment per worker *I/L*.

Job reallocation is on average equal to 0.14. Poland is the country displaying the highest rate of job reallocation, while the Czech Republic and Greece the lowest. Table 1 also shows that average cash-flow, normalized by fixed assets, is around 0.67 while average firm size, measured as the number of employees, is equal to 32.24 employees. It is well-known that the firm size distribution is significantly skewed, as shown by the low value of the median which is equal to 9.[12]

Finally, the average EPL value is 2.47, with the United Kingdom displaying the lowest level of EPL in our sample period and Portugal the highest. It is noteworthy (and also well-known) that EPL varies very little over time. Table A.2, in Appendix, which reports descriptive statistics by year, indeed shows that average EPL ranges from 2.44 and 2.49 over our sample period.

5. Results: average effects of EPL

We will start assessing the relevance of employment regulations looking at the average effect of EPL in industries with different needs for employment reallocation. These issues are explored applying the difference-in-differences estimation method illustrated in eq. (1) and looking at the effects of EPL on the capital and investment to labour ratio, as well as on labour productivity. For comparison with previous studies and to validate our empirical approach, we also assess whether employment protection legislation does in fact affect the level of job reallocation.

12 Amadeus gathers information from balance sheets coming from different sources. Hence, cross-country differences might reflect several factors, including different accounting standards and accounting procedures. However, this sample biases are unlikely to be important as our identification strategy relies on within country cross sectoral/firm information (when firm level fixed effects are not included in the specification) and within firm information when we include fixed effects. Hence, any aggregate bias will be captured by our country and country by year fixed effects, depending on the specification.

All estimates are obtained accounting for industry-by-time dummies to control for differential trends by type of economic activity. For example, throughout all countries some industries may experience faster (e.g. the computer industry) or lower-than-average (e.g. manufacturing) capital adjustment, job reallocation or productivity growth.[13] We also include country-by-time dummies to control for all country-specific time-varying characteristics (for example all national-level institutions) which have the same effects across firms. Notice that this set of dummies absorbs the main effect of EPL, as this variable only varies by country and time.[14]

The coefficient in column 1 of Table 2 shows that EPL reduces the capital-labour ratio in firms operating in high job reallocation industries. The coefficient on the interaction is strongly significant and in the neighbourhood of -0.45. In order to get an idea of its magnitude, it is useful to consider the capital-intensity ratio between industry 1561 "Manufacture of grain mills product" and industry 2955 "Manufacture of machinery for paper or paperboard production", the two lines-of-work we estimate being at the 10^{th} and 90^{th} percentiles of the "frictionless" job reallocation distribution. Our estimates imply that *reducing* employment protection from the level of Greece in 1997 to that of Denmark the same year (this shift correspond to the 90^{th} to the 10^{th} percentile of the country-by-year EPL distribution in our sample) would increase such ratio by 11.2%. Put differently, the marginal effect of reducing the EPL index by one unit ranges from around 5% for industries at the 10^{th} percentile of the reallocation distribution to nearly 9% for industries at the 90^{th} percentile (at the median, it amounts to 7%).

We then turn to examine the effect of employment protection legislation on investment normalized by units of labour, as this is the relevant variable in models of hold-up. In particular, following the analysis of consumer durables by Bertola et al. (2005), we separately focus on firms probability of adjusting through positive investment (the extensive margin, column 2) on one hand, and on the size of investments (the intensive margin, column 3) on the other. Estimating a linear probability model of positive investment suggests that higher EPL increases the frequency of adjustment: the coefficient is 0.041 (s.e. 0.019). The effect, although statistically significant, is relatively small in magnitude: this coefficient implies that the propensity to invest increases by only 0.6 percentage points at the median industry. On the other hand, analysing the extent of investment reveals that firms that adjust tend to do it

13 We also experimented, with little changes in the results, with two alternative specifications that closely parallel existing evidence from the literature. On one hand we aggregated Amadeus data at the industry level to ease comparison with results obtained by works using EUKLEMS data (as Bassanini et al., 2009). On the other, we interacted EPL with sectoral job turnover in the less regulated country in our sample, the UK, rather than our frictionless measure. In this we closely follow Rajan and Zingales (1998) and most of the following literature. Detailed results are available in a previous version of the paper, available at http://ftp.iza.org/dp4158.pdf

14 While we study firm-level outcomes, our variable of interest in equation (1), the interaction term *EPL* × *benchflows*, varies at the four-digit industry level in 14 countries and 7 years. We take care of the intra-cluster correlation of standard errors likely to arise in all the specifications discussed.

in smaller amounts as the burden imposed by employment regulation increases (column 3).[15] This result helps explaining the negative EPL effects on capital intensity just highlighted. The estimated effect is highly statistically significant and implies that replicating the thought exercise above, i.e. reducing EPL from the Greek to the Danish level, would increase the amount of investment per worker by more than 11 percent in high reallocation industries relative to low reallocation industries. Or to see it differently, it implies that lowering the employment protection index by one unit would induce firms in industries at the 90th percentile of the reallocation distribution to raise investment by nearly 9% as opposed to slightly more than 5% for industries at the 10th percentile of the distribution.

In column 4 we explore the effect of EPL on labour productivity finding strong and significantly negative coefficients of around -0.28, which can be quantified thinking that reducing EPL from the Greek to the Danish levels would raise average value added per worker in high reallocation industries by 7.1 percent. Alternatively, the estimated coefficient implies the marginal effect of reducing the EPL index by one unit ranges from 3.1% for industries at the 10th percentile of the reallocation distribution, as "Manufacture of grain mills product", to more than 5% for industries at the 90th percentile, as "Manufacture of machinery for paper or paperboard production".

While the negative relation between EPL and job flows is well established (see references in section 2), most previous studies look at sectoral data. Our estimate in column 5 confirms these results with firm level data. We find that firms in more volatile industries present lower levels of job reallocation in countries with more stringent employment protection laws. To get an idea of the magnitude of the effects, our estimates imply that reducing employment protection as in the cases above would increase yearly reallocation by nearly 1 percentage point in firms at the 90th percentile of "frictionless" reallocation rates relative to firms at the 10th percentile. The median reallocation rate in our sample is 5.4.

The negative results on labour productivity are consistent with previous empirical literature (e.g. Autor et al, 2007 and Bassanini *et al*., 2009) and are somewhat expected in light of our results on job flows and the capital-labour ratio. If the reallocation of labour is important and EPL hinders it both across and within sectors, then productivity might fall. Indeed, finding an effect of EPL on job reallocation is a pre-requisite to claim that dismissal restrictions hamper the optimization of resources and allocative efficiency (Bertola, 1990). A relatively new finding is that EPL reduces the extent of investment and the capital stock per worker while increasing the *frequency* of capital adjustments. The negative effect on investment and capital reinforces the negative impact of reduced allocative efficiency on productivity, and is

15 Consistently with Bertola et al. (2005) who find – in their analysis of consumer durables – that variables which positively affect the probability of adjustment tend to have a negative effect on the size of the adjustment, our analysis also seems to show that on average stricter labour adjustment costs induce firms to smooth investments over time, i.e. to make smaller capital adjustments at higher frequency. In section 6 we will better qualify this result by showing that only large firms increase the propensity to invest in the face of stricter EPL.

consistent with the interpretation that investments are held-up by workers in high EPL environments.

6. EPL and the role of Financial Market Imperfections

We are now in the position to analyse the results on the joint effect of EPL and financial constraints on the outcome variables i.e. the differential effect of EPL for financially constrained firms. Our empirical strategy, outlined in equation (3), amounts to evaluate whether there is a differential effect of EPL in firms with different levels of internal resources (inversely related to financial constraints) on the variables analysed so far: capital per worker, investment per worker, value added per worker and job reallocation rates.

In the first 3 columns of Tables 3 to 6, we show the results obtained with measures of financial constraints based on two measures of financial liquidity. The first reflects the flow of internal resources potentially available for investment purposes (operating cash-flow); the second is based on the stock of internal resources (net liquid assets) accumulated over time. The limitations of these measures of internal resources have been discussed in the previous sections.

Our preferred measure of financial constraints is firm's size, presented in columns 4 and 5 of Tables 3 to 6, as measured by the number of employees at the end of the budget year. As discussed earlier, Cabral and Mata (2003) show that, conditional on age, firm size is a good proxy for financial constraints. Although there is some discussion about the impact of financial constraints on the firm size distribution (see Angelini and Generale, 2005) they are generally viewed an important determinant of firm size for firms within the same cohort. We should bear in mind however that for many of the countries in our sample (e.g. Italy, Germany and Spain) there are different thresholds of firm size below which EPL is in general less strict. If EPL is more stringent for larger firms (those that, having controlled for age, should be less subject to financial constraints) our estimates of the joint impact of EPL and financial fragility would be downward biased.

As the variables measuring financial constraints (cash flow, net liquid assets and firm size) vary at the firm level, we are now able to control for any time-invariant unobserved firm characteristic that may affect the dependent variables while being correlated with the level of firms' internal resources by the use of firms fixed effects, thus fully exploiting the firm-level dimension of the dataset. Note in particular that the inclusion of firm fixed effects allows accounting for the year of foundation of the firm. Hence, following Cabral and Mata (2003), we take the (log of) firm size to be a good proxy for financial constraints.

As before, we first look at the effect on capital and investment normalized by unit of labour and on the capital-labour ratio (section 6.1). Then we look at the effects on labour productivity (section 6.2).

6.1 Capital per worker

Table 3 reports results on the ratio of capital to labour. Columns 1, 2 and 3 show the estimates obtained with our measures of financial constraints based on firm-level liquidity: cash-flows and liquid assets. EPL reduces the capital-labour ratio, but less so in firms with higher internal resources as the coefficient on EPL × BF × Cashflow is positive and statistically significant. Having a high cash flow thus reduces significantly the negative effect on the capital-labour ratio or equivalently, from the point of view of financially constrained firms, they have to reduce capital more when EPL increases. In order to quantify the joint effect of financial restrictions and employment regulation, Figure 2 plots the implied reduction in capital intensities predicted based on our estimates for firms with different liquidity endowments. Consider first high cash flow firms, i.e. those at the 90^{th} percentile of the cash flow distribution. The marginal effect of increasing the EPL index by one unit would be a reduction in the capital labour ratio ranging from 3.2% for firms in low reallocation industries (i.e. those at the 10% percentile of job reallocation distribution) to 5.3% when high job reallocation is needed. The spread would increase sensibly for financially constrained firms (i.e. those at the 10th percentile of the cash flow distribution), as our estimates imply a reduction in capital intensity ranging from slightly more than 4% in low reallocation industries to over 7% for firms in high job reallocation industries. Using liquid assets instead of cash-flow (column 3) does not alter the results.

Given that cash-flow is likely to be endogenous, column 4 uses firm size as an alternative proxy for financial constraints. The coefficient of the triple interaction term is still positive and significant, meaning that the negative effect of EPL on the capital-labour ratio is lower in larger firms. Since larger firms are typically subject to more stringent employment protection mandates, we interpret this finding as a clear sign of the interplay between financial constraints and EPL. The evidence instead suggests that EPL is more binding in financially fragile firms, which are unable to engage in capital labour substitution as a result of the legislation. Column 5 shows that the previous results are robust to the inclusion of a full set of country by year dummies.

We have interpreted the negative effect of EPL on capital investment and the capital-labour ratio in the basic specification of equation (1) along the lines of the “hold up” theory. The results of equation (3), which looks at differential effects depending on the internal financial structure of firms, are consistent with the same view: the presence of stricter EPL disincentives the use of internal funds for financing new investments: i.e., if capital is largely sunk and high EPL favours ex-post profit appropriation by workers, firms will use their internal funds to pay higher wages and will invest less. This is all the more true for financially constrained firms with low liquidity.

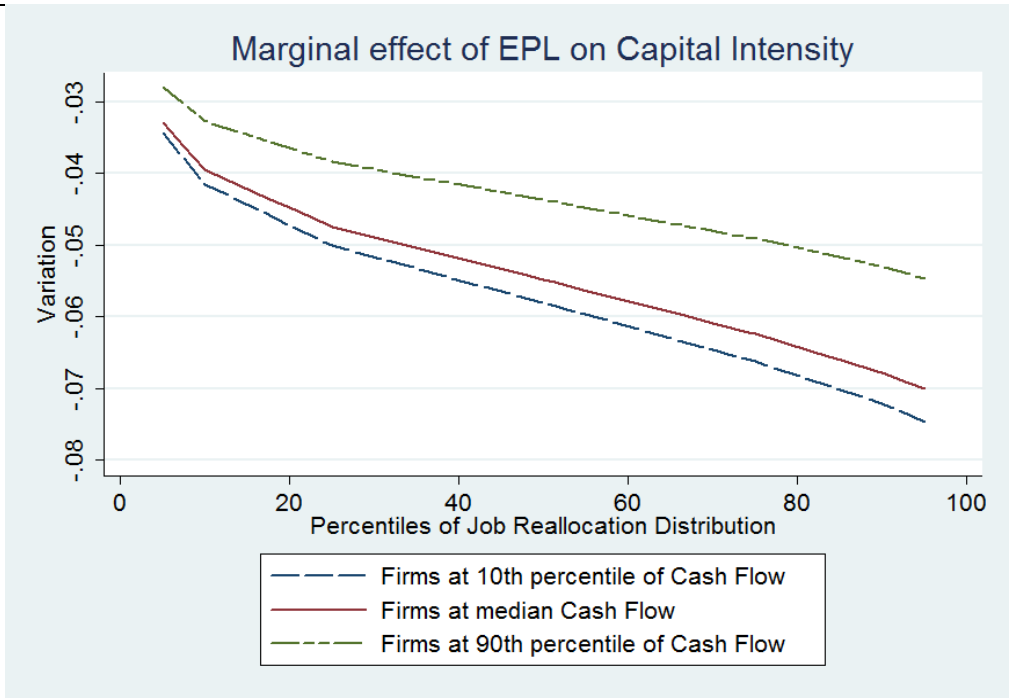


Figure 2: Marginal effects of EPL on capital intensity at different points of cash-flow distribution

6.2 Investment per worker

Tables 4 and 5 turn to the results on investment per worker. As before, we distinguish between the intensive and extensive margins. Discussing first the extensive margin, when we use as measures of financial constraints cash flows or net liquid assets we do not find any significant impact on the probability of investment (columns 1 to 3) while we find significant results using firm size (columns 4 and 5). This contrasts with the results discussed above, where all indicators of financial constraints provided a similar picture with regards to the capital labour ratio. The most likely rationale for this apparent contradiction is the endogeneity of the two liquidity variables. Low cash-flow may be a poor proxy of financial constraints as firms with profitable investment opportunities and little access to capital markets may accumulate liquid resources exactly because they know they will be credit constrained.

Regarding the results with firm size as measure of financial constraints, the results in column 4 of table 4 show a negative impact of EPL on the probability of investment (negative sign of the double interaction term EPL × BF). This negative impact is exacerbated by finan-

cial fragility as measured by firm's size, as shown by the positive coefficient (significant at the 10 percent level) of the triple interaction EPL × BF × Internal Resources. When we include country by year dummies (column 5) the results are very similar. According to this estimate, the effects of stricter employment regulation on the probability of investment changes significantly depending on financial needs as proxied by firm-size. In particular, for small firms (i.e. those at the 10^{th} percentile of the size distribution) increasing EPL is found to reduce the investment probability by nearly 2 percentage points in low reallocation industries to 3.6 percentage point in industries at the 90^{th} percentile of the reallocation distribution. For large firms (those at the 90^{th} percentile), conversely, EPL is found to *increase* the investment probability by about 2.3 percentage points, *irrespectively* of the industry intensity of job reallocation. Calculations show that the overall effect of EPL on the probability of investment is negative only for firms below approximately 46 employees. This result highlights the importance of taking into account firm level heterogeneity at the time of evaluating the impact of firing costs on investments: larger firms seem to have enough internal resources to at least partially overcome the hold-up problems highlighted above, being able to engage in some capital labour substitution.

When moving to the intensive margin of investment (Table 5) we find no effect of financial constraints on firms' reaction to EPL. Being investment a lumpy process, our evidence suggests that EPL reduces the probability of investment in smaller firms, which are more likely to be affected by financial constraints. However, once the decision of investment is taken, the amount to be invested does not seem to be altered by the financial situation of the firm or labour legislation.

6.3 Labour productivity

Table 6 considers the impact of the interplay between financial markets and EPL on labour productivity. As before, we find a negative impact of EPL on firm's productivity, but this effect is attenuated in firms that are less likely to be affected by financial constraints. The interaction term EPL × BF × Internal Resources is positive and highly significant in columns 4 and 5. As before, statistically significance is absent when we use financial indicators of liquidity (column 1 to 3), although the positive sign that suggests a more negative impact of EPL in smaller firms is retained.

Summing up, the results on capital per worker clearly favour the interpretation that financial constraints exacerbate the negative effects of EPL on capital deepening. Our results on investment are somewhat weaker, and highly dependent on the indicator of financial weakness used. If we attend to firm size as our indicator of financial constraints, we find that in more stringent EPL environments financially fragile firms are less likely to invest. However, once the decision of investment has been taken, there is no evidence that the size of the in-

vestment project is affected by the interplay of financial and labour frictions. Finally, this negative impact of financial imperfections associated with firing costs on capital per worker results in lower productivity, although again here there is some variation depending on the indicator of financial constrains being used.

7. Robustness checks

In this section, we provide a number of robustness checks for our baseline regressions, following the specification presented in equation (2). We test robustness with respect to *a*) balanced–unbalanced samples; *b*) the time span of the sample; *c)* the specification of the estimated equation; *d*) the exclusions of specific sectors or countries.

a) The sample is unbalanced, therefore includes entry of new firms and exit. Thus, the overall effect we measure includes both the direct impact on incumbent firms and the indirect compositional effect through entry and exit. However, we are not able to disentangle the two effects primarily because firms can enter or exit the Amadeus sample for many reasons (e.g. merger, acquisition, change of name, change in the obligation to provide/have a balance sheet) that prevent us from reliably measuring the true entry and exit. To try and have an idea of the extent to which our effects are due to the churning of firms, we compare the results obtained on the unbalanced sample (which includes entry and exit) with results on a balanced sample of firms that stay in sample every year from 1997 to 2003. We have between 332.000 and 627.000 observations in the samples, depending on the dependent variable. We find that the results on the balanced sample are virtually the same as on the unbalanced sample for all variables with the exception of the impact of EPL on investment. For both investment margins, the coefficients retain their sign with respect to the unbalanced sample, but become non-statistically significant.

b) EPL data is available up to 2003, while our firm level dataset contains quite complete information for 2004 and 2005. We have investigated a possible extension of the OECD EPL index. The Fondazione Rodolfo de Benedetti has collected information on EPL reforms in the period 1986-2005 and classifies them in structural and marginal, depending on the scope of the regulatory change. None of the countries in our sample experienced structural EPL reforms during 2004-2005, but some did follow marginal reforms. We have repeated our regressions under the assumption that the EPL levels remain constant in each country after 2003, and results (available upon request) are virtually the same to those presented here.

c) We also run regressions where the dependent variable is in growth rates rather than in levels. However, notice that investment per worker (*I/L*) and Job Reallocation are already growth rates. Therefore we regressed the rate of change of *VA/L* on EPL following the specifications presented in eq. (2) and (3) and found no average effects of EPL on the growth rate of productivity, neither differential effects of EPL in firms with larger levels of internal resources. Additionally, one may also worry that our variables may be affected by past EPL.

However, these effects are likely to be captured by the *current* level of EPL given the well-known limited time variability of EPL, and by country and time dummies.

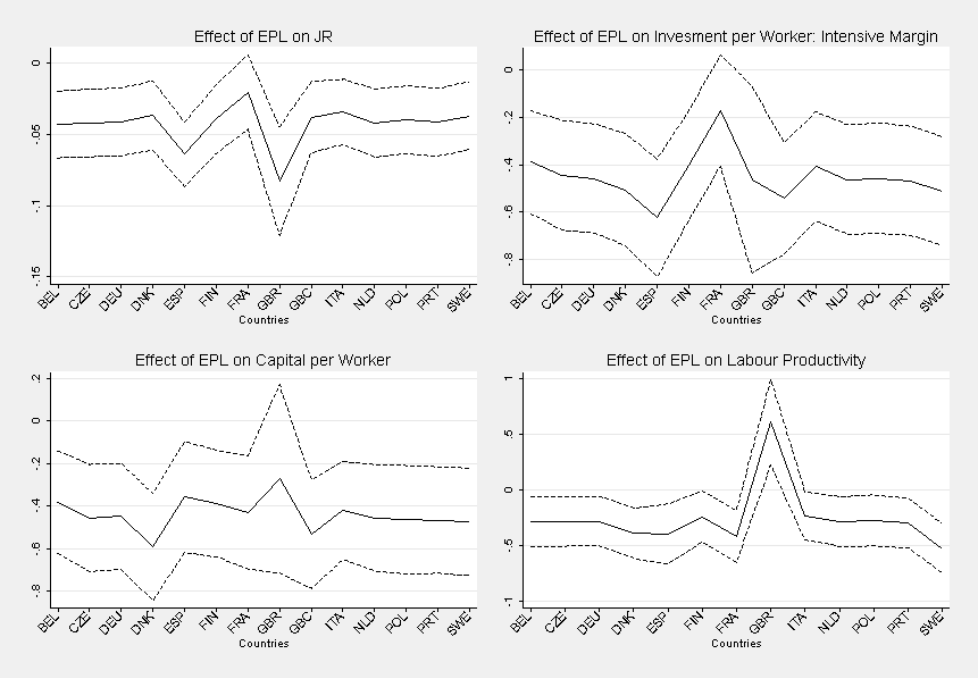


Figure 3. Effect of EPL on *K/L*, *I/L (intensive margin)*, *VA*/*L* and *JR* excluding one country at the time. Dotted lines are confidence bands at the 95% level.

d) We assess the impact of the exclusion of specific sectors in the regression. We have used our preferred specification, which includes sector by year and country by year fixed effects (and corresponds to columns 2 in tables 3 to 6). Hence, identification relies in within country variation across sectors, in the spirit of the original contribution of Rajan and Zingales (1998). Dropping one sector at a time never turns the sign of our variable of interest, the interaction of EPL with benchmark flows, which remains negative when *JR*, the intensive margin of *I/L*, *K/L* and *VA/L* are the dependent variables in each of the 446 regressions. Moreover, the coefficients are statistically significant at the 5% level, the *t*-statistics ranging from 2.98 to 5.39 in the case of JR, from 3.02 to 4.36 in the case the intensive margin of investment, from 2.81 to 3.94 in *K/L* regressions and from 1.93 to 3.21 (except one single case where the *t*-statistic is 1.41) when the dependent variable is *VA/L*. The intensive margin of investment shows the weakest results, the positive sign being significant in 95% of the regressions.

Our next exercise examines the impact of the presence of specific countries in the sample. Figure 3 shows the impact of dropping one country at a time in each of our outcome vari-

ables, focusing on the specification that includes country by year and sector by year fixed effects. We report estimates of the intensive margin of investment only, since we did not find a significant impact of EPL on the extensive margin in Table 2. The estimates presented in the text are relatively stable when specific countries are excluded from the sample. In all the cases the estimated effects retain their negative sign, with one notable exception; the interaction term *EPL×BenchFlows* in the labour productivity regression becomes positive when the UK is excluded from the sample. The exclusion of France from *JR* and I/L intensive margin regressions, and of the UK in the case of K/L somewhat dampens the negative sign, as the coefficient of the interaction term, although retaining its negative sign, becomes non-significant at standards levels of testing.

8. Conclusion and policy implications

This paper is a first attempt to assess the joint impact of government mandate employment protection and financial market imperfections on investment and productivity exploiting comparable micro-data in a cross-country context.

We proceed in two steps. We first analyse the average effect of EPL on capital per worker, investment per worker and labour productivity. We find that EPL reduces all of them in high reallocation sectors relative to low reallocation sectors. The magnitude of the effect is economically not negligible and lies around 11.2%, 11.4% and 7% of the difference in, respectively, the capital-labour ratio, the intensive margin of investment per worker and labour productivity of high relative to low reallocation industries.

These findings bring about potentially important policy implications. The debate on the economic consequences of EPL needs to consider not only the direct effect on employment flows, but also the indirect impact due to distorted investment incentives. Investment subsidies usually do not take into account the possible distortions induced by EPL and therefore may be excessive or insufficient. Moreover, the distorted incentives for investment and their productivity effects found here may slow down the structural change from manufacturing industries (low reallocation sectors) towards services (high reallocation sectors) as in Rogerson (2008). Since most of the employment growth in modern economies occurs in the service sector, these distortions may reduce employment growth, efficiency and income growth.

Regarding the role of credit market imperfections in shaping firms' response to strict employment protection, our results suggest that sectors and countries where access to credit is difficult are expected to have a lower capital stock per worker, lower productivity and lower propensity to invest. These results, which are robust to different specifications and indicators of financial constraints, suggest that firms with insufficient access to credit in high EPL environments are unable to substitute the relative expensive factor, labour, for capital. Consequently, the negative effect of EPL on productivity is reinforced among firms that are financially constrained. Note however that, in contrast with the results for capital per worker, the

estimated impacts of the interaction between financial imperfections and EPL on investment per worker and productivity are statistically significant only when firm size is used as a proxy of the likelihood of being financially constrained. This is likely to reflect the endogeneity of the alternative measures of financial constraints we use, namely, net liquid assets and cash flows, but further research is needed.

These findings are potentially important because they provide confirmation that policies aiming to improve firms' access to credit may alleviate the negative impact of labour market frictions on *efficiency*, facilitating capital deepening and technology adoption. The obvious policy implication of EPL being more harmful for liquidity constrained firms, or for sectors and countries where access to external credit is more difficult, is that policies aimed at alleviating the effects of EPL should first target those sectors or countries. Alternatively, policies aiming to soften financial constraints should be first directed to countries and sectors where either EPL is more stringent or the need for reallocation is higher. However, it is also true that EPL provides insurance to workers against labour market risk, which is more valuable in countries with less developed financial markets, where other insurance mechanisms are absent (Bertola, 2004). Hence, from the point of view of overall *welfare*, employment protection policies should be jointly evaluated with financial market frictions in the classic efficiency-equity trade-off.

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Table 1. Descriptive statistics

Variable	Mean	St. dev.	*p10*	*p50*	*p90*	*N*
K/L	30.13	127.21	3.57	16.05	69.27	2070937
I/L (intensive margin)	5.75	8.55	0.35	2.67	14.64	1561795
I/L (extensive margin)	0.86	0.34	0.00	1.00	1.00	1808079
VA/L	35.58	23.47	15.41	31.10	59.76	1536425
JR	0.14	0.21	0.00	0.05	0.40	2130690
Cash-flow / *K*	0.67	1.02	0.04	0.42	1.75	2131566
ROA	0.05	0.12	-0.05	0.04	0.19	2131566
Firm size	32.24	125.60	2.00	9.00	63.00	2131566
EPL	2.47	0.69	1.70	2.70	3.10	2131566

Note: Capital. investment and value added are expressed in thousands of euros at 1995 (German) prices.

Table 2. Effects of EPL

	K/L	Prob(*I*>0)	*I/L*	*VA/L*	*JR*
EPL × Benchflow	-0.450	0.041	-0.457	-0.284	-0.041
	(0.120)***	(0.019)**	(0.110)***	(0.106)***	(0.011)***
Observations	2070937	1808079	1561795	1536425	2130690
R-squared	0.26	0.02	0.11	0.18	0.06

Robust standard errors in parentheses are clustered at the country-sector-year. The regression includes Sector × Year and Country × Year effects. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3. Joint effect of EPL and financial market imperfections on capital per worker

	(1)	(2)	(3)	(4)	(5)
EPL	0.014	-	-	-0.045	-
	(0.004)***	-	-	(0.009)***	-
EPL × BF	-0.522	-0.374	-0.379	-1.374	-0.887
	(0.110)***	(0.110)***	(0.111)***	(0.248)***	(0.235)***
Internal Resources	0.029	0.029	0.018	-0.138	-0.183
	(0.002)***	(0.002)***	(0.001)***	(0.007)***	(0.007)***
ROA	-0.088	-0.100	-0.010	0.020	0.000
	(0.005)***	(0.005)***	(0.004)**	(0.004)***	(0.004)
EPL × IR	-0.002	-0.003	-0.006	0.017	0.029
	(0.001)***	(0.001)***	(0.001)***	(0.003)***	(0.003)***
BF × IR	-0.157	-0.184	-0.096	-0.513	-0.174
	(0.056)***	(0.057)***	(0.037)***	(0.171)***	(0.154)
EPL × BF × IR	0.059	0.073	0.050	0.286	0.193
	(0.022)***	(0.022)***	(0.014)***	(0.065)***	(0.061)***
Observations	2070937	2070937	2070659	2070937	2070937
R-squared	0.13	0.16	0.16	0.14	0.16
Year FE	YES	-	-	YES	-
Country × Year	NO	YES	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES
Proxy for internal resources	Cash flow	Cash flow	Net Liquid Assets	Firm-size	Firm-size

Robust standard errors in parentheses are clustered at the firm-level. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4. Joint effect of EPL and financial market imperfections on investment per worker (extensive margin)

	(1)	(2)	(3)	(4)	(5)
EPL	-0.044			-0.049	
	(0.002)***			(0.005)***	
EPL × BF	-0.019	-0.027	-0.040	-0.255	-0.249
	(0.037)	(0.037)	(0.038)	(0.116)**	(0.116)**
Internal Resource	-0.003	-0.003	-0.001	-0.005	-0.016
	(0.002)*	(0.002)*	(0.001)	(0.003)	(0.004)***
ROA	0.015	0.014	0.015	0.017	0.016
	(0.005)***	(0.005)***	(0.004)***	(0.004)***	(0.004)***
EPL × IR	0.001	0.001	0.001	0.002	0.005
	(0.001)**	(0.001)**	(0.000)**	(0.001)	(0.001)***
BF × IR	0.052	0.056	-0.008	-0.231	-0.214
	(0.046)	(0.046)	(0.023)	(0.079)***	(0.079)***
EPL × BF × IR	-0.018	-0.019	0.003	0.068	0.065
	(0.018)	(0.018)	(0.009)	(0.031)**	(0.031)**
Observations	1808079	1808079	1807866	1808079	1808079
R-squared	0.01	0.01	0.01	0.01	0.01
Year FE	YES	-	-	YES	-
Country × Year	NO	YES	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES
Proxy for internal resources	Cash flow	Cash flow	Net Liquid Assets	Firm-size	Firm-size

Robust standard errors in parentheses are clustered at the firm-level. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Joint effect of EPL and financial market imperfections on investment per worker (intensive margin)

	(1)	(2)	(3)	(4)	(5)
EPL	-0.052	-	-	-0.078	-
	(0.009)***	-	-	(0.022)***	-
EPL × BF	0.491	0.292	0.208	-0.367	0.167
	(0.222)**	(0.218)	(0.220)	(0.552)	(0.521)
Internal Resource	-0.033	-0.032	0.010	-0.259	-0.380
	(0.006)***	(0.006)***	(0.003)***	(0.015)***	(0.015)***
ROA	0.174	0.169	0.124	0.177	0.172
	(0.017)***	(0.017)***	(0.014)***	(0.014)***	(0.014)***
EPL × IR	0.015	0.014	0.004	0.007	0.040
	(0.002)***	(0.002)***	(0.001)***	(0.006)	(0.006)***
BF × IR	0.144	0.125	-0.133	-1.280	-0.607
	(0.153)	(0.153)	(0.083)	(0.385)***	(0.347)*
EPL × BF × IR	-0.060	-0.052	0.044	0.206	0.010
	(0.058)	(0.058)	(0.032)	(0.146)	(0.137)
Observations	1561795	1561795	1561641	1561795	1561795
R-squared	0.01	0.02	0.02	0.01	0.02
Year FE	YES	-	-	YES	-
Country × Year	NO	YES	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES
Proxy for internal resources	Cash flow	Cash flow	Net Liquid Assets	Firm-size	Firm-size

Robust standard errors in parentheses are clustered at the firm-level. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. Joint effect of EPL and financial market imperfections on value added per worker

	(1)	(2)	(3)	(4)	(5)
EPL	0.171	-	-	0.137	-
	(0.003)***	-	-	(0.007)***	-
EPL × BF	0.019	0.034	0.017	-0.487	-0.467
	(0.064)	(0.064)	(0.065)	(0.177)***	(0.167)***
Internal Resource	-0.013	-0.012	-0.018	-0.034	-0.066
	(0.002)***	(0.002)***	(0.001)***	(0.006)***	(0.006)***
ROA	0.019	0.019	0.004	-0.014	-0.016
	(0.005)***	(0.005)***	(0.004)	(0.004)***	(0.004)***
EPL × IR	0.003	0.002	0.005	0.011	0.021
	(0.001)***	(0.001)**	(0.000)***	(0.002)***	(0.002)***
BF × IR	-0.019	-0.000	-0.019	-0.446	-0.416
	(0.062)	(0.061)	(0.029)	(0.134)***	(0.120)***
EPL × BF × IR	0.008	0.002	0.004	0.159	0.161
	(0.022)	(0.022)	(0.011)	(0.048)***	(0.045)***
Observations	1536425	1536425	1536181	1536425	1536425
R-squared	0.02	0.04	0.05	0.02	0.04
Year FE	YES	-	-	YES	-
Country × Year	NO	YES	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES
Proxy for internal resources	Cash flow	Cash flow	Net Liquid Assets	Firm-size	Firm-size

Robust standard errors in parentheses are clustered at the firm-level. * significant at 10%; ** significant at 5%; *** significant at 1%

DATA APPENDIX

This appendix describes the construction of the main variables used in the analysis. The unit of observation in Amadeus is the firm. We extract from the database the following variables from the balance sheet and profit and loss accounts: total assets, fixed assets, fixed tangible assets, value added, profit before taxes, cash-flow, net liquid assets, exports and depreciation. We add to this initial set the main sector of operation of the firm, the number of employees and the number of subsidiaries.

All nominal series used in the analysis are deflated using 2-digit sectoral level (60 sectors) deflators of value added (benchmark year is 1995), and converted into Euros using sectoral PPP exchange rates at the same level of aggregation. The base country for PPPs is Germany. The deflator and PPP exchange rates are obtained from EUKLEMS.

Investment in the paper is defined as the difference between book value of fixed assets in year t+1 and fixed assets in year t plus depreciation in year t+1. Using the series of investment properly deflated, we construct a new series of capital following the perpetual inventory method. For these purposes, we rely on the harmonized depreciation rates by industry obtained from EUKLEMS.

Value added and capital per worker (computed using the perpetual inventory method) are defined as the logarithm of the respective ratios, while the intensive margin of investment per worker is the logarithm of the ratio of investment and employment. The extensive margin of investment is measured as a dichotomic variable that takes value 1 if the firms changes the capital stock in period t+1 with respect to period t.[16] Return on assets is defined as profit before taxes divided by total assets, while cash flows and net liquid assets are normalized by tangible assets in the previous accounting period. Job reallocation at the firm level is defined in parallel with the sectoral definition of Davis and Haltiwanger (1990). It is the absolute value of the change in employment between two consecutive periods divided by the average employment between both periods. Hence, it is a measure that treats symmetrically the creation and destruction of jobs and is bounded between 0 and 2.

We trimmed outlier observations in several steps. We first drop 1% of each country sample constituted by the extreme values of both tails in the distribution of the key original variables (fixed assets, tangible assets, cash flow, profits, employment and value added). After constructing the ratios that will be used in the analysis, we further exclude observations whose difference with respect to the median (in absolute value) exceeds five times the absolute distance between the 75^{th} and 25^{th} percentile in the distribution.

16 Given that investment is defined as the difference in fixed assets between two consecutive balance sheets plus depreciation in the end period, measurement error in any of the three variables can result in measured investment episodes that did actually not take place. We observe indeed an important number of tiny investment episodes in the data (positive or negative investment for less than 50 EUR per worker). In the text we consider investments for less than 50 EUR per worker in absolute value to be zero. We have experimented excluding those observations and results are qualitatively the same.

The resulting panel is highly unbalanced. In order to preserve the comparability across exercises using different dependent variables, we restrict the analysis presented in the paper to a reduced sample where we drop observations with missing fixed assets, employment or the ratio of cash flow over fixed assets in period *t*-1. The cash flow condition results in losing about one third of the sample.

We use the OECD measure of employment protection regulation. EPL refers to the institutions related to the dissolution of matches between firms and workers. Most notably, administrative and legal procedures including notice periods, severance pay and firing taxes. These arrangements may be the result of government legislation, collective labour agreements and/or individual contracts.

The overall EPL indicator is a weighted average of 18 basic items. The items are grouped into EPL for: *i*) employment protection of regular workers against individual dismissal, *ii*) specific requirements for collective dismissals, and *iii*) regulation of temporary forms of employment. Within the EPL items for regular workers against individual dismissal we can again distinguish three subgroups: *i*) procedural inconveniences that the employer may face when starting the dismissal process, *ii*) legislative provisions that state under which conditions a dismissal is justified or fair, and *iii*) regulations on notice periods and severance pay. For each item the score is normalised on a scale from 0 to 6, where a higher score represents more strict regulation on the relevant item.[17]

[17] The OECD indicator has some well-known limitations. In particular, the weights of the various components are subjective and are attributed on the basis of legislative provisions, while in practice legislative provisions can be extended by contractual provisions, which are typically not incorporated in the indicator. Also, the interpretation of the regulations by the court generates variation in EPL strictness over time and across countries that is not captured by the indices, *e.g.* court decisions may be affected by underlying labour market performance (Ichino et al., 2003).

Table A1: Descriptive statistics by country

	Country	*K/L*	*P(I/L>0)*	*I/L*	*VA/L*	*JR*	*EPL*
Mean	BEL	67.299	0.906	9.656	58.338	0.143	2.2
St. Dev		(78.513)	(0.292)	(11.81)	(27.188)	(0.217)	(0)
p10		12.682	1	0.727	32.728	0	2.2
p90		144.379	1	25.33	90.909	0.4	2.2
N		293381	266650	241645	28782	296370	296375
Mean	CZE	20.776	0.892	3.853	14.337	0.042	1.9
St. Dev		(26.212)	(0.31)	(4.599)	(10.516)	(0.165)	(0)
p10		3.603	0	0.332	5.339	0	1.9
p90		44.797	1	9.446	26.79	0	1.9
N		11600	9668	8625	5456	11880	11898
Mean	DEU	87.023	0.978	12.178	66.635	0.072	2.443
St. Dev		(119.754)	(0.147)	(14.521)	(33.497)	(0.118)	(0.073)
p10		12.08	1	1.546	35.02	0.005	2.35
p90		198.985	1	28.617	107.271	0.156	2.5
N		1811	1184	1158	1648	1805	1849
Mean	DNK	24.479	0.804	4.957	54.321	0.121	1.4
St. Dev		(26.286)	(0.397)	(5.724)	(29.991)	(0.184)	(0)
p10		4.154	0	0.375	28.132	0	1.4
p90		56.264	1	12.934	88.866	0.333	1.4
N		42262	34307	27579	18937	43052	43052
Mean	ESP	23.698	0.826	5.497	30.792	0.165	3.035
St. Dev		(26.768)	(0.379)	(6.718)	(16.393)	(0.23)	(0.093)
p10		3.839	0	0.308	14.286	0	2.9
p90		53.394	1	14.839	51.539	0.444	3.1
N		465896	398835	329328	451730	476568	476607
Mean	FIN	19.717	0.822	5.031	38.912	0.109	2.029
St. Dev		(24.663)	(0.382)	(6.339)	(20.07)	(0.186)	(0.045)
p10		2.846	0	0.305	16.989	0	2
p90		46.434	1	13.582	63.688	0.333	2.1
N		45703	38113	31336	40188	46956	46956

Table A1: Descriptive statistics by country (continued)

Mean	FRA	14.62	0.85	2.62	36.978	0.114	3
St. Dev		(123.079)	(0.357)	(2.982)	(22.333)	(0.17)	(0)
Min		2.757	0	0.263	19.387	0	3
Max		29.202	1	6.663	58.097	0.316	3
N		471568	412241	350391	371040	486107	486121
Mean	GBR	21.655	0.88	3.63	31.875	0.117	0.664
St. Dev		(22.218)	(0.325)	(4.172)	(21.078)	(0.162)	(0.042)
Min		3.919	0	0.332	11.517	0	0.6
Max		46.526	1	9.102	54.943	0.286	0.7
N		154079	128925	113422	113217	159589	160012
Mean	GRC	33.435	0.943	7.843	-	0.035	3.355
St. Dev		(35.074)	(0.231)	(11.207)	-	(0.131)	(0.284)
p10		4.474	1	0.366	-	0	2.8
p90		75.723	1	20.503	-	0.074	3.5
N		41175	38274	36108	-	41589	41597
Mean	ITA	45.057	0.962	9.868	46.894	0.182	2.312
St. Dev		(56.404)	(0.19)	(12.165)	(22.996)	(0.226)	(0.311)
p10		7.542	1	0.874	23.642	0	1.9
p90		98.608	1	24.713	74.384	0.444	2.7
N		273555	230386	221736	265483	286489	286515
Mean	NLD	35.515	0.961	6.58	60.919	0.108	2.137
St. Dev		(40.649)	(0.195)	(7.838)	(37.423)	(0.163)	(0.144)
p10		5.104	1	0.723	27.64	0	2.1
p90		83.879	1	15.974	105.165	0.256	2.1
N		4950	3856	3704	3997	5022	5024
Mean	POL	29.72	0.94	9.219	22.343	0.315	1.499
St. Dev		(74.622)	(0.237)	(21.286)	(38.895)	(0.533)	(0.175)
p10		3.727	1	0.505	6.306	0	1.24
p90		61.311	1	19.895	37.768	1.357	1.7
N		12313	10466	9840	9309	12378	12671
Mean	PRT	35.983	0.967	9.758	31.029	0.105	3.7
St. Dev		(31.659)	(0.179)	(12.205)	(18.582)	(0.162)	(0)
p10		7.765	1	0.898	13.427	0	3.7
p90		77.089	1	24.446	54.905	0.254	3.7
N		2035	908	878	1916	2049	2052

Table A1: Descriptive statistics by country (continued)

Mean	SWE	18.847	0.794	3.092	26.739	0.099	2.2
St. Dev		(298.994)	(0.404)	(3.845)	(28.085)	(0.193)	(0)
P10		2.258	0	0.233	11.244	0	2.2
P90		36.883	1	8.381	41.464	0.4	2.2
N		250609	234266	186045	224722	260836	260837
Mean	**Total**	30.127	0.864	5.753	35.581	0.136	2.467
St. Dev		(127.209)	(0.343)	(8.554)	(23.468)	(0.208)	(0.687)
Min		3.575	0	0.349	15.408	0	1.7
Max		69.267	1	14.64	59.756	0.4	3.1
N		2070937	1808079	1561795	1536425	2130690	2131566

Note: Capital. investment and value added are expressed in thousands of euros at 1995 prices.

Table A2: Descriptive statistics by year

	Year	*K/L*	*P(I/L>0)*	*I/L)*	*VA/L*	*JR*	*EPL*
Mean	1998	29.185	0.914	7.042	38.913	0.143	2.488
St. Dev		(36.166)	(0.28)	(9.669)	(21.467)	(0.205)	(0.747)
p10		3.96	1	0.478	17.826	0	0.6
p90		68.818	1	17.913	65.369	0.4	3
N		205218	181635	166004	146405	209611	209695
Mean	1999	30.216	0.901	7.271	38.195	0.142	2.488
St. Dev		(39.95)	(0.299)	(11.425)	(23.536)	(0.215)	(0.7)
p10		3.842	1	0.44	16.866	0	2.1
p90		71.336	1	18.432	64.844	0.4	3
N		247467	221016	199139	180770	252815	253038
Mean	2000	28.654	0.878	5.777	36.25	0.142	2.475
St. Dev		(38.018)	(0.327)	(8.379)	(21.359)	(0.222)	(0.637)
p10		3.378	0	0.366	15.771	0	2.1
p90		68.659	1	14.722	61.599	0.4	3
N		331195	293312	257486	244202	339715	339949
Mean	2001	29.281	0.855	5.315	35.024	0.144	2.473
St. Dev		(40.73)	(0.352)	(7.78)	(21.711)	(0.212)	(0.677)
p10		3.525	0	0.33	15.437	0	2
p90		69.053	1	13.551	58.266	0.4	3.1
N		374663	335141	286558	279412	384656	384781
Mean	2002	30.119	0.844	5.054	34.679	0.128	2.448
St. Dev		(58.362)	(0.363)	(7.22)	(23.757)	(0.199)	(0.693)
p10		3.591	0	0.32	14.913	0	1.4
p90		69.278	1	13.009	57.784	0.4	3.1
N		435161	383524	323570	325235	448172	448283
Mean	2003	32.178	0.836	5.234	33.711	0.128	2.454
St. Dev		(251.821)	(0.37)	(7.688)	(26.195)	(0.201)	(0.687)
p10		3.468	0	0.313	14.215	0	1.4
p90		68.936	1	13.459	56.374	0.4	3.1
N		477233	393451	329038	360401	495721	495820

Note: Capital. investment and value added are expressed in thousands of euros at 1995 prices.