Employment Protection Legislation and Economic Resilience

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Abstract

Theory predicts that stricter employment protection legislation (EPL) should influence the way in which business cycles effect different economies. Global credit supply shocks, especially those observed in the recent financial crisis, produce a suitable quasi-natural experiment for studying this prediction. Using EPL data for a panel of 28 OECD economies and an exogenous measure of global credit supply shocks, this paper shows that this prediction is borne out by the data. Strict employment protection is associated with weaker response of the labor market in the initial phase of the cycle, slower recovery in terms of output, and less cyclical response of participation. We also carry out a decomposition exercise in an attempt to understand EPL's channels of influence.

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1 Introduction

Employment protection legislation (EPL) refers to regulations on employee hiring and termination practices. As such, EPL has attracted a great deal of interest from researchers trying to comprehend its implications for macroeconomic performance in general and labor market outcomes in particular. Much of the focus of this literature has centered on the effects of strict EPL on unemployment, broadly finding inconclusive results both in theory and in the data (see, e.g., Boeri and van Ours (2013) for a good overview of this literature).

From an empirical standpoint, a largely understudied aspect of the potential implications of EPL for macroeconomic performance is the nature of its effects on economic resilience to macroeconomic shocks. We think of economic resilience as being composed of two main parts: the ability to *resist* shocks and the ability to *recover* from them quickly. Accordingly, there are two important questions that need be addressed in this context. First, whether strict EPL can enable the economy to reduce its vulnerability in the recessionary phase of the shock-driven cycle. Second, whether strict EPL can affect the country's speed of recovery.[1,2]

While these two questions have received some attention by several, mostly theoretical, works dealing with the effect of EPL on employment dynamics (see, e.g., Nickell (1978), Bentolila and Bertola (1990), Garibaldi (1998), Bertola (1999), and Nunziata (2003)), empirical work tackling these questions has been quite limited. To the best of our knowledge, there has been no empirical work that provided direct empirical evidence on the rela-

[1]This definition of economic resilience is broadly in line with that used in Duval and Vogel (2008).

[2]Notably, as discussed below, theory implies that EPL is a structural policy tool that cannot be conclusively classified as either a shock-absorber or shock-amplifier, this in much contrast to other policy tools such as capital inflow restrictions or exchange rate flexibility which are given by theory a largely conclusive role as shock-absorbers. Hence, it is imperative that the aforementioned two research questions be addressed separately, rather than simply lumped together into one single question that tries to place EPL in either category.

tion between EPL and macroeconomic variables' sensitivity to shocks. The few papers that have looked at the relation between EPL and economic resilience can be divided into two strands: (i) one which has done so indirectly, i.e., not by conditioning on a particular identified shock, and (ii) one that has done so directly but by only focusing on limited aspects of the relation between EPL and economic resilience that are not informative for the shock-transmitting nature of EPL.

The first strand of the literature has been initiated by Nunziata (2003), who regress employment responsiveness to expansions and recessions on EPL in a panel of 20 OECD economies and find that stricter EPL reduces employment responses in both phases, in line with theoretical predictions. Messina and Vallanti (2007) regress job flows on the interaction between the phase of the cycle and EPL using data on homogeneous firm level data of manufacturing and non-manufacturing industries from 14 European countries, finding that stricter EPL dampens the response of job destruction to the cycle, thus making job turnover less counter-cyclical.

The second strand includes two main works. The first is the work by Blanchard and Wolfers (2000), who use a panel of 20 OECD economies to regress 5-year averages of unemployment on interactions between EPL and three country-specific measures of macroeconomic shocks: total factor productivity; real interest rate; and the measure of labor demand shifter from Blanchard (1997).[3] The main takeaway from Blanchard and Wolfers (2000) is that adverse shocks' effects on 5-year averages of unemployment are amplified by stricter EPL. Importantly, this result has limited informativeness for the relation between EPL and economic resilience due to the use of long year-averages of unemployment, which masks potentially important information on the EPL-dependent dynamics of the unemployment response.

[3]This measure can be thought of as the log of the labor share purged of the effects of factor prices on the share in the presence of a low elasticity of substitution in the short run.

The second is the paper by Bowdler and Nunziata (2007), who focus on the effects of interactions of labor market coordination and unionization density with various macroeconomic variables on inflation, finding that the former tends to dampen the inflation response while the latter tends to amplify it. While these labor market structures are different from EPL and do not necessarily relate to it in a conclusive manner, Bowdler and Nunziata (2007) report in Footnote 17 that interactions that included EPL yielded insignificant results. Notably, this paper does not consider labor market as well as other real activity outcomes and thus can not contribute to our understanding of the nexus between EPL and resilience of the real economy.

The objective of this paper is to fill the empirical gap in the literature. To accomplish this goal, this paper unfolds in two parts. In the first, we lay out a real business cycle model with search and matching in the labor market, augmented with staggered wage contracting where wage contracts are determined by Nash bargaining. The model closely follows the framework in Gertler and Trigari (2009) and establishes a valuable conceptual base upon which to build the discussion and interpretation of our empirical results. We make the arguably reasonable assumption that the parameter governing the curvature of the hiring rate adjustment cost function proxies for EPL; this assumption is based on the notion that stricter EPL should manifest itself as higher hiring costs for a given hiring rate (e.g., legal and administrative added costs). We then solve the model and demonstrate that stricter EPL results in a weaker unemployment response to an adverse demand shock during the recessionary period, while having no effect on output's response, followed by a weaker recovery of both variables in the recovery phase.

The explanation for the theoretical unemployment response is straightforward: firms in the stricter EPL economy are more reluctant to fire workers in the recessionary period due to the expected higher costs from future hiring and are more disincentivized to hire workers in the recovery phase owing to the associated added hiring costs. In the recovery phase, investment returns to steady state much more strongly in the non-strict EPL state which in turn produces a stronger recovery in output as well. The stronger investment responses accumulate into sufficiently sizable capital response difference which ultimately generates the differential output response in the recovery phase.

In the second part, we conduct a thorough empirical examination of the aforementioned theoretical prediction. Toward this end, we employ EPL data from the OECD Employment Database for a panel of 28 OECD economies and measure demand shocks by making use of the Gilchrist and Zakrajšek (2012) credit supply shock series.[4] Their shock series serves as an exogenous and common global credit supply shock; as such, the Gilchrist and Zakrajšek (2012) series can be employed to study the effect of EPL on economic resilience. We then integrate the EPL and credit supply shock data with macroeconomic data for the countries in our sample and estimate non-linear dynamic fixed-effect panel regressions to study whether the effect of global credit supply shocks differs across policy regimes. This is accomplished via an implementation of the Jorda (2005) local projections approach in a panel set-up so as to be able to directly estimate the non-linear, state-dependent impulse responses to global credit supply shocks. In addition to the conventional treatment, we examine the policy's effects on several labor market variables and on real per-capita output.

Our empirical findings can be summarized as follows. Strictness of EPL causes labor markets to respond less to an adverse shock both in terms of unemployment and employment to population ratio for almost two years from the shock's impact. The complimentary responses, associated with a slower recovery from the shock are hinted at by the point estimates, but are not statistically significant. Output responses to the shock

[4]Gilchrist and Zakrajšek (2012) use micro-level data to construct a credit spread index which they decomposed into a component that captures firm-specific information on expected defaults and a residual component that they termed as the excess bond premium.Gilchrist and Zakrajšek (2012) show that their spread measure has better predicative power for macroeconomic variables than more standard credit spread measures such as the Baa-Aaa Moody's bond spread.

are very similar across EPL regimes up to one year from impact. After the first year, economies having a stricter EPL regime exhibit slower recovery in terms of output per-capita's return to pre-shock levels. These results are in line with our theoretical predictions. Additionally, strict EPL regime also prevents a drop in participation rate over the course of the business cycle.

Following these results, we attempt to decompose the implications of strict EPL for the economies cyclical dynamics into those of four distinct indices that measures different aspects of employment protection. The results from this exercise are quite informative and they suggest these channels of influence for strict EPL: (i) An effect on labor force participation which stems mainly from high severance pay regulation. (ii) A dampening effect of the difficulty of dismissal in the economy on the drop in employment following a shock. Interestingly, this effect arises not large separation costs that can be attributed to severance pay but from a risk inherent in the termination process itself.

We conclude our analysis by replicating our results for other forms of employment protection, namely: temporary employment protection, and protection from collective dismissals. Collective dismissals protection seems to matter for the cycle's dynamics only through a small dampening effect on participation. Surprisingly, stricter protection for temporary employees causes a persistent dampening effect on unemployment's rise and on the drop in employment to population ratio, prevents discouragement and even seems to hastens output's recovery towards steady state levels.

The remainder of the paper is organized as follows. First, Section 2 reviews key facts and definitions from the literature. We then lay out in Section 3 a theoretical model which can serve as the theoretical motivation for the subsequent empirical analysis. In Section 4 we begin with a description of the data, after which the methodology is presented in Section 5. Section 6 presents that main empirical evidence of this paper which are discussed in Section 7. The final section concludes.

2 EPL - definitions, measurement and implications

2.1 EPL - Definition

Employment protection legislation can be divided into two main components: severance and procedure. The aspect of severance pay is simply a transfer from the employer to a terminated employee which, theoretically speaking, can be viewed as neutral, if the firms are allowed to offset this transfer through their employment mechanism, as in Lazear (1990). Thus, severance pay can influence the equilibrium in a meaningful way only in an imperfect market containing frictions, uninsurable risks or other imperfections. The issue of procedure is considerably more complex for modelling as it contains several structural features. These features include: length of notice before termination can take place; wrongful termination, its definition and the legal recourse that can ensue following termination without due cause; and compensations made following wrongful termination. The above mentioned can be viewed narrowly as a tax that firms must pay as a result of termination. However, if these environmental features cause a firm to employ a larger personnel management department and increase ongoing legal expenses as a provision against claims of wrongful termination, or effect public perception of firms involved in an open trial, than employment protection alters the firms' optimization problem in a non-trivial fashion. The macroeconomic implications of employment protection are further influenced if we consider its effects upon the behaviour of employed and unemployed individuals and their choices regarding future employment or separation.

2.2 EPL - Measurement

EPL is measured as a 'hierarchy of hierarchies', meaning it is the aggregate of several scales which rank the strictness of legislation (e.g., from 0 to 6 as in the OECD's indices) which are aggregated according to predetermined weights. It is important to note, that these aggregated indices of EPL are composed from several scores which are ordered variables. The final index can take non-integer values, as can the individual components, but that does not change the fact that the components themselves are a ranking system of non-quantifiable variables and thus, are not themselves continuous variables. One could possibly conceive of a monotonous non-linear transformation of the components or final index which would reflect the same order of ranking but would change the results of any regression analysis attempted using them radically. Despite this measurement method, the conventional treatment of this variable is done by using an EPL index as if it were a continuous variable, noteworthy examples of this can be found in Blanchard and Wolfers (2000), Messina and Vallanti (2007), Nunziata (2003), and Duval and Vogel (2008). The only methodological exceptions to this, to the best of my knowledge, are studies which consider only the quantifiable elements of EPL such as months of notice and months of payment offered as severance pay and ignore the regulatory environment e.g., Lazear (1990). Or, studies whose focus is correlations and utilize the Spearman correlation coefficient e.g., Gnocchi et al. (2015).

The OECD's database [5] of EPL includes several such indices based on their coverage[6]: regular employment, temporary employment, and individual or collective dismissals. Generally speaking, the panel of these indices exhibits very small time variations, as opposed to relatively large cross-sectional variance.[7]

[5] All OECD data were retrieved from `http://stats.oecd.org/`.

[6] A more comprehensive discussion of EPL measurements, coverage and definitions can be found in Boeri and van Ours (2013).

[7] The relatively low variance of EPL and labour market institutions in also noted in Gnocchi et al. (2015) and in Lazear (1990).

2.3 The Direct Effects of EPL

The first to directly model employment protection as having any significance for business cycles was Nickell (1978). Nickell's model examines the effects of a fixed cost for hiring or firing an employee on the firm's employment decisions under a partial equilibrium with perfect foresight, and in a continuous time framework. This model demonstrates that the cost of terminations, or the adjustment costs of labour input, causes firms to employ less during the peak of a cycle and to employ more during the cycle's trough. This straightforward result gives rise to an interesting trade-off: on the one hand, the firms are producing in a less efficient manner under a strict EPL regime causing a welfare loss; on the other, individuals are more likely to experience more job stability within such a regime. Thus, one comes to the open question of how much employment protection is best from a social welfare point of view? and to the more practical question of how does EPL influence other economic variables of interest?

A significant amount of attention has been focused on labour market institutions in general, and on EPL in particular, within the context of Europe's high unemployment rates. In his review of European unemployment Blanchard (2005) divides the effects of EPL on employment into three parts: first, EPL reduces flows to unemployment since terminations are more costly; second, EPL increases the bargaining power of the workers, which in turn increase wages and the duration of unemployment; third, as a result, the effects on unemployment itself remains ambiguous. The effects of EPL on flows is studied in Garibaldi (1998), Bentolila and Bertola (1990), and in Messina and Vallanti (2007). These works, attempt to uncover the implications of employment protection within the context of European labour markets and describe a smoothing of labour market dynamics as a result of strict EPL as well as lower employment volatility.

EPL being an institution which makes it difficult to fire an already employed worker, serves to strengthen the employees' bargaining power in their interactions with the firm. Kahn (2007) finds that strict EPL lowers the relative probability of youths, immigrants and maybe women to be employed, and that strict EPL also increases the relative incidence of temporary employment among those groups.

2.4 EPL and Economic Resilience

The first study to directly connect EPL and economic resilience is the work of Duval and Vogel (2008) which examines broadly the differences in economic resilience between OECD countries. The authors define economic resilience in terms of output-gap sizes over the course of a cycle i.e., the severity of shock impact and the duration of recovery. From other works dealing with economic resilience it is possible to conclude that although economic resilience can be defined in several different ways, in essence, one's focus on resilience can be divided into three parts: first, the strength of impact or the immediate effect of the shock; Second, the duration of recovery that follows the impact; and third, and perhaps the most fluidly defined, the inherent capacity of the economy to reduce vulnerabilities.[8]

As a mechanism that is embedded within the dynamic structure of the labour market, EPL has an effect on the dynamics of the business cycle itself. It is unlikely that having a fixed, strict EPL regime could generate a cycle, however conditional upon the occurrence of a cycle, it is likely that a different EPL regime will affect the way in which the cycle progresses. As such, it is helpful to consider EPL within the context of economic resilience in terms of the strength of impact and the speed of recovery. Using these, one can argue that a change in EPL that reduces the overall damage over a cycle is a way to reduce vulnerabilities, although there are other social and political reasons to consider varying

[8]See for example the definitions in Briguglio et al. (2005), which only refers to recovery, Hallegatte (2014), which refers to the first two aspects, or Sánchez et al. (2017) which utilize the broadest definition.

forms of employment protection.

Duval and Vogel (2008) demonstrate that strict EPL is positively and significantly contributing to the persistence of shocks while it dampens the force of impact. Thus, different EPL regime may be able to channel the cycle's dynamics in a different fashion and enable the economy to revert towards its steady state through an alternative path, one that may have vastly different implication for welfare and equality.

Earlier works that approach the same issues without explicitly naming them so, are the works of Blanchard and Wolfers (2000) and Nunziata (2003). Blanchard and Wolfers (2000) focus on the aforementioned issue of European unemployment and discuss its possible causes. The main explanation suggested by them for the variability and relatively high persistence in European unemployment is the interaction between adverse shocks to the European economies and the different labour market institutions within each economy. This description of the European unemployment data is useful in order to understand that a large part of the market's innate resilience is derived from the quality of it institutions. The work of Nunziata (2003) can be viewed as a more specific example of the way in which different institutions interact and create alternative market outcomes. Expanding upon Nickell's model, Nunziata formalizes a continuous time, perfect foresight, partial equilibrium model that exhibits both EPL and working-time regulation. On the theoretical level, the conclusions regarding EPL are similar to those of Nickell's original model. The author then conducts an empirical estimation and simulations on the way these two institutions interact with one another and with output's elasticity to employment. These simulations show that strict EPL lowers output's elasticity to employment and combined by weak working-time standards can cause employment not to respond to cycles at all. This is due to the fact that if the adjustment of labour on the firm's level is costly, and one can simply alter the work schedule for existing workers rather than fire them; the variability in inputs used for production over the cycle will arise from changes in hours and not in employment. These works encapsulate the complexity that arises from the interactions between institutions and business cycles and demonstrate their potential importance to policy makers regarding economic resilience.

3 What do we expect adjustment costs to do?

In what follows, we sketch out a search and matching DSGE model base on the framework of Gertler and Trigari (2009) (the GT model), which utilizes staggered Nash bargaining and quadratic adjustment costs. This quadratic adjustment cost parameter will be used as an instrument for EPL as it can be thought of as a reduced form way of capturing regulation induced costs of adjusting labor input. The model can establish a valuable conceptual base upon which to build the discussion of our empirical results and will prove helpful in facilitating our understanding of the relationship between EPL and economic resilience.

Since our empirical framework utilizes credit supply shocks to answer our research question, we add to the GT model a preference shock that represents a pure demand shock which can be viewed as a reduced form encapsulation of a structural credit supply shock. We also augment the model with habit formation, in order to increase the model's realism. The full log-linear model can be found in Appendix A.

3.1 The Model

Unemployment, Vacancies, and Matching. The model assumes a continuum of infinitely lived workers, and a continuum of infinitely lived firms, each of measure one. At each period, the firm employs n_t workers and posts v_t vacancies. Market aggregates are given by $\bar{n}_t = \int_i ndi$ and $\bar{v}_t = \int_i vdi$ correspondingly. The total number of unemployed workers is

$$\bar{u}_t = 1 - \bar{n}_t. \tag{1}$$

Matches occur according to the following matching function:

$$\bar{m}_t = \sigma_m \bar{u}_t{}^{\sigma} \bar{v}_t{}^{1-\sigma}. \tag{2}$$

In order to explain the workers surplus from a match, the following transitional probabilities are defined: The probability of a firm to fill a vacancy is $q_t = \frac{\bar{m}_t}{\bar{v}_t}$; the probability of a worker to find a job is $p_t = \frac{\bar{m}_t}{\bar{u}_t}$.

The firms exogenously separates from $1 - \rho$ percent of its workers in each period (ρ is the probability of a worker to survive in a specific job until the next period).

Firms. In each period t each firm produces output y_t using capital k_t and labor n_t according to a Cobb-Douglas production function

$$y_t = z_t k_t^{\alpha} n_t^{1-\alpha}, \tag{3}$$

where z_t is a common productivity factor, which follows a stochastic first-order Markov process. It is important to note, that in the context of this model, both capital and labor are predetermined variables. Therefore, output is also predetermined and the firm's production stream can be influenced via hiring and changes in capital accumulation (capital is owned by the household and is rented by the firms) which will only influence output during the next period. The model assumes perfectly mobile capital and quadratic adjustment costs for labor force.

Conveniently, we define the hiring rate as $x_t = \frac{q_t v_t}{n_t}$. Therefore, the dynamics of labor force size in the model for every firm are given by

$$n_{t+1} = (\rho + x_t)n_t. \tag{4}$$

We denote the aggregate state as $\mathbf{s}$; let $\beta\Lambda(\mathbf{s_t}, \mathbf{s_{t+1}})$ be the firm's discount rate, where β is the household's subjective discount factor. Let r_t be the rental rate of capital and w_t be the wage rate. The value F of each firm is given by

$$\begin{aligned} F(n_t, w_t, \mathbf{s_t}) = \max_{k,x}\{z_t k_t^{\alpha} n_t^{1-\alpha} - w_t n_t - \frac{\kappa}{2} x_t^2 n_t - r_t k_t + \\ + \beta E_t\{\Lambda(\mathbf{s_t}, \mathbf{s_{t+1}}) F(n_{t+1}, w_{t+1}, \mathbf{s_{t+1}}) | n_t, w_t, \mathbf{s_t}\}\}. \end{aligned} \tag{5}$$

This can also be presented as $F(n_t, w_t, \mathbf{s_t}) = J(w_t, \mathbf{s_t})n_t$, where $J(w_t, \mathbf{s_t})$ represents the firm's surplus per employee. We denote the capital to labor ratio of the firm by $\tilde{k_t} = k_t/n_t$. Thus the firms problem can be presented as:

$$\begin{aligned} J(w_t, \mathbf{s_t}) = \max_{\tilde{k}_t, x_t}\{z_t \tilde{k_t}^{\alpha} - w_t - \frac{\kappa}{2} {x_t}^2 - r_t \tilde{k_t} + \\ (\rho + x_t)\beta E_t\{\Lambda(\mathbf{s_t}, \mathbf{s_{t+1}}) J(w_{t+1}, \mathbf{s_{t+1}}) | w_t, \mathbf{s_t}\}\}. \end{aligned} \tag{6}$$

The parameter κ, which is the quadratic adjustment cost parameter accounts for the additional costs incurred by the firm for adjusting the size of its labor force. This parameter effectively proxies for the additional cost of employing workers, e.g., due to changes in the firm's overhead expenses (such as legal fees) as a result of increases in personnel (in a similar fashion to investment adjustment costs). In what follows the calibration of κ will enable us to change the level of adjustment costs as a proxy for EPL on the theoretical level.

Workers. Workers will be indexed by their respective wage w_t. Let $V(w_t, \mathbf{s_t})$ be the current value of employment, and $U(\mathbf{s_t})$ be the current value of unemployment. $V(w_t, \mathbf{s_t})$ is given by:

$$V(w_t, \mathbf{s_t}) = w_t + \beta E_t\{\Lambda(\mathbf{s_t}, \mathbf{s_{t+1}})[\rho V(w_{t+1}, \mathbf{s_{t+1}}) + (1-\rho)U_{t+1}(\mathbf{s_{t+1}})]|w_t, \mathbf{s_t}\}. \tag{7}$$

In order to define the value of unemployment we need to use the average value of employment conditional on being a new employee $\bar{V}_x(\mathbf{s_t})$. Let $G(w_t, \mathbf{s_t})$ be the CDF of the wage rate in state $\mathbf{s_t}$ then $\bar{V}_x(\mathbf{s_t})$ is given by:

$$\bar{V}_x(\mathbf{s_{t+1}}) = \int_w V(w_{t+1}, \mathbf{s_{t+1}}) \frac{x(w_t, \mathbf{s_t})}{\bar{x}} dG(w_t, \mathbf{s_t}), \tag{8}$$

Where $\bar{x}_t$ is the average hiring rate which is given by $\bar{x}_t = \int_w x(w_t, \mathbf{s_t}) dG(w_t, \mathbf{s_t})$. Let b be the flow value from unemployment (i.e. unemployment benefits or leisure). Then $U(\mathbf{s_t})$ can be expressed as

$$U_t(\mathbf{s_t}) = b + \beta E_t\{\Lambda(\mathbf{s_t}, \mathbf{s_{t+1}})[p_t \bar{V}_x(\mathbf{s_{t+1}}) + (1-p_t)U(\mathbf{s_{t+1}})]|\mathbf{s_t}\}. \tag{9}$$

The worker surplus and the worker surplus conditional on being a new hire are correspondingly

$$H(w_t, \mathbf{s_t}) = V(w_t, \mathbf{s_t}) - U(\mathbf{s_t}), \tag{10}$$

$$\bar{H}_x(w_t, \mathbf{s_t}) = \bar{V}_x(\mathbf{s_{t+1}}) - U(\mathbf{s_t}). \tag{11}$$

Nash Bargaining and Wage Dynamics. In every period, each firm can either renegotiate the wage rate with probability of $1-\lambda$ or continue paying its employees the existing wage rate with probability λ. Thus the average duration of a specific wage contract is $1/(1-\lambda)$.

All workers in the firm receive the same wage rate regardless of their employment history. Let ${w_t}^*$ denote the renegotiated wage rate of a firm that has renegotiated its wage in period t. The Nash bargaining problem is:

$$ {w_t}^* = \ argmax \ \ H(w_t, \mathbf{s_t})^{\eta} J(w_t, \mathbf{s_t})^{1-\eta}, \tag{12} $$

Subject to

$$ w_{t+1} = \begin{cases} w_t & \text{with probability } \lambda, \\ {w_{t+1}}^* & \text{with probability} 1 - \lambda. \end{cases} \tag{13} $$

Although this problem has a non-concave bargaining set, the solution still defines a global optimum (depending on calibration), and since the magnitude is not large, the possible gain from a wage lottery is relatively small and can be offset by the transaction costs of the lottery (Gertler and Trigari, 2009). Next, we describe the process for wage dynamics in the model. The average wage $\bar{w}$ is given by

$$ \bar{w} = \int_w w dG(w_t, \mathbf{s_t}), \tag{14} $$

Which can be expressed recursively as

$$ \bar{w}_{t+1} = (1-\lambda){w_{t+1}}^* + \lambda \int_w w \frac{\rho + x(w_t, \mathbf{s_t})}{\rho + \bar{x}_t} dG(w_t, \mathbf{s_t}). \tag{15} $$

The density of wages is given by

$$ dG(w, \mathbf{s_{t+1}}) = \begin{cases} \lambda \frac{\rho + x(w, \mathbf{s_t})}{\rho + \bar{x}} dG(w, \mathbf{s_t}) & \forall w \neq w^*_{t+1}, \\ \\ \lambda \frac{\rho + x(w, \mathbf{s_t})}{\rho + \bar{x}} dG(w, \mathbf{s_t}) + (1-\lambda) & w = w^*_{t+1}. \end{cases} \tag{16} $$

Consumption and Saving. The household set-up is the representative family construct used by Merz (1995), which enables perfect consumption insurance. The family is modeled as a continuum of employed and unemployed individuals distributed among all the firms. The family pools its collective income before choosing optimal per-capita consumption and assets holding. The family has ownership of the firms, which enables it to receive profits. The household chooses between consumption $\bar{c}$ and capital $\bar{k}$ that is rented to firms at rate r. Let $\Omega(\mathbf{s_t})$ denote the value function of the household. The household's optimization problem is:

$$\Omega(\mathbf{s_t}) = \max_{\bar{c}_t, \bar{k}_{t+1}} \{\log \bar{c}_t + \beta \Omega(\mathbf{s_{t+1}} | \mathbf{s_t})\}, \tag{17}$$

subject to

$$\bar{c}_t + \bar{k}_{t+1} = \bar{w}_t \bar{n}_t + (1 - \bar{n}_t) b + (1 - \delta + r_t) \bar{k}_t + T_t + \Pi, \tag{18}$$

Where T is a lump-sum transfer from the government and Π is the profit received from firms. The stochastic discount factor is

$$\Lambda(\mathbf{s}_t, \mathbf{s}_{t+1}) = \frac{\frac{\partial(\Omega(\mathbf{s}_{t+1}))}{\partial \bar{c}_{t+1}}}{\frac{\partial(\Omega(\mathbf{s}_t))}{\partial \bar{c}_t}}. \tag{19}$$

Total employment evolves according to

$$\bar{n}_{t+1} = (\rho + \bar{x}_t) \bar{n}_t. \tag{20}$$

To complete the model we add the resource constraint and the government budget constraint

$$\bar{y}_t = \bar{c}_t + \bar{k}_{t+1} - (1 - \delta) \bar{k}_t + \frac{\kappa}{2} \int_i x^2 di, \tag{21}$$

$$T_t + (1 - \bar{n}_t) b = 0. \tag{22}$$

Additions to the Model. The GT model features only TFP as an exogenous variable. Our identification strategy, which will be explained in the next sections, utilizes the Excess Bond Premium (EBP) identified by Gilchrist and Zakrajšek (2012), which is an arguably structural credit supply shock. This shock exhibits features of an aggregate demand shock which operates through the lowering of aggregate credit supply in the economy.

For the sake of simplicity, we refrain from constructing a DSGE model which is based on the GT model and also includes a financial sector with financial frictions as in, e.g., Bernanke et al. (1999); rather, we prefer to use the existing model to explore how the model dynamics may change due to variations in EPL and thus we will alter the model slightly in order to include a structural preference demand shocks. Toward this end, we change the household's optimization problem in the following way:

$$\Omega(\mathbf{s_t}) = \max_{\bar{c}_t, \bar{k}_{t+1}} \{\log\left(\bar{c}_t - h\bar{c}_{t-1} - d_t\right) + \beta\Omega(\mathbf{s}_{t+1})\}. \tag{23}$$

This modification of the utility function is in line with Wen (2006), in which h represents a habit formation parameter[9] and d_t is an $AR(1)$ process which evolves according to $d_t = \rho_d d_{t-1} + {\epsilon_t}^d$ and ${\epsilon_t}^d$ is a white noise process. These modifications result in the following stochastic discount factor

$$\Lambda(\mathbf{s}_t, \mathbf{s}_{t+1}) = \frac{\bar{c}_t - h\bar{c}_{t-1} - d_t}{\bar{c}_{t+1} - h\bar{c}_t - d_{t+1}}. \tag{24}$$

As will be shown below, our preference demand shock can be thought of as a negative shock to the supply of savings in the economy as it encourages households to save less, which results in a decline in investment and economic activity. As such, it reasonably captures an some of the important features encapsulated in the empirical credit supply

[9]The addition of habit formation does not change the direction of the theoretical impulse responses; instead it serves as an amplification mechanism for the demand shock itself.

shock series from Gilchrist and Zakrajšek (2012) which we utilize to study our research question.

Impulse Responses. We calibrate our model according to the calibration made in Gertler and Trigari (2009). The calibration of the habit formation parameter is done according to a meta-analysis of habit formation parameter estimates conducted by Havranek et al. (2017). We choose the value $h = 0.66$, which is the median value of estimated habit formation parameter in macro studies. To calibrate our new shock variable we use the same autoregressive parameter as for the demand shock, and a standard deviation of 0.01 for the sake of simplicity. The calibrated parameters appear in Table 1.

We solve the model via a first order approximation of the model with the parameter κ calibrated to 50 percent, 100 percent and 150 percent of the value from Gertler and Trigari's calibration in order to simulate the dynamics in more flexible versus more rigid market environments. The impulse responses from this exercise are shown in Figure 1.

We can see that the main effect of the difference in the structural parameter can be viewed as a mixed effect on labor market resilience. On the one hand, as the market becomes more flexible the labor market responds to a demand shock [10] more violently in the initial, recessionary phase. Hiring decreases more substantially on impact, which translate into a stronger decrease in vacancies. As a result, unemployment increases more dramatically. However, the recovery phase see a stronger return to steady state for the more flexible labor market. Taken together, these results can be interpreted as follows: the fall in hiring in the stricter EPL economy is lower during the recessionary phase due to higher hiring adjustment costs but the stricter EPL also produces less hiring in the

[10] Our main hypothesis regarding labor market dynamics would have remained similar in form, though shorter in duration, if we were to refer to a TFP shock in the context of the GT model. Regarding other variables of interest, the effect on consumption would have been similar, but the effect on output and investment would have been altered to a stronger short-run response between more flexible and more rigid markets.

expansionary, recovery phase, thus resulting in the mixed effects of EPL on economic resilience. For the empirical analysis that will follow our main hypothesis will be that a more flexible labor market setup leads to a stronger short run response on the labor market but a faster recovery.

In terms of the goods markets, we see little to no difference in dynamics or their magnitude at short-run horizons, albeit somewhat of a faster recovery in the more flexible markets does take place at later horizons.

4 Data

The OECD's databases have several indices of employment protection; we chose the index 'Strictness of employment protection - individual dismissals (regular contracts)' (EPR V1), and sub-series of its components[11]. We chose this specific index (which abstracts from self-employment, temporary employment, and collective dismissals) mainly for reasons of data availability. One can make the claim that this abstraction is problematic. However, on a deeper level, the EPL index is a measure of the labor market environment in which the agents operate and as such serves as a reasonable instrument for unobservable cultural factors.

Also, from a practical standpoint, one must ask as to the relevance of EPL to other forms of employment. The self-employed, having no employer, cannot be terminated, wrongfully or otherwise, and would not pay severance to himself. Those involved in the unofficial sectors of the economy, be they legal or otherwise, would be less affected by legislation that applies to contracts which they themselves do not have. We are therefore left with the regular and temporary workers who have a legally binding relationship with their employers, of which regular employment still is the most frequently used form

[11] See Table 2 for the break-down of the index to its components and the data that composes each.

of employment.[12] The collective dismissals portion of EPL, which our measure also abstracts from, is only available from 1998 and is only given a weight of 29% in the combined index that includes it. Moreover, the latter index has a correlation of 84% with our index. Hence, we opted to use the one available for the longest period of time, and use the measures of temporary employment protection and collective dismissals as robustness tests in Section 6.4.

Data for the EPL index is available for the years between 1960 and 2004 in a database created by Nickell (2006). However, the EPL index displayed there for the years 1960 to 1985 is a backward extension of the OECD's index created by assuming that its rate of change over time is the same as the change in another index (the EP index which uses data taken from Blanchard and Wolfers (2000) and from Lazear (1990)). From 1985 onward the index given by Nickell (2006) is the same as the OECD's index. Since the OECD's index is available for twenty eight consecutive years for most of our countries, we chose, for the sake of consistency, to rely solely on the OECD's index instead of utilizing a mixed measurement methodology.

Additional to the effects of EPL in itself we wish to understand the significance of each individual component of EPL in the transmission of shocks. With this in mind we have added to our data four different series of the individual components of EPL: the procedural inconveniences that effect an employee's termination, the length of notice before termination, the amount of severance pay due following termination, and the legal aspects of an unfair dismissal including its definition, the trail period after which an employee can make a wrongful termination claim and the possible results of said claim. These series are already a part of the OECD's database used in the calculation of the OECD's index,

[12] See Table 10.2 in Boeri and van Ours (2013) for coverage of EPL on most of the OECD countries in our sample. Column b in this table shows that even taking into account the temporary and the self employed EPL on regular workers, the index used covers more than 50 per cent of the population in all countries and more then 70 per cent in most countries.

the only methodological difference is that we separate the series on notice and severance into two according to the OECD's respective weights for these two components.

In order to test our hypotheses, we have created a panel containing the following variables[13]: our main dependent variables (unemployment, participation, employment to population ratio, and output per-capita); our shock variable, which will be discussed shortly; and our state variable, the EPL index. We use data from 28 OECD economies for the period between 1985 to 2013.[14] Our choice of sample, both along the country dimension and the time dimension, arises from the availability of the EPL index.[15]

Our dependent variables are taken from the OECD's database.[16] All dependent variables are taken as log cumulative changes and first order log differences are used as controls. We use the dependent variables in log cumulative changes in order to compare movements in a variable between different countries with different steady state levels.

As a shock variable in the analysis that follows we will use the EBP (Excess Bond Premium) measure from Gilchrist and Zakrajšek (2012), who use micro-level data to construct a credit spread index which they decomposed into a component that captures firm-specific information on expected defaults and a residual component that they termed as the excess bond premium. To the best of our knowledge, there is no financial shock variable which was calculated specifically for every one of the markets we use in our analysis. That said, the increasingly global nature of the economy means that EBP can be interpreted as a global shock variable within the framework of our analysis.

[13]For further details and information on the data sets used see Appendix B.

[14]We use monthly data for unemployment, quarterly data for the rest of our variables of interest; all data are seasonality adjusted except EPL which is available only in annual frequency and assumed identical within each year.

[15]In the UK the OECD's EPL index is available for 2014 and therefore we use data from this year as well for the UK. The same series is missing for New Zealand, Hungary, Turkey, Korea, and Mexico for the years 1985-1989 and in the Czech Republic and in the Slovak Republic for the years 1985-1992.

[16]All OECD data were retrieved from http://stats.oecd.org/, see exact details in Appendix B.

5 Methodology

As mentioned in section 2, EPL is not truly a continuous variable. Since we wish to see if this treatment of EPL as continuous is important for its resilience implications and to the correct identification of the impact that different EPL regimes have on the dynamics of a business cycle, we will describe two specifications aimed at estimating impulse responses that utilize the local projection method formulated by Jorda (2005): one that treats EPL as a discrete variable and one that does not.

These specifications follow the econometric framework employed in Auerbach and Gorodnichenko (2012), Owyang et al. (2013), Ramey and Zubairy (2017), and Tenreyro and Thwaites (2016), who use the local projection method developed in Jorda (2005) to estimate impulse responses. This method allows for state-dependent effects in a straightforward manner while involving estimation by simple regression techniques. Moreover, it is more robust to misspecification than a non-linear VAR. As in Auerbach and Gorodnichenko (2012), we make use of the Jorda (2005) local projections method within a fixed effects panel model, where inference is based on Driscoll and Kraay (1998) standard errors that allow arbitrary correlations of the error term across countries and time.

In particular, we estimate the impulse responses to the credit supply shock by projecting a variable of interest on its own lags and current and lagged values of the EBP variable from Gilchrist and Zakrajšek (2012), while allowing the estimates to vary according to the EPL state in a particular country and time.

EPL as a discrete state variable: In defining the state of EPL we wish to group observations together in a way that allows for sufficient differentiation to be made between the groups and in a manner that can describe broadly the policy used; to many groups will not lead to statistically strong results, while to few and we lose the differentiability.

In order to allow for sufficient differences, we use the following groups: first, the lower quartile of EPL distribution or a state of lax EPL, second, the upper quartile of EPL distribution or a state of strict EPL, and third, the rest of the observations or those with medium EPL. Using these groups we assume that the margins behave in a different fashion then the rest of the distribution, but due to the discrete form of analysis this does not assume that the response's magnitude will be thus ordered.

The following equation demonstrates the class of state-dependent models that we estimate using y as an example of a dependent variable:[17]

$$\begin{aligned} \ln y_{i,t+h} - \ln y_{i,t-1} = A_{i,t-4}[\alpha^h_{A,i} + \beta^h_A EBP_t + \Theta^h_A(L)EBP_{t-1} + \Gamma^h_A(L)\Delta \ln y_{i,t-1}] \\ +B_{i,t-4}[\alpha^h_{B,i} + \beta^h_B EBP_t + \Theta^h_B(L)EBP_{t-1} + \Gamma^h_B(L)\Delta \ln y_{i,t-1}] \\ +C_{i,t-4}[\alpha^h_{C,i} + \beta^h_C EBP_t + \Theta^h_C(L)EBP_{t-1} + \Gamma^h_C(L)\Delta \ln y_{i,t-1}] + \epsilon^h_{i,t+h} \end{aligned} \tag{25}$$

where i and t index countries and time; α_i is the country fixed effect; $\Theta(L)$ and $\Gamma(L)$ are lag polynomials; β^h gives the response of the outcome variable at horizon h to a credit supply shock at time t; $\epsilon^h_{i,t+h}$ is the residual; and, importantly, all the coefficients vary according to the state of EPL which is represented by the state dummies $A_{i,t-4}$, $B_{i,t-4}$ and $C_{i,t-4}$[18] that takes the value of one when the EPL regime is lax, medium, or strict as we defined before. The estimated impulse responses to the credit supply shock for the three states at horizon h are simply β^h_A, β^h_B, and β^h_C respectively.

[17] In order to correctly adopt a state-dependent model on panel data, we must refer to a form of normalized changes in variables for these changes to be commensurable, between one country to the other. To accomplish such normalization, we simply use a dependent variable of the form $\ln y_{i,t+h} - \ln y_{i,t-1}$ which represents the cumulative percent change in our variable of interest from the baseline level prior to the shock until horizon h.

[18] The notation $A_{i,t-4}$, represents a one year lag of the dummy. When we use unemployment as a dependent variable with a monthly data frequency we will still use a one year lag, but this will be the twelfth lag of our dummy $A_{i,t-12}$.

EPL as a continuous state variable: as before our aim is to use local projections to estimate impulse responses to EBP, but now our model includes the following alteration:

$$\begin{aligned} \ln y_{i,t+h} - \ln y_{i,t-1} &= \alpha_i^h + \beta^h EBP_t + \Theta_1^h(L) EBP_{t-1} + \Gamma_1(L)\Delta \ln y_{i,t-1} \\ &+ EPL_{i,t-4}[\alpha_i^h + \gamma^h EBP_t + \Theta_2^h(L) EBP_{t-1} + \Gamma_2^h(L)\Delta \ln y_{i,t-1}] + \epsilon_{i,t+h}^h \end{aligned} \tag{26}$$

The notations in Equation 26 are similar to those of Equation 25, but this time EPL is taken as a continuous state variable interacting with current and past realizations of the dependent variable and of EBP.

Estimate of the response of EBP conditional on the level of EPL are given by $\beta^h + \gamma^h EPL_{i,t-4}$. Unlike the impulse responses estimated from Equation 25 which assume no order to the responses in different states, Equation 26 will inevitably estimate that the observation which has a higher level of EPL will have a higher response (or a lower one if γ^h is negative), and the difference in these responses will be statistically significant if γ^h is statistically significantly different from zero.

For both specifications, lags of y and EBP are included in the regression to remove any predictable movements in EBP; this facilitates the identification of an unanticipated shock to EBP, which is what is sought after. We assign the value of the order of lag polynomials $\Theta(L)$ and $\Gamma(L)$ to 8, i.e., we allow for 8 lags of output growth and EBP in the regression.[19] We assume a relatively large number of lags because of the construction of the EPL variable. Since the latter was converted from annual to quarterly frequency by assuming identical values within the year, it is necessary to include it in the regression with four lags so as to avoid correlation of the error term with it; this in turn requires that more than 4 lags of output and EBP be included in the regression so as to purge the state dummies of any potentially endogenous sources.

The EBP credit supply shock is normalized so that it has a zero mean and unit vari-

[19] When using monthly data, we use 24 lags,instead of 8 following the same argument.

ance. Note that a separate regression is estimated for each horizon. We estimate a total of 25 regressions for our quarterly frequency specification (and 73 for our monthly unemployment specification) and collect the impulse responses from each estimated regression, allowing for an examination of the state-dependent effects of credit supply shocks for 6 years following the shock.

The analysis of EPL components: When we analyze the effects of the individual components of EPL using the state-dependent specification described by Equation 25 and the continuous specification given in Equation 26 but this time we group observations in different states according to the upper quartile, lower quartile, and the middle two quartiles of the distribution of the specific component of interest, or use the component series in the appropriate interaction.

6 Empirical Analysis

In this section we perform an empirical analysis of EPL's implications for economic resilience, utilizing the aforementioned specifications and components. Section 6.1 presents our main results using a discrete specification. Section 6.2 checks for the results robustness to continuous treatment of EPL. Section 6.3 attempts at decomposing the results of the previous sections into the different components of EPL. And Section 6.4 examines the implications of alternative forms of employment protection.

6.1 EPL's resilience implications - discrete specification

We estimate the discrete specification described in Equation 25 for unemployment, employment to population ratio, labor force participation and output per capita. The estimation results are presented in Figure 2, where strict EPL economies are shown in blue, lax EPL economies in red, and the rest of the distribution in black.

As a result of a one standard deviation increase in EBP, we can clearly see that as predicted by our model, unemployment rises, and the employment to population ration falls. The results indicate that these responses are weaker where EPL is strict, up to a level in which our strict EPL economies exhibit no statistically significant labor market response during the first year from impact. Unlike our theory, the recovery of these variables is not significantly different across EPL regimes. This result maybe due to the smaller absolute different in responses predicted by theory combined with a weaker statistical power of the estimate for a longer horizon.

The model presented in Section 3 abstracts from participation all together. However, the data suggests that strict employment protection prevents worker discouragement following a shock as participation does not respond in any significant manner to the shock in strict EPL economies while lax EPL economies exhibit a decrease in participation that lasts for almost four years.

Output per capita drops following a shock but does not exhibit a differential response until the second year from impact. Output's recovery in strict EPL economies is far slower and five years from impact we can still observe a 1.5 percentage points difference between strict and Lax EPL economies.

6.2 EPL's resilience implications - continuous specification

The conventional treatment of EPL in the literature is as if it had been a continuous measure, as such, we find it valuable to examine whether this form of empirical analysis changes the results or not. With this aim in mind, we have estimated the impulse responses to EBP using the specification described in Equation 26.

The results from this exercise are presented in Figure 3. Now we use the red, black, and blue lines to indicate the estimated impulse responses for the 25th, 50th, and the 75th percentiles of the EPL distribution. Shaded areas indicate that the interaction term in Equation 26, γ^h is statistically significantly different then zero for the specific horizon with P-value ≤ 0.05.

In terms of overall market dynamics the two sets of results agree with one another quite well. The responses of unemployment and employment to population ratio are very similar to those obtained from the previous estimation with a drop in employment and an increase in unemployment at impact. Strictness of EPL dampens these responses and serves as a short run shock absorber in the labor market. The interaction term for participation is significant for only the second year but there is still a smaller response of participation in the strict EPL economies.

Output's responds to the adverse shock to EBP with a drop that is strengthens by strictness of EPL. That being said, this response, though significant and highly persistent is smaller in size.

6.3 Decomposing EPL's effects

This decomposition is motivated by three factors. First, in the discrete analysis we see that the impulse responses of the middle part of the distribution are much closer to one extreme or the other which may suggest a non linear effect. Second, the correlations between all of the component series are small.[20] Last, the form of aggregation used to calculate the index may group as similar two countries for which employment protection laws are different but the aggregate of their scores in all the components measured amount to the same grand total.

These factors lead us to believe that each individual component may cause a different

[20] Full correlation matrix is given in Table 3, the no pair of components exhibits a stronger correlation than 0.56 and most are lower than 0.2 in absolute value.

dynamic effect and thus have separate policy implications. To test this hypothesis, we employ the same identification used in Sections 6.1 and 6.2 but now use the component series as our state variables.

Difficulty of dismissal (Figure 4) seems to be the component responsible for most of the differential response in unemployment and employment to population ratio after the shocks impact, and causes some differential response to participation. Output's response conditional on this state variable is less straightforward, as the continuous specification yields a rather small but significant effect, and the discrete one yields inconclusive results.

Another component that can be interpreted as the major driving force behind one of our results is severance pay (Figure 7). Unsurprisingly, higher severance pay lessens worker discouragement and helps to maintain the size of the current workforce after a shock. it also causes differential response in the employment to population ratio.

As to the other two components, results are less conclusive. Length of notice (Figure 5), does not seem to matter to the cyclical dynamics other than a slight dampening effect on participation. Procedural inconvenience (Figure 6) also seems not to have any meaning for the cycle's dynamics as the results from the continuous specification are similar to those of difficulty of dismissal but weaker and those from the discrete one are inconclusive.

6.4 Other forms of employment protection

Our interest in employment protection stems from its cyclical implications. As such, the measure of regular employment protection may be lacking in its exclusion of temporary workers and collective dismissals. In a labor market that is highly regulated with regard to regular employees, one may find incentives for temporary forms of employment. The occurrence of a cycle can drive a firm that utilizes both forms of employment to adjust its labor input only through its temporary workers, if their termination is cheaper. Additionally, there are distinct regulatory measures govern the form of collective termination due to adverse conditions or a firm's restructuring (e.g. *EUR-Lex Directive 98/59.* (2016)).

Since these measures may have cyclical implication other than those of regular employment protection, we wish to examine their relevance to economic resilience in a fashion similar to the analysis carried out in the previous sections.

Results from estimating the two specifications given by Equation 25 and by Equation 26 are shown in Figure 8 for collective dismissals and in Figure 9 for temporary employment protection.

The results indicate that stricter protection from collective dismissals dampens the drop in participation. This difference is statistically significant for the second year after impact only. Other than this effect, we see a persistent and rather small different in output response that is statistically significant for the continuous specification only.

Employment protection on temporary workers (EPT) the other hand, generates substantial differences in responses. Countries having strict EPT exhibit no significant increase in unemployment over the course of the cycle, and the difference between strict regime countries and lax regime countries is significant for up to four years after impact. The drop in employment to population ratio is also dampened by strict EPT regime and this decrease is highly persistent. Surprisingly, strict EPT also generates no trade-off with output response as per capita output in slightly less effected by the shock. This result is statistically significant in both specifications but only during the second year from impact.

7 Discussion

Our results indicate that employment protection has a considerable effect on the economy's cyclical dynamics and its resilience to financial shocks. Our theoretical predictions suggests that in the stricter economies we should observe a smaller effect of the shock upon impact on labor market variables, but a more sclerotic recovery as well. This prediction is borne out by the data only partially, as we only see differential responses in the labor market only during the initial phase of the shock driven cycle.

Nickell (1978) describes a lower variation of employment over the business cycle. This find is also obtained by Nunziata (2003). Our results verify this find in a more complex setting using an identified shock and panel data for 28 countries. The data shows that countries having stricter employment protection will exhibit slower adjustment of the labor input used in production. This finding agrees with our theory of interpreting employment protection as adjustment cost to human capital variation as similar response was obtain from the model described in Section 3. Although the issue of flows lays outside the scope of this paper, our results are in accordance with the aforementioned strand of literature which claims that employment protection lowers job flows and makes the labor market more sclerotic.

The analysis shows that employment protection can influence the dynamics of labor force participation and prevent discouragement. This effect, which, to the best of our knowledge, had not yet been studied in depth, could be interpreted as an increase in the job-seeker's value from a future match with an employer, anticipating a longer employment period. If this is indeed the mechanism behind this response then that could explain the fact that we do not have a conclusive find regarding a different path of recovery for employment and unemployment. Having a labor market characterized by slower flows in a recovery period we would expect employment to recover slower. But, having more people active in the labor market might mitigate that adverse outcome.

In addition to the above mentioned labor market responses our model also suggests that output should respond differently only after a year or so, and that these differences should be small in magnitude and rather persistent. Our results, stray from this only in magnitude. The discrete specification yields a maximal gap in responses of about 1.5 percent in output per capita, while our theoretical model does not hint at any effect of this size. This discrepancy can be explained in several ways. First, and somewhat likely, is that our theoretical model merely illustrates an increase in EPL in an American market based calibration and not on a fully calibrated version of a typical European market. However, the size of labor market responses does not exhibit such discrepancies, and even fits nicely with our responses. Therefore, we believe that this merits a deeper explanation, which is that EPL is more than a mere adjustment cost.

Employment protection laws can act as an added adjustment cost, but they can generate risks as well. A firm that operates in an environment in which terminating an employee may lead to a prolonged trial, considerable legal expenses, a chance of reinstatement of a now disgruntled and more difficult to fire worker, and a chance of negative publicity, may very well think twice whether or not to do so. On the macroeconomic level, if said risks may not be completely insurable, it may lead firms to accumulate wealth solely as a provision against such an adverse outcome. This wealth will not be efficiently expanded for productive efforts but saved for a proverbial 'rainy day'. Thus, if an adverse shock hits the economy then the firm will use its liquid reserves for costly terminations or for other recession-related activities. Following this shock, a recovering firm will use its profits to replenish its reserves, and not only to generate future growth. This pattern, if it indeed occurs, may cause the market to slow down its recovery, and inhibit output growth.

Our decomposition of employment protection's effect into its component series and the different channels of transmission discussed above rise an interesting question: how do we measure labor market institutions? Could it be that if we create a more specific sets of indicators, and formulate policy recommendations based upon more accurate measures, we can aid policy makers in the formation of improved market conditions for sustainable growth and social welfare? The OECD's employment protection indices mask several channels of influence as if they were one.

From the point of view of a single firm operating in a market employment protection can be broken down into the following: (i) A known transfer to the employee at time of termination, (ii) an environment which imposes greater overhead costs, (iii) a predetermined delay in termination, and (iv) a risk of legal recourse and bad publicity. It may be the case, that if we measure these factors individually, we may gain a more accurate way to compare labor market institutions and the cost of doing business within an economy.

In addition to the question of measuring the different channels of transmission that regular EPL influences we have examined the issue of protection for temporary workers. Our model does not distinguish between types of employment, and this is not the main focus of our analysis. However, in light of our results' strength we believe that this issue deserves some attention.

The share of temporary workers from the total number of dependent employment is not large. On average, for the time frame of our sample, temporary workers consist $9.4\% - 11.1\%$ of the total number of wage and salary workers.[21] Despite their small size, there are several works which suggest that most of the firm's flexibility comes from its temporary employees and not from its regular ones, and that in fact, temporary workers are a source of increased cyclical changes in labor input, e.g. Bentolila and Saint-Paul (1992), Nunziata and Staffolani (2007), and Cahuc et al. (2016). Due to the fact that our baseline specification shows that employment to population ratio decreases in approximately 1% to a one standard error shock in EBP, it is possible that most of the adjustment in inputs, or even all of it, comes from the temporary workers.

Temporary workers can be another source of influence for regular employment protection. In a highly regulated market of permanent workers, one can certainly under-

[21] See https://data.oecd.org/emp/temporary-employment.htm for full data set.

stand the desirability of a fixed term employment contract. The work of Dräger and Marx (2012) provides evidence which support the claim that given high levels of firing costs, firms would be more prone to adjust their temporary workforce when facing output fluctuations. This is yet another channel through which employment protection is likely to affect the economy's resilience, but this time by determining the form of employment fluctuation at the margins.

8 Conclusion

This paper has examined the relation between EPL and economic resilience using an extensive empirical analysis, while using a slightly modified version of the Gertler and Trigari (2009) model as a conceptual base upon which to structurally interpret results. Our findings indicate that strict EPL has the capacity to act as a short-run shock absorber as it diminishes the decrease in employment following an adverse demand shock. However, in the recovery period strict EPL causes a slower recovery to pre-shock levels in terms of output.

Our identification strategy in this paper allowed us to identify effects generated by a single measure of employment protection legislation on the economy as a whole. As such, it had enabled differentiation between the possible channels of shock transmission influenced by strictness of EPL. Our findings suggest that these measures associated with risk of termination costs, generate much of what we conceive of as adjustment costs. This result suggests both directions for new research through modelling employment protection as an increased risk of termination costs and higher overheads and that perhaps the main indices that measure employment protection should separate these distinct sources of influence and not aggregate them into one index.

Our results also indicate that higher severance pay policy can prevent worker discouragement as a result of a recession. It could be of particular interest to examine whether or not a cyclical policy in terms of severance, even if subsidized by the government, can be effective in generating similar results at lower costs.

Finally we have shown that protection of temporary workers can dampen the labor market responses we observed and improve resilience also in terms of output. This find causes us to consider which kinds of individuals should be targeted by employment protection regulation? It may be that by protecting temporary workers we can improve the market conditions, both from a macroeconomic perspective of improving growth and form a social point of view.

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Appendix A Log-Linear Model

This appendix follows the model appendix's outline in Gertler and Trigari (2009) with our additions in the appropriate places. The log-linear model presented here is all in aggregate terms. Thus, for the sake of simplicity we omit the bar sign from the aggregate terms, and use the following simplified notations instead: we denote steady state levels of variables with a $*$ sign e.g., the steady-state level of unemployment in the model is u^*, and the log-deviation of a variable from its steady-state level is denoted by a tilde sign e.g., $\tilde{u}_t \equiv \log \frac{u_t}{u^*} \simeq \frac{u_t - u^*}{u^*}$.

The production function:

$$\tilde{y}_t = \tilde{z}_t + \alpha \tilde{k}_t + (1 - \alpha)\tilde{n}_t. \tag{A.1}$$

Resource constraint:

$$\tilde{y}_t = \frac{c^*}{y^*}\tilde{c}_t + \frac{i^*}{y^*}\tilde{i}_t + (1 - \frac{c^*}{y^*} - \frac{i^*}{y^*})\,(\tilde{n}_t + 2\tilde{x}_t). \tag{A.2}$$

The matching function:

$$\tilde{m}_t = \sigma \tilde{u}_t + (1 - \sigma)\tilde{v}_t. \tag{A.3}$$

Employment dynamics:

$$\tilde{n}_{t+1} = \tilde{n}_t + (1 - \rho)\tilde{x}_t. \tag{A.4}$$

Transition probabilities:

$$\tilde{p}_t = \tilde{m}_t - \tilde{u}_t, \tag{A.5}$$

$$\tilde{q}_t = \tilde{m}_t - \tilde{v}_t. \tag{A.6}$$

Unemployment dynamics:

$$\tilde{u}_t = -\frac{n^*}{u^*}\tilde{n}_t. \tag{A.7}$$

Capital dynamics:

$$\tilde{k}_{t+1} = (1-\delta)\tilde{k}_t + \delta\tilde{i}_t. \tag{A.8}$$

Vacancies and hiring:

$$\tilde{x}_t = \tilde{v}_t + \tilde{q}_t - \tilde{n}_t. \tag{A.9}$$

Consumption and savings:

$$\tilde{\Delta}_{t,t+1} + (1-\beta(1-\tilde{\delta}))E_t[\tilde{r}_{t+1}] = 0. \tag{A.10}$$

Marginal utility:

$$E_t[\tilde{\Delta}_{t,t+1}] = -E_t[\tilde{c}_{t+1}]\frac{1}{1-h} + \tilde{c}_t\frac{1+h}{1-h} - \tilde{c}_{t-1}\frac{h}{1-h} + \frac{E_t[\tilde{d}_{t+1}] - \tilde{d}_t}{c^*(1-h)}. \tag{A.11}$$

Aggregate hiring:

$$\tilde{x}_t = E_t[\tilde{\Delta}_{t,t+1} + \frac{\beta a^*}{\kappa x^*}\tilde{a}_{t+1} - \frac{\beta w^*}{\kappa x^*}\tilde{w}_{t+1} + \beta\tilde{x}_{t+1}]. \tag{A.12}$$

Marginal product of labor:

$$\tilde{a}_t = \tilde{y}_t - \tilde{n}_t. \tag{A.13}$$

Rental rate of capital:

$$\tilde{r}_t = \tilde{y}_t - \tilde{k}_t. \tag{A.14}$$

Effective bargaining power:

$$\tilde{\chi}_t = -(1-\chi^*)(\tilde{\mu}_t - \tilde{\epsilon}_t), \tag{A.15}$$

with

$$\tilde{\epsilon}_t = \rho\lambda\beta E_t[\tilde{\Delta}_{t,t+1} + \tilde{\epsilon}_{t+1}],$$

and

$$\tilde{\mu}_t = (\beta\lambda x^*)\tilde{x}_t - (\lambda\beta x^*)(\frac{\beta w^*}{\kappa x^*}\lambda\mu^*)(\lambda\beta)\mu^*(\tilde{w}_t - \tilde{w}_{t+1}) + \lambda\beta E_t[\tilde{\Delta}_{t,t+1} + \tilde{\mu}_{t+1}].$$

Spillover-free target wage:

$$\tilde{w}_t^0 = \chi^*\varphi_a\tilde{a}_t + (1-\chi^*)\varphi_p\tilde{p}_t + [(1-\chi^*)\varphi_p + \chi^*\varphi_x]\tilde{x}_t + \varphi_\chi(\tilde{\chi}_t - \beta(\rho - p^*)E_t[\tilde{\chi}_{t+1}]), \tag{A.16}$$

where

$$\varphi_a = \frac{a^*}{w^*},\ \varphi_p = \frac{\beta p^* H^*}{w^*},\ \varphi_x = \frac{\kappa x^{*2}}{w^*},\ \varphi_\chi = \frac{x^*\kappa\chi^*}{(1-\chi^*)\beta w^*}.$$

Aggregate wage:

$$\tilde{w}_t = \gamma_b\tilde{w}_{t-1} + \gamma_o\tilde{w^0}_t + \gamma_f\tilde{w}_{t+1}, \tag{A.17}$$

where

$$\gamma_b = \frac{1+\tau_2}{\phi}, \gamma_o = \frac{\varsigma}{\phi}, \gamma_f = (\frac{\tau}{\lambda} - \tau_1)\phi^{-1},$$

$$\varsigma = \frac{(1-\tau)(1-\lambda)}{\lambda}, \phi = 1 + \tau_2 + \varsigma + \frac{\tau}{\lambda} - \tau_1$$

$$\tau = \frac{\lambda\rho\beta\psi}{1+\lambda\rho\beta\psi}, \psi = \mu^*\chi^* + (1-\chi^*)\epsilon^*,$$

$$\tau_1 = \chi^*\mu^*\beta[(\rho - p^*)(x^*\beta\lambda)(\lambda\mu^*) + p^*\eta^{-1}](1-\tau),$$

$$\tau_2 = \chi^*\mu^*(x^*\beta\lambda)[1 - \lambda\mu^*](1-\tau).$$

Technology shock process:

$$\tilde{z}_t = \rho_z\tilde{z}_{t-1} + \epsilon_{z_t}. \tag{A.18}$$

Demand shock process:

$$\tilde{d}_t = \rho_d\tilde{d}_{t-1} + \epsilon_{d_t}. \tag{A.19}$$

Model steady-state levels for key variables:

$$n^* = 1 - u^*, \tag{A.20}$$

$$u^* = \frac{x^*}{x^* + p^*}, \tag{A.21}$$

$$x^* = 1 - \rho, \tag{A.22}$$

$$y^* = k^{*\alpha} n^{*1-\alpha}, \tag{A.23}$$

$$c^* = y^* - \delta k^* - \frac{\kappa x^{*2}}{2} n^*, \tag{A.24}$$

$$i^* = \delta k^*, \tag{A.25}$$

$$a^* = (1-\alpha)\frac{k^*}{n^*}^{\alpha}, \tag{A.26}$$

$$\frac{k^*}{n^*} = (\frac{r^*}{\alpha})^{\frac{-1}{1-\alpha}}, \tag{A.27}$$

$$r^* = \frac{1}{\beta} - 1 + \delta, \tag{A.28}$$

$$w^* = -\frac{\kappa x^*}{\beta} + a^* + \frac{\kappa x^{*2}}{2} + x^* \rho \kappa, \tag{A.29}$$

$$\mu^* = \frac{1}{1 - \lambda\beta}, \tag{A.30}$$

$$\epsilon^* = \frac{1}{1 - \rho\lambda\beta}, \tag{A.31}$$

$$p^* = \frac{w^* - (1-\chi^*)b - \chi^*(a^* + \frac{\kappa x^{*2}}{2})}{\kappa x^* \chi^*}, \tag{A.32}$$

$$H^* = \frac{\chi^* \kappa x^*}{\beta(1-\chi^*)}. \tag{A.33}$$

Appendix B Data

B.1 Indicators of EPL

Variables Definitions. EPL is defined as the OECD's index 'Strictness of employment protection - individual dismissals (regular contracts)' (EPR V1) which is defined according to a method of hierarchies of hierarchies on a 0 to 6 scale. The index aggregates a total of eight different indicators spread over three equally weighted categories: procedural inconvenience (notification procedures and timing), notice and severance pay for no-fault individual dismissal, and difficulty of dismissal. Four component series are used, their calculation is shown in Table 2. The series are used as annual data series and assumed identical over the course of each calendar year. Additionally, we use the series EPT V1 for the protection on temporary employment. This series is measured in a similar fashion, but this time as an aggregate of measures that limit the use of fixed-term and agency workers, and govern their utilization. Finally we add the series of collective dismissals that aggregates scores on the definition, procedures and costs involving collective dismissals according to the OECD's weights. This series is aggregated by the OECD into the EPL indicies which include information on protection from collective dismissals.

Sample. Our panel for this variable includes the EPR V1, and EPT V1 indicators' values for the years of 1985-2014 for 28 countries the following time periods (for collective dismissals the series is available for all the following countries for the years 1998-2013, and 1998-2014 for the United Kingdom): Australia 1985-2013; Austria 1985-2013; Belgium 1985-2013; Canada 1985-2013; Czech Republic 1993-2013; Denmark 1985-2013; Finland 1985-2013; France 1985-2013; Germany 1985-2013; Greece 1985-2013; Hungary 1990-2013; Ireland 1985-2013; Italy 1985-2013; Japan 1985-2013; Korea 1990-2013; Mexico 1990-2013; Netherlands 1985-2013; New Zealand 1990-2013; Norway 1985-2013; Poland 1990-2013; Portugal 1985-2013; Slovak Republic 1993-2013; Spain 1985-2013; Sweden 1985-2013; Switzerland 1985-2013; Turkey 1990-2013; United Kingdom 1985-2014; United States 1985-2013.

B.2 Credit supply shock.

Variables Definition. To measure global credit supply shocks, we make use of the Gilchrist and Zakrajšek (2012) credit supply shock series. Gilchrist and Zakrajšek (2012) use micro-level data to construct a credit spread index which they decomposed into a component that captures firm-specific information on expected defaults and a residual component that they termed as the excess bond premium. The most updated series of the excess bond premium variable, available from Simon Gilchrist's website [22] is our measure of credit supply shocks in this paper. It is taken in monthly values from 1985:m1-2014:m12. Quarterly values are averages of the corresponding raw monthly values for 1985:Q1-2014:Q4.

B.3 Output per-capita

Variables Definitions. Per-capita output is defined as the quarterly GDP per capita in U.S. dollars, using constant prices and fixed PPP, and seasonality adjusted. The series is obtained from the OECD's database at http://stats.oecd.org/ and taken as log-first-differences.

Sample. Our panel includes observations for the years of 1985-2014 for 28 countries during the following time periods: Australia 1985:Q1-2013:Q4; Austria 1995Q1-2013:Q4; Belgium 1995:Q1-2013:Q4; Canada 1985:Q1-2013:Q4; Czech Republic 1995Q1-2013:Q4; Denmark 1995:Q1-2013:Q4; Finland 1990:Q1-2013:Q4; France 1985:Q1-2013:Q4; Germany 1991:Q1-2013:Q4; Greece 1995:Q1-2013:Q4; Hungary 1995:Q1-2013:Q4; Ireland 1998:Q1-2013:Q4; Italy 1995:Q1-2013:Q4; Japan 2007:Q3-2013:Q4; Mexico 2005:Q1-2013:Q4; Netherlands 1995:Q1-2013:Q4; New Zealand 1991:Q1-2013:Q4; Norway 1995:Q1-2013:Q4; Poland 1995:Q1-2013:Q4; Portugal 1995:Q1-2013:Q4; Slovak Republic 1995:Q1-2013:Q4; Spain 1995:Q1-2013:Q4; Sweden 1993:Q1-2013:Q4; Switzerland 1991:Q1-2013:Q4; United Kingdom 1995:Q1-2013:Q4; United States 1985:Q1-2013:Q4.

B.4 Unemployment.

Variables Definitions. Our panel utilizes the OECD's harmonized unemployment (all persons) series in both monthly and quarterly data frequencies. The series is taken as log-first-differences. Both series are from the OECD's database at http://stats.oecd.org/.

[22] The permanent link for this updated excess bond premium series is https://www.federalreserve.gov/econresdata/notes/feds-notes/2016/files/ebp_csv.csv.

Quarterly sample. Our quarterly panel for unemployment includes observations for the years of 1985-2014 for 28 countries during the following time periods: Australia 1985:Q1-2013:Q4; Austria 1993:Q1-2013:Q4; Belgium 1985:Q1-2013:Q4; Canada 1985:Q1-2013:Q4; Czech Republic 1993:Q1-2013:Q4; Denmark 1985:Q1-2013:Q4; Finland 1988:Q1-2013:Q4; France 1985:Q1-2013:Q4; Germany 1991:Q1-2013:Q4; Greece 1998:Q2-2013:Q4; Hungary 1996:Q1-2013:Q4; Ireland 1985:Q1-2013:Q4; Italy 1985:Q1-2013:Q4; Japan 1985:Q1-2013:Q4; Korea 1990:Q1-2013:Q4; Mexico 1987:Q1-2013:Q4; Netherlands 1985:Q1-2013:Q4; New Zealand 1986:Q1-2013:Q4; Norway 1989:Q1-2013:Q4; Poland 1997:Q1-2013:Q4; Portugal 1985:Q1-2013:Q4; Slovak Republic 1998:Q1-2013:Q4; Spain 1986:Q2-2013:Q4; Sweden 1985:Q1-2013:Q4; Switzerland 2010:Q1-2013:Q4 (available only for Q2 for 1999-2009); Turkey 2005:Q1-2013:Q4; United Kingdom 1985:Q1-2014:Q4; United States 1985:Q1-2013:Q4.

Monthly sample. Our monthly panel for unemployment includes observations for the years of 1985-2014 for 26 countries (data for New Zealand and Switzerland is unavailable) during the following time periods: Australia 1985:M1-2013:M12; Austria 1993:M1-2013:M12; Belgium 1985:M1-2013:M12; Canada 1985:M1-2013:M12; Czech Republic 1993:M1-2013:M12; Denmark 1985:M1-2013:M12; Finland 1988:M1-2013:M12; France 1985:M1-2013:M12; Germany 1991:M1-2013:M12; Greece 1998:M4-2013:M12; Hungary 1996:M1-2013:M12; Ireland 1985:M1-2013:M12; Italy 1985:M1-2013:M12; Japan 1985:M1-2013:M12; Korea 1990:M1-2013:M12; Mexico 1987:M1-2013:M12; Netherlands 1985:M1-2013:M12; Norway 1989:M1-2013:M12; Poland 1997:M1-2013:M12; Portugal 1985:M1-2013:M12; Slovak Republic 1998:M1-2013:M12; Spain 1986:M4-2013:M12; Sweden 1985:M1-2013:M12; Turkey 2005:M1-2013:M12; United Kingdom 1985:M1-2014:M12; United States 1985:M1-2013:M12.

B.5 Population and participation.

Variables Definitions. We define labor force participation as the ratio between the active population (persons actively engaged in search or currently in employment) and the working age population. Both measures include all persons aged 15 and over, other than for Spain, the United Kingdom, and the United States for which the lower bound is 16. We also make use of the ratios between the employed and unemployed population to the working age population, again for the same ages as mentioned above.The raw data includes four data series (employed, unemployed, active, and working age population) expressed in thousands of persons. The three resulting ratios are taken as log-first-differences. all raw series used for the creation of this series are from the OECD's database at http://stats.oecd.org/.

Sample. Our quarterly panel for these ratios includes observations for the years of 1985-2014 for 28 countries during the following time periods: Australia 1985:Q1-2013:Q4; Austria 1999:Q1-2013:Q4; Belgium 1999:Q1-2013:Q4; Canada 1995:Q1-2013:Q4; Czech Republic 1998:Q1-2013:Q4; Denmark 1999:Q1-2013:Q4; Finland 2000:Q1-2013:Q4; France 2003:Q1-2013:Q4; Germany 2005:Q1-2013:Q4; Greece 1998:Q1-2013:Q4; Hungary 1999:Q1-2013:Q4; Ireland 1999:Q1-2013:Q4; Italy 1998:Q1-2013:Q4; Japan 1985:Q1-2013:Q4; Korea 1999:Q3-2013:Q4; Mexico 2005:Q1-2013:Q4; Netherlands 2000:Q1-2013:Q4; New Zealand 1986:Q1-2013:Q4; Norway 2000:Q1-2013:Q4; Poland 2000:Q1-2013:Q4; Portugal 1998:Q1-2013:Q4; Slovak Republic 1999:Q1-2013:Q4; Spain 1999:Q1-2013:Q4; Sweden 2001:Q1-2013:Q4; Switzerland 2010:Q1-2013:Q4 (available only for Q2 for 1999-2009); Turkey 2006:Q1-2013:Q4; United Kingdom 1999:Q2-2014:Q4; United States 1985:Q1-2013:Q4.

Table 1: Model Parameterization

Parameter	Description	Value
σ	Matching function elasticity	0.5
σ_m	Matching function constant	1
α	Capital share in production	0.33
β	Discount factor	0.997
h	Habit formation parameter	0.66
ρ	Survival rate of employees	0.965
ρ_d	Autoregressive parameter of demand shock	0.983
σ_d	Standard deviation of demand shock	0.01
δ	Depreciation rate of capital	0.008
κ	Employment adjustment costs	148.2
η	Employees' bargaining power	0.5
λ	Renegotiation frequency	0.889
ρ_z	Autoregressive parameter of technology shock	0.983
σ_z	Standard deviation of technology shock	0.0075
b	Flow value of unemployment	1.46

Notes: The table consists of the parameters' values used for the model in Section 3.

Table 2: EPL - components and weights.

EPL index	Weights	OECD main series	Weights	Component series	Weights	OECD basic series
EPR v1 - regular contracts	33.3%	Procedural inconvenience	100.0%	Procedural inconvenience	50.0%	Notification procedures
					50.0%	Delay involved before notice can start
	33.3%	Notice and severance pay for no-fault individual dismissal	42.9%	Termination notice	33.3%	Length of the notice period at 9 months tenure
					33.3%	Length of the notice period at 4 years tenure
					33.3%	Length of the notice period at 20 years tenure
			57.1%	Severance pay	33.3%	Severance pay at 9 months tenure
					33.3%	Severance pay at 4 years tenure
					33.3%	Severance pay at 20 years tenure
	33.3%	Difficulty of dismissal	100.0%	Difficulty of dismissal	25.0%	Definition of justified or unfair dismissal
					25.0%	Length of trial period
					25.0%	Compensation following unfair dismissal
					25.0%	Possibility of reinstatement following unfair dismissal

Notes: The weights and the basic series are those used by th OECD and retrieved from http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm. The additional separation in our components series between notice and severance pay can be factored according to the above weights in order to obtain the OECD's main series on both that is used for the EPL index.

Table 3: EPL and components correlation matrix

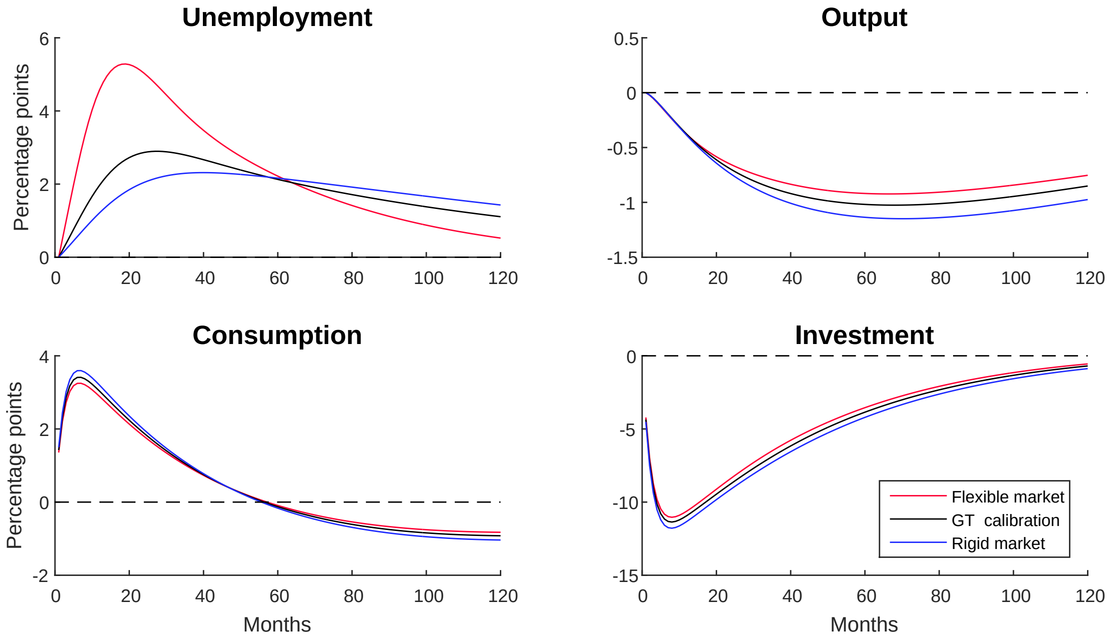
Spearman correlation coef.	**EPL**	**Procedural inconve-nience**	**Termination notice**	**Severance pay**	**Difficulty of dismissal**
EPL	1				
Procedural inconvenience	0.814^{***}	1			
Termination notice	0.504^{***}	0.560^{***}	1		
Severance pay	0.338^{***}	0.0831^{***}	-0.045^{**}	1	
Difficulty of dismissal	0.756^{***}	0.429^{***}	0.174^{***}	0.162^{***}	1

Notes:Spearman rank correlations between the EPL index and the component series presented at Table 2.

*** significant at 0.01 significance level.

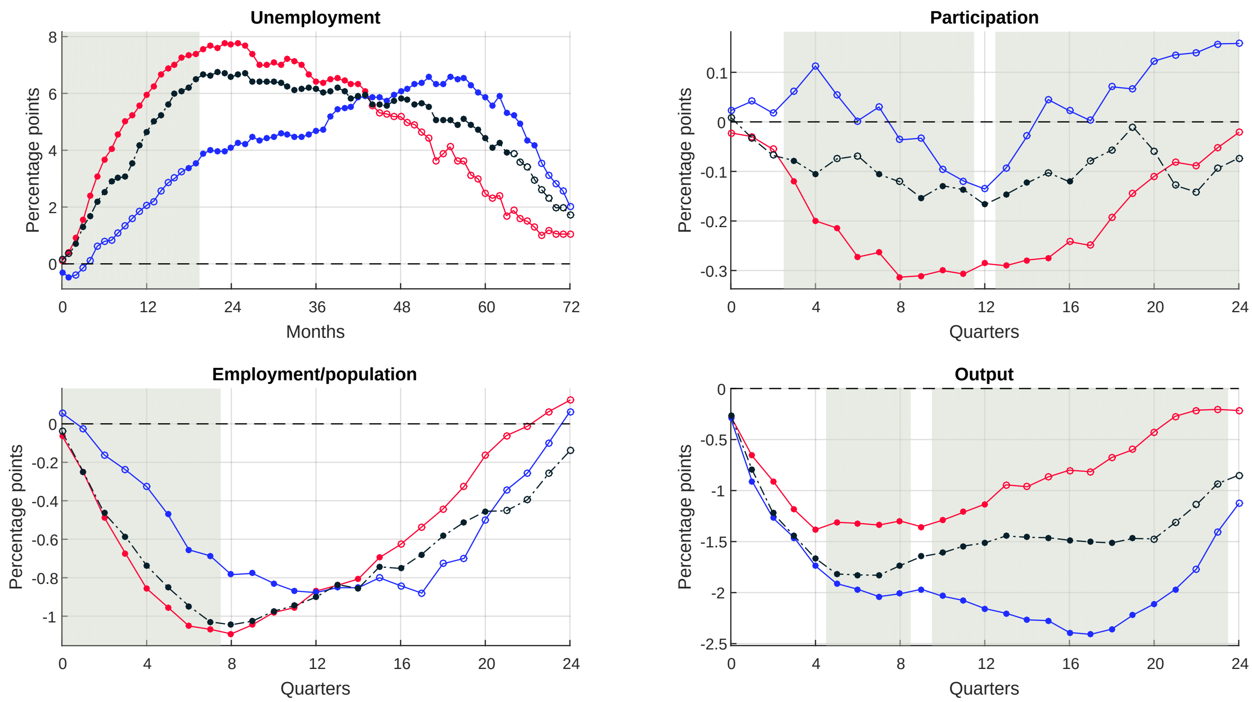
** significant at 0.05 significance level.

Figure 1: Theoretical impulse responses to a demand shock



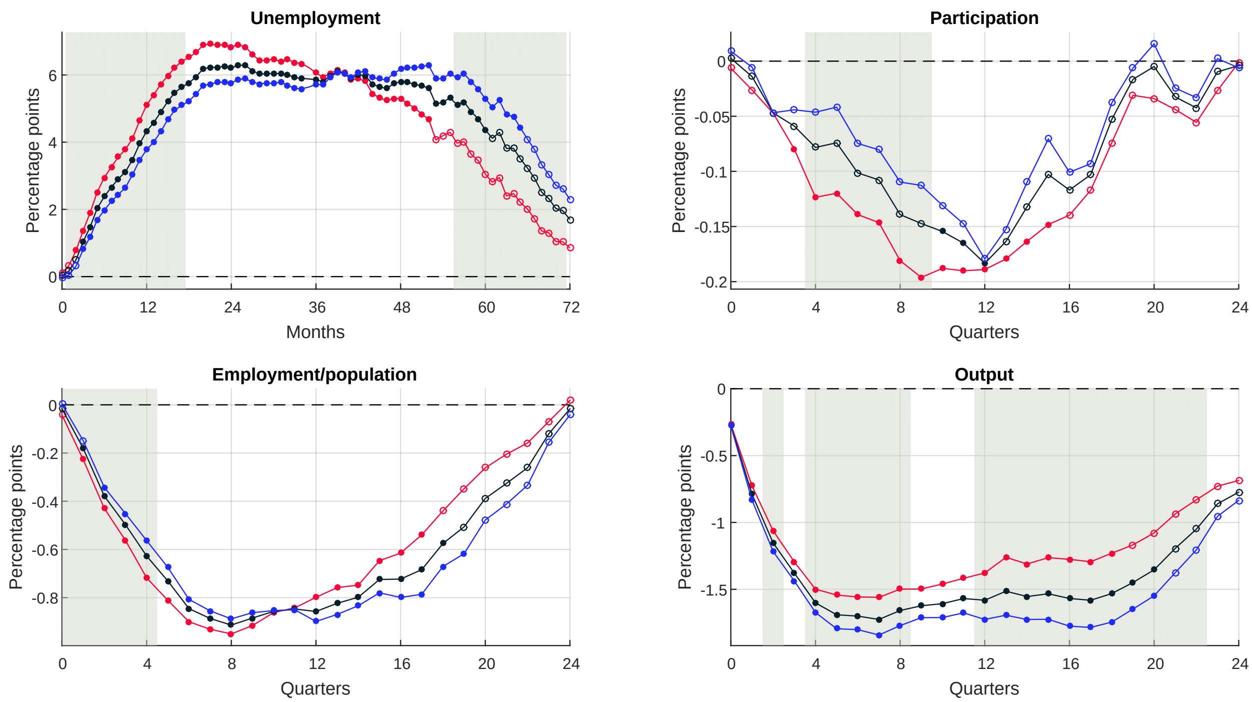
Notes: Flexible (κ is $\frac{1}{2}$ from the original calibration) markets are displayed in red, rigid (κ is $\frac{3}{2}$ from the original calibration) markets in blue and markets matching the Gertler and Trigari (2009) calibration (with the aforementioned additions) in black.

Figure 2: Impulse Response Functions to EBP Shock - by EPL Regime Using a Discrete Specification



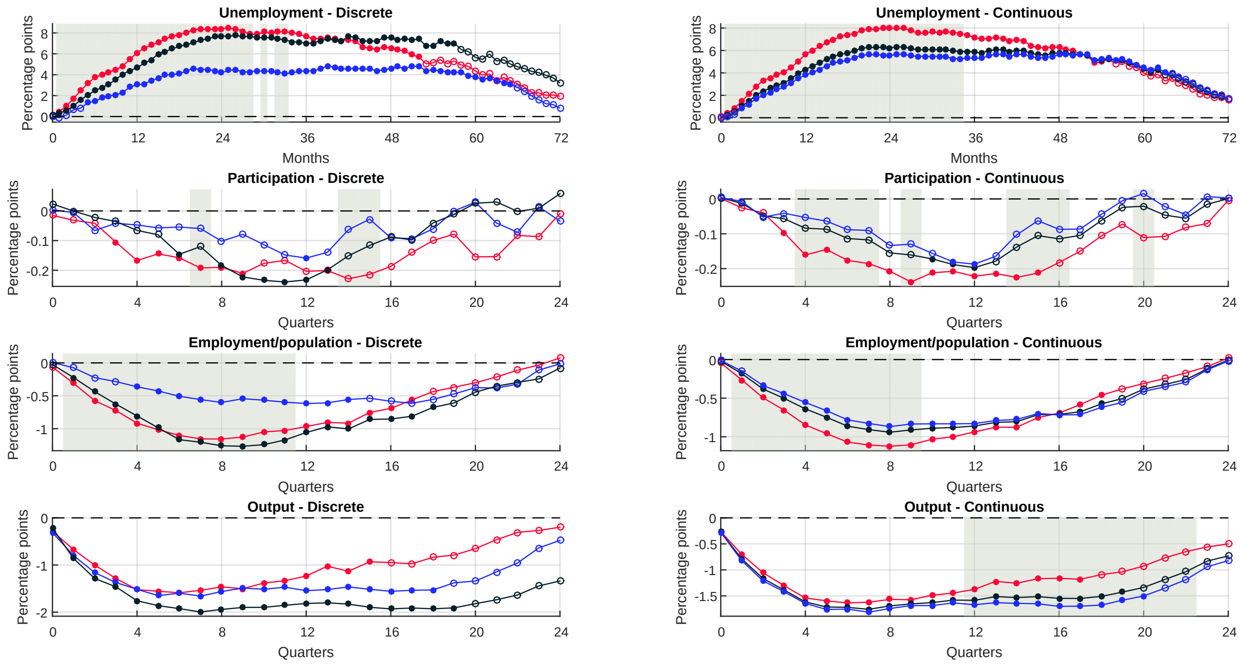
Notes: The IRF for strict EPL regime is presented in blue, the IRF for the lax EPL markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05).

Figure 3: Impulse Response Functions to EBP Shock - by EPL Regime Using a Continuous Specification



Notes: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value ≤ 0.05) in the shaded horizon.

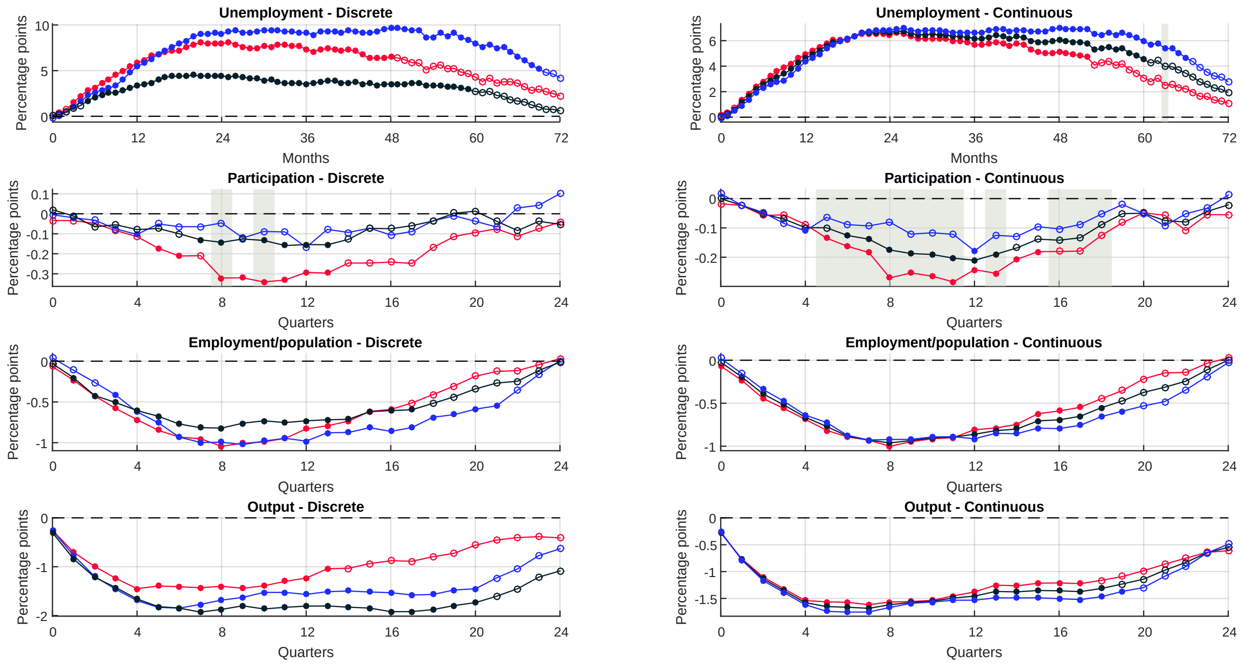
Figure 4: Impulse Response Functions to EBP Shock - by Difficulty of Dismissal



Notes fo discrete specification: The IRF for strict policy regime is presented in blue, the IRF for the lax policy markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05).

Notes fo continuous specification: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value ≤ 0.05) in the shaded horizon.

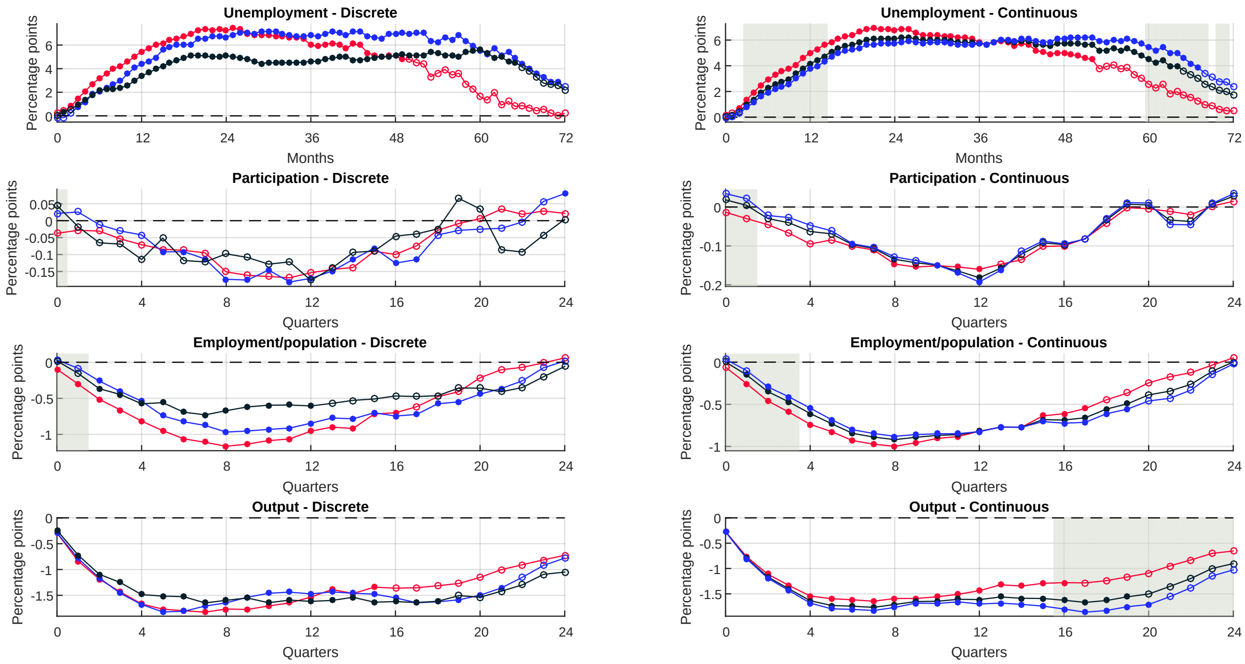
Figure 5: Impulse Response Functions to EBP Shock - by Length of Notice



Notes fo discrete specification: The IRF for strict policy regime is presented in blue, the IRF for the lax policy markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05).

Notes fo continuous specification: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value ≤ 0.05) in the shaded horizon.

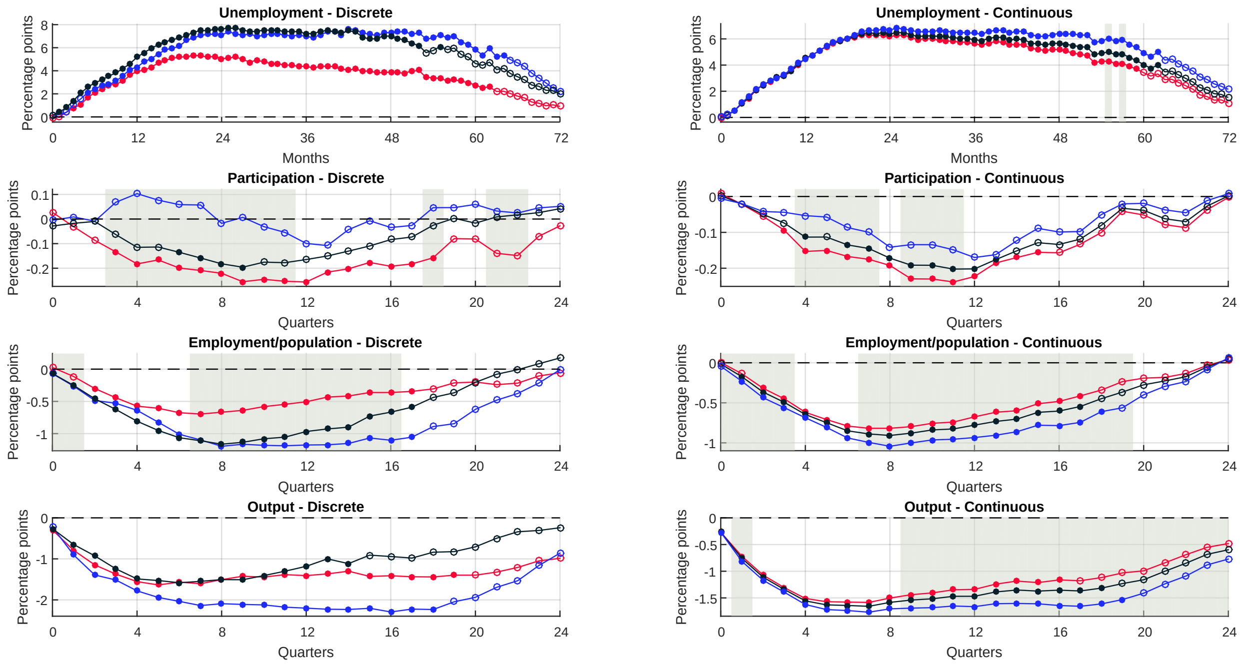
Figure 6: Impulse Response Functions to EBP Shock - by Procedural Inconvenience



Notes fo discrete specification: The IRF for strict policy regime is presented in blue, the IRF for the lax policy markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value $\leq$ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value $\leq$ 0.05).

Notes fo continuous specification: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value $\leq$ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value $\leq$ 0.05) in the shaded horizon.

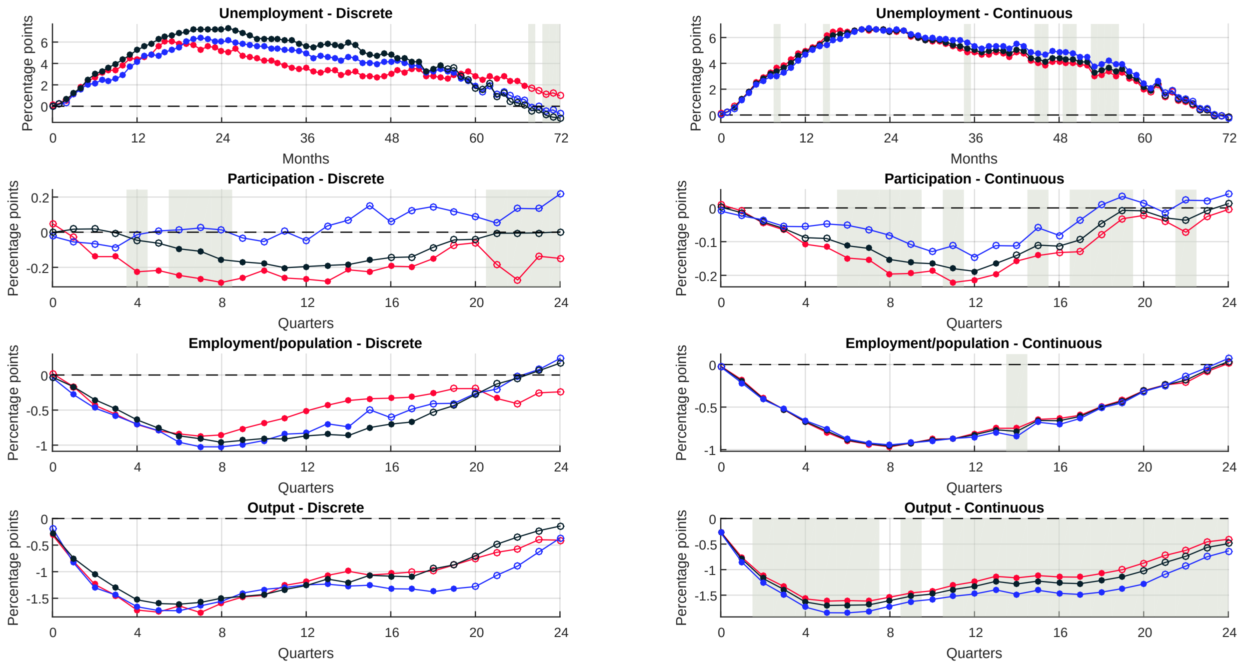
Figure 7: Impulse Response Functions to EBP Shock - by Severance Pay



Notes fo discrete specification: The IRF for strict policy regime is presented in blue, the IRF for the lax policy markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05).

Notes fo continuous specification: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value ≤ 0.05) in the shaded horizon.

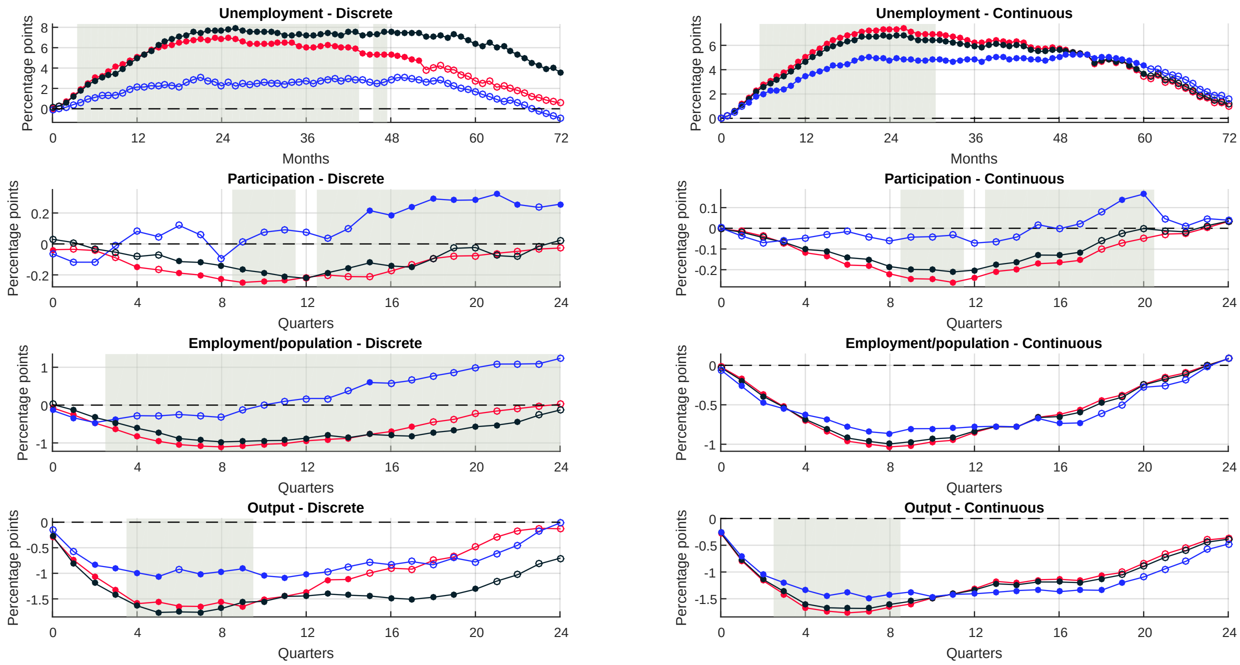
Figure 8: Impulse Response Functions to EBP Shock - by Protection From Collective Dismissals



Notes fo discrete specification: The IRF for strict policy regime is presented in blue, the IRF for the lax policy markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05).

Notes fo continuous specification: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value ≤ 0.05) in the shaded horizon.

Figure 9: Impulse Response Functions to EBP Shock - by Temporary Employment Protection



Notes fo discrete specification: The IRF for strict policy regime is presented in blue, the IRF for the lax policy markets in red and the middle two quartiles in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05).

Notes fo continuous specification: IRF for strict EPL regime (75th percentile) is presented in blue, the IRF for lax EPL regime (25th percentile) in red, and the 50th percentile case in black. Full data points represent horizons at which the point estimate for the total impulse response is statistically significantly different than zero (p-value ≤ 0.05), and the shaded areas indicate that the interaction term between the shock and EPL is statistically significantly different than zero (p-value ≤ 0.05) in the shaded horizon.