Employment Protection Legislation and Economic Resilience: Protect and Survive?*

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Abstract

Employment protection legislation (EPL) policies are in use throughout the developed world but their role in the transmission of macroeconomic shocks into the real economy is mostly unstudied. Using EPL data for a panel of 21 OECD economies, we carry out a quasi-natural experiment which utilizes global credit supply shocks, especially the large ones observed in the recent financial crisis, to study this role within a non-linear, state-dependent panel fixed-effects local projections framework. We show that strict EPL is associated with a weaker response of the labor market to an adverse global credit supply shock in the initial phase of the cycle, but subsequent to this phase a much stronger and more persistent decline in real output takes place. The stronger output decline can be mostly explained by a stronger fall in aggregate total factor productivity (TFP) and factor utilization, where the differential fall in the latter occurs after that in the former, suggesting that increased factor misallocation can be a potentially important mechanism underlying the fall in TFP.

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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 EPL strictness on unemployment, broadly finding inconclusive results both in theory and in the data.[1]

From an empirical standpoint, a largely understudied aspect of the potential implications of EPL for macroeconomic performance is the nature of its effects on resilience to macroeconomic shocks in terms of real activity. 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.[2] Accordingly, our research question is as follows: does EPL strictness have a bearing on an economy's resilience to macroeconomic shocks? Notably, we study this question with empirical tools that allow us to examine the amplifying- or dampening-nature of EPL for macroeconomic shocks' effects in both the recessionary phase as well as the recovery phase of the shock-driven cycle.

The objective of this paper is to fill the empirical gap in the literature. We conduct a thorough empirical examination of the effects of the strictness of EPL on the way in which economies respond to macroeconomic shocks. Toward this end, we employ EPL, labor market, and national accounts data in a panel of 21 OECD economies for 1985-2013 and estimate state-dependent impulse responses to the global credit supply shock series from Gilchrist and Zakrajek (2012).[3] This shock series serves as an arguably exogenous

[1]See Boeri and van Ours (2013) and Holmlund (2014) for a good overview of this literature.

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

[3]Gilchrist and Zakrajek (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 Zakrajek (2012) show that their spread measure has better predicative power for macroeconomic variables than more standard credit spread mea-

and common global credit supply shock to the countries in our sample, whose large realizations in the recent financial crisis make it particularly appealing for studying the role of EPL in affecting economic resilience.

We utilize a non-linear, state-dependent identification strategy to study whether the effect of global credit supply shocks differs across EPL regimes. This is accomplished via an implementation of the Jorda (2005) local projections approach in a fixed-effects panel set-up so as to be able to directly estimate state-dependent impulse responses to global credit supply shocks. Our empirical findings can be summarized as follows. Strictness of EPL causes labor markets to be less responsive to an adverse shock in terms of unemployment, employment to population ratio, and labor-force participation for about a year and a half after the shock, with no other differential response pattern present in the goods market during the first year following the shock. After the first year, economies under a stricter EPL regime start to exhibit a significantly stronger decline in terms of real output. This relative drop in real output is not only persistent, statistically significant, and robust to various choices of specification and samples, but also sizable in magnitude, peaking at a difference of 2.4% of cumulative real output growth after five years following a one standard deviation adverse credit supply shock.

To better understand the mechanism underlying our output-based results, we use data on total factor productivity (TFP) and factor utilization and show that the stronger output fall can be largely explained by a significantly stronger decline in both TFP and factor utilization. Since our TFP measure is unadjusted for factor utilization changes and the differential drop in utilization takes place only after that in TFP occurs, we infer that a potentially important channel for explaining the TFP differential decline lies in increased factor misallocation taking place in the strict EPL state.[4] Specifically, our results indicate

sures such as the Baa-Aaa Moody's bond spread.

[4]Underlying this factor-misallocation based interpellation is the assumption that technology is unaffected by credit supply shocks, which is what the literature on the TFP channel of credit supply shocks

that the stronger output decline in the first 3 years after the shock can be explained by a factor-misallocation-induced TFP decline, whereas the subsequent two-year differential output fall seems to be mostly driven by a corresponding differential drop in factor utilization.

We conclude our analysis by examining under the same methodological framework the effects of both alternative forms of EPL relative to our baseline measure as well as other labor market institutions. This examination leads us to believe that none of the other institutional factors we have examined would influence cyclical dynamics in a similar fashion. Surprisingly, stricter protection for temporary employees causes a persistent dampening effect on the initial decline in real output.

The paper proceeds as follows. Section 2 reviews key results and concepts from the literature. We then describe the data in Section 3, after which our identification strategy is presented in Section 4. Section 5 presents that main empirical evidence of this paper and is followed by a robustness analysis for our main result, the relative decline in output, which we present in Section 6. The final section concludes.

2 Literature Review

2.1 EPL - Definition

The literature on EPL has mostly defined it as consisting of 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

normally assumes (see, e.g., Buera et al. (2011), Pratap and Urrutia (2012), Petrosky-Nadeau (2013), Khan and Thomas (2013), Buera and Moll (2015), Buera et al. (2015), Gopinath et al. (2017), Buera and Shin (2017), and Manaresi and Pierri (2017)).

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 modeling 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 features can be viewed narrowly as a tax that firms must pay as a result of termination. However, if these features cause a firm to employ a larger personnel management department and increase ongoing legal expenses as a provision against claims of wrongful termination, then EPL alters the firms' optimization problem in a non-trivial way. The macroeconomic implications of EPL are further influenced if we consider its effects on the behavior of employed and unemployed individuals and their choices regarding future employment or separation.

2.2 The Direct Effects of EPL

The first to directly model EPL 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 in a partial equilibrium setting with perfect foresight. This model demonstrates that the cost of terminations causes firms to employ less during the expansionary part of the cycle and to employ more during the recessionary cycle. This straightforward result gives rise to an interesting trade-off: on the one hand, firms are producing in a less efficient manner under a strict EPL regime causing a welfare loss; on the other hand, individuals are more likely to experience more job stability within such a regime.

A significant amount of attention has been focused on labor 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; and third, as a result of these first two parts, the effects on unemployment itself remains ambiguous. The effects of EPL on flows is studied also in Garibaldi (1998), Bentolila and Bertola (1990), and in Messina and Vallanti (2007). These works attempt to uncover the implications of EPL within the context of European labor markets and describe a smoothing of labor 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. Using data from a large Italian bank, Ichino and Riphahn (2005) find that increased employment protection reduces workers' effort, as measured by increased absenteeism. Kahn (2007) finds that strict EPL lowers the relative probability of youths, immigrants, and women to be employed, and that strict EPL also increases the relative incidence of temporary employment among those groups. Lastly, from a production function standpoint, Cingano et al. (n.d.) find evidence suggesting that strengthening EPL induces a trade-off between labor and capital in the production process and increases average tenure of employees, thus raising the level of job-specific human capital used in production.

2.3 EPL and Economic Resilience

While the question of how labor market institution in general and EPL in particular influence cyclical dynamics 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), and Bertola (1999)), 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 regarding the relationship between EPL and macroeconomic variables' sensitivity to shocks. The few papers that have looked at this relationship 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 regresses employment responsiveness to expansions and recessions on EPL in a panel of 20 OECD economies and finds that stricter EPL reduces employment responses in both phases, in line with theoretical predictions. Using firm-level data from manufacturing and non-manufacturing industries of 14 European countries, Messina and Vallanti (2007) regress job flows on the interaction between the phase of the cycle and EPL and find that stricter EPL dampens the response of job destruction to the cycle, thus making job turnover less counter-cyclical. Duval and Vogel (2008) examine the differences in economic resilience between OECD countries by defining economic resilience in terms of output-gap sizes over the course of a cycle, i.e., the severity of recessions and the duration of recovery, demonstrating that strict EPL is positively and significantly contributing to the persistence of shocks while it dampens the force of impact. Later works from more recent years have focused on the implications of EPL for macroeconomic volatility, generally finding limited importance of EPL for volatility (see, e.g., Rumler and Scharler (2011) and Gnocchi et al. (2015)).

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: TFP; real interest rate; and the measure of labor demand shifter from Blanchard (1997).[5] 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.

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 the resilience of the real economy.

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 Data

Measuring Strictness of EPL. 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

[5] 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.

as in the OECD's indices), where these scales are aggregated according to predetermined weights.[6]

The OECD's database of EPL includes several such indices, differing in terms of their coverage:[7] regular employment, temporary employment, and individual or collective dismissals. Generally speaking, the panel of these indices exhibits very small time variation, as opposed to relatively large cross-sectional variance.[8] Since our focus in this paper is mainly employment protection on regular employees, we chose as our EPL measure the index 'Strictness of employment protection - individual dismissals (regular contracts)' (EPR V1).[9,10] The EPL runs annually from 1985 to 2013.

One can make the claim that the abstraction from other forms of EPL is problematic. However, the EPL measure we use is arguably the most superior for our purposes given that it corresponds to the labor market environment in which most of the agents operate. More specifically, 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 that have a legally binding relationship

[6] A critique of this measurement method and its limitations can be found in Myant and Brandhuber (2016).

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

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

[9] See Table A1 for the break-down of the index to its components and the data that composes each.

[10] Data for this EPL index is also available annually for 1960-2004 in a database created by Nickell (2006). However, the 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 EPL 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 sample, we chose, for the sake of consistency, to rely on the OECD's index instead of utilizing a mixed measurement methodology.

with their employers, of which regular employment still is the most frequently used form of employment. (The average share of temporary workers of total dependent workers i.e, the sum of temporary and regular workers, for our sample is 12%.[11]) Furthermore, in Section 6.2 we analyze the effects of other forms of EPL, i.e., protection of temporary workers and the issue of collective dismissals. We find evidence that suggests that these forms of EPL have different cyclical implications than those of regular employment protection, thus supporting supports our initial decision to address them as separate institutions.

Notably, any EPL index is composed of 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 ordinal variables. This point stresses the importance of using our dummy, order-preserving based identification approach as opposed to using continuous interactions in our estimations. Specifically, one could possibly conceive of an order-preserving non-linear transformation of the EPL components which would reflect the same order of ranking but would change the results of a continuous-interaction-based regression analysis. Nevertheless, the conventional treatment of the EPL index has largely been 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 our knowledge, are studies which consider only the cardinal elements of EPL such as months of notice and months of payment offered as severance pay and ignore the regulatory environment as in Lazear (1990), or studies that focus on correlations and utilize the Spearman correlation coefficient as in Gnocchi et al. (2015).

[11]We computed this average share from OECD data available at https://data.oecd.org/emp/temporary-employment.htm.

Outcome Measures. In order to examine the implications of EPL for macroeconomic resilience, we have created a panel containing the following variables:[12] Key labor market variables: unemployment, employment to population ratio, and labor force participation rates; National accounts data (all in real terms): output,[13] consumption, investment, government expenditure, imports, and exports; our shock variable, EBP, which will be discussed shortly; and our state variable, the EPL index. We use data from 21 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 on the LHS of the regressions and as log-first-differences when controlled for in lags on the RHS of the regressions. We use the dependent variables in log cumulative changes in order to properly compare movements in a variable between different countries with different steady state levels.

As the shock variable in the analysis that follows we will use the EBP (Excess Bond Premium) measure from Gilchrist and Zakrajek (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

[12] For further details and information on the data used in this paper see Appendix A.

[13] We use output and not output per-capita for two reasons: First, to be consistent with the other national accounts data that are available only without such normalizations; and second, due to data availability, for output we have 2,420 quarterly observations while for output per-capita only 1,774 such observations are available for the same countries and time-frame. In Section 6.1 we show that our results are robust to using this choice of measure.

[14] We use monthly data for unemployment and quarterly data for the rest of our variables of interest; all data are seasonally 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.

[16] All OECD data were retrieved from `http://stats.oecd.org/`; for exact details see Appendix A.

variable which was calculated specifically for every one of the economies we use in our analysis. That said, the increasingly global nature of the world economy means that EBP can be interpreted as a global shock variable within the framework of our analysis.

4 Methodology

We follow the class of state-dependent specifications that use the local projection method from Jorda (2005) to estimate impulse response functions and adapt it to a state-dependent setting as the one employed in Auerbach and Gorodnichenko (2012), Owyang et al. (2013), Ramey and Zubairy (2017), and Tenreyro and Thwaites (2016). The major advantage of this identification method is that 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.

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 regime in place; too many groups will limit sample sizes severely, while too few will not enable differentiation. In order to allow for sufficient differentiation, we use the following groups: first, the lower quartile of EPL distribution as a measure of a lax EPL state; second, the upper quartile of EPL distribution as a measure of a strict EPL state; and third, the rest of the observations (i.e., the interquartile range of the EPL distribtuion) as the measure of intermediate EPL. This kind of grouping allows us to identify differential effects across strict, intermediate, and lax EPL, where our interest lies mainly in looking at the difference between strict and lax EPL given that this gap reasonably captures a sufficiently large differentiation between EPL regimes for picking up any true effects in the data.

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

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

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

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 $C_{i,t-4}$ that take the value of one when the EPL regime is lax, intermediate, or strict as we defined above. 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.[18]

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

[17]In order to correctly adopt a state-dependent model for panel data, we must refer to a form of normalized changes in variables for these changes to be commensurable between countries. 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 log-cumulative-difference 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, i.e., $A_{i,t-12}$.

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 the log-first-difference of the outcome variable 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 variance. Note that a separate regression is estimated for each horizon. We estimate a total of 21 regressions for our quarterly frequency specification (and 61 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 5 years following the shock.

Our form of state-dependence is slightly different from the conventional one (see, e.g., Ramey and Zubairy (2017)) which usually uses a binary state variable. Our identification utilizes a more refined measure of order by breaking down the raw EPL measure into 3 different ordered EPL regimes. If EPL's strictness indeed causes a change in the response of a certain variable then we would expect to see that its responses to the shock across EPL regimes will maintain an ordered pattern, i.e., $\beta^h_A > \beta^h_B > \beta^h_C$ or $\beta_A h < \beta^h_B < \beta^h_C$. Section 6.1 conducts an analysis of the results robustness to the choice of cut-off values to assure that our results are insensitive to alternative cut-off values.

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

5 Empirical Analysis

In this section we perform an empirical analysis of EPL's implications for economic resilience, utilizing the aforementioned identification method. Section 5.1 presents our results, with the subsequent Section 5.2 presenting a more in-depth examination of the causes behind the effect on real activity.

5.1 EPL's Resilience Implications

We estimate the state-dependent specification described in Equation (1) for output, consumption, investment, government expenditure, imports, exports, the real wage, the stock of vacancies, employment to population ratio, labor-force participation and unemployment. The estimation results are presented in Figures 1 and 2, where the responses of economies under a strict EPL regime are shown in blue, those of economies under a lax regime in red, and the intermediate regime responses are presented in black.

Regardless of the EPL state, the credit supply shock causes the expected dynamics, i.e., an increase in unemployment and a decrease in real activity measures (most importantly, a decrease in real output, consumption and investment). Our interest lies in the differences of responses across the policy regimes, which are indicated by the shaded areas in Figures 1 and 2.

Labor Market Outcomes. The first form of differential response to arise between regimes is in the labor market and is presented in Figure 1. Being in a lax EPL state produces an immediate increase in unemployment and a decrease in employment while being in a strict EPL state generates no significant changes in unemployment until a year after the shock and no statistically significant decrease in employment at all horizons. After about 4 years, the differential response of unemployment and vacancies significantly reverses, with the former (latter) rising (dropping) more in the strict EPL state relative to the lax state. This reversal is largely consistent with the notion that employers in the strict EPL state find it more costly to hire workers in the shock-driven recovery phase (see, e.g., Nunziata (2003)). Another difference observed across EPL states is that labor-force participation is adversely affected by the shock in the lax EPL state while being in the strict EPL state produces no such effect.[20] Notably, all the above-mentioned differential response patterns during the first year of the shock-driven cycle occur without any significant differential responses in real activity.

Real Activity. The second form of differential response is the response of real activity measures presented in Figure 2. One year after the shock, we begin to see that real output starts to decline more in the strict EPL state than in the lax EPL state. This gap in output is steadily widening and starts to be significantly different from zero from the 7th quarter onwards. This gap in output translates to a relative cumulative output loss of 0.75% after 2 years, 1.31% after three years, 2.18% after four years, and peaks at 2.40% after five years.[21] Later, in Section 6.1 we will show that this response pattern is robust to cut-off values' selection, lag order selection, and alternative sample and output measure choices.

The other measures of real activity do not exhibit any statistically significant differential response pattern until at least two years after the shock. Consumption starts to decline in a significantly differential fashion from the 9th quarter onwards. For investment a significant differential decline occurs from the 11th quarter onwards. Imports fall differentially from the 10th quarter onwards quarters whereas exports begin to decline

[20]The effect on participation could be interpreted from a structural standpoint as being driven by the relatively higher value of the job-seeker from a future match with an employer, anticipating a longer employment period.

[21]We present all our results for a five year horizon. However, to test that this effect does not grow further in magnitude, we estimated the corresponding difference after six years to be 1.55% using the same methods explained above.

differentially after 5 quarters, but only until the 7th quarter and then again after 12 quarters up to the 15th quarter (and at somewhat lower confidence levels relative to the other variables, with p-values always exceeding 5%). These differential responses all occur in the same direction as that of output's response, i.e., being in a strict EPL state generates a stronger decline in all these real activity measures relative to being in the lax EPL state. It is noteworthy that these differential responses all occur in the absence of any persistent significant changes in the real wage in all EPL regimes with similarly weak responses of government expenditures.

The sequence of differential responses presented so far suggests the following: First, there is a different labor market response across EPL policy regimes that causes the strict EPL state to experience smaller changes in employment as a result of the shock. Second, being in a strict EPL state causes a stronger decline in output although inputs are less affected by the shock, giving rise to what at first seems like a contradiction. The difference in output response across the policy regimes is too strong to be explained solely by changes in inputs at any point in time. The differential response of investment would not be able to account for any significant diminution in the capital stock available for production until at least three years after the shock, and even then the differences are not strong enough to explain the differential output response by themselves.[22] This means that it is more likely that this difference in capital stock response arises from the earlier differential decline in overall real activity. If we look at employment to population ratio as a measure of the labor input in production, we observe no differential response after the first two years meaning that something else must be driving these response patterns in output. We now turn to an investigation into the potential root causes of output's differential

[22]To illustrate, if we were to assume a 10% annual depreciation rate of the capital stock, and use the exact cumulative changes in investment presented in Figure 2, assuming that both EPL groups begin from the same level of steady state capital stock, the differences between the capital stock in the strict and lax policy regimes will be less than 0.1% for the first three years of the cycle, 0.54% for the fourth year and 1.07% for the fifth one.

response.

5.2 Explanations for the Differential Response of Output

As explained in the previous paragraph, the form and strength of the differential output responses we have estimated cannot stem from the differences in investment or from the changes in employment to population ratio, in turn leading us to further examine the behavior of inputs in the production function. The analysis that follows is driven by the following considerations: First, are we accurately accounting for the labor input? And second, are we taking into account all the relevant parts of the production function that could explain the differential responses in output across EPL states?

To account for a better measurement of labor input, we use data on actual hours worked. Notwithstanding the longer, annual frequency of this series, using it has the potential of better measuring true variation in input quantity than relative to using the number of employed persons. Next, if we consider a generalized production function then output will be determined by raw inputs' quantities, the degree to which they are utilized, and the level of TFP. With these two observations in mind we add to our panel data on total hours worked and TFP, both available from the OECD's databases at an annual frequency, as well as data on capacity utilization available at quarterly frequency from the same source.[23] Using these additional data series, we conduct the same estimation procedure for the impulse response functions of these three variables again conditioning on the initial regime of EPL in place.[24]

The results from this exercise are shown in Figure 3. The most significant result we obtain is that TFP declines in a strict EPL state while under a lax regime TFP is not affected

[23]Detailed description of the data series used can be found in Appendix A.

[24]For variables of an annual frequency, we use 2 lags of annual values in estimation, meaning that in Equation (1) $L = 2$.

by the shock in a statistically significant way. This difference in TFP responses is sizable, peaking at 0.79% after three years, and statistically significant. There is a smaller initial decline in hours worked in the lax EPL state that lasts only for the first year after the shock.

Capacity utilization, which can be thought of as a proxy for factor utilization, behaves in a significantly differential manner that can at least in part also account for the differential output response. Overall, across all 3 EPL states, we see that the beginning of the cycle is associated with a decrease in capacity utilization. However, the persistence of the decline in utilization is varying according to the initial state of EPL. After 10 quarters we see a diverging pattern of recovery that is significant from about 3.5 years after the shock onwards, with the associated response difference peaking at 1.71% after 17 quarters.

Taken together, the results from Figure 3 indicate that the smaller, immediate decline in effective inputs in the strict EPL state is followed by a decline in TFP which, in turn, leads to the stronger relative drop in real output. This amplification mechanism further enhances the cycle's strength, contributes to its persistence, and leads to a slower recovery of the economy. Importantly, since our TFP measure is unadjusted for factor utilization changes and the differential drop in utilization takes place only after that in TFP occurs, and assuming that credit supply shocks do not move technology (see Footnote 4), we can infer that a potentially important channel for explaining the TFP differential decline lies in increased factor misallocation taking place in the strict EPL state. More generally, our results indicate that the stronger output decline in the first 3 years can be explained by a factor-misallocation-induced TFP decline, whereas the subsequent, further two-year differential output fall seems to be mostly driven by a corresponding differential drop in factor utilization.

5.3 How to Structurally Interpret Our Results?

How does standard theory align with respect to our findings? According to contemporary theory there should be an increase in the utilization of a factor of production as a result of a decline in its quantity. Assuming increasing marginal costs to utilization, this simply means that firms will adjust the desired effective quantity of an input along the most flexible and least costly margin. An example for this kind of substitution between an input and its utilization can be found in the model from Christiano et al. (2005) with respect to capital, where the utilization rate is determined by the rental rate of capital. An adverse shock that would lower capital stock, other factors held equal, would increase its marginal product and lead to a higher rate of capital utilization via an increase in the rental rate.[25] When we apply this rationale for the capital stock to our results, then after about three to four years following the shock the drop in investment should start to translate into a decline in the stock of capital, which should in turn drive capacity utilization up. Taking into account that investment drops more severely in the strict EPL state, theory suggests that capacity utilization should increase more in this state, while in practice the converse is true. This means that some other mechanism is lowering the marginal product of capital under strict EPL, which in turn lowers utilization; our results can serve as a guide for model builders in trying to uncover this structural mechanism. While it is beyond the scope of this paper to try to build a structural model that is consistent with our results, we note here that perhaps introducing adjustment costs to factor utilization itself may produce the somewhat delayed differential fall in utilization relative to the one observed for TFP, to which we now turn our discussion.

The reason that leads us to regard EPL-related misallocation as a potential cause of the TFP decline which precedes the drop in real activity is the empirical evidence linking

[25] See Equation (3.35) from Section 3.3.4 in Christiano et al. (2005).

EPL and factor misallocation in general. Caballero et al. (2013) find that stricter EPL with respect to dismissal regulations is linked to a lower speed of adjustment to shocks which in turn lowers productivity growth, a process which they connect to Schumpeter's idea of 'creative destruction'. Using a difference in differences estimation and industry level data, Bassanini et al. (2009) show that EPL strictness is associated with a lower productivity growth rate and that this effect is due to the binding limitation on termination which may lead to a lower change in aggregate productivity unless the market is extremely centered around industries for which terminations are not the primary source of turnover. Petrin and Sivadasan (2013) find from plant level evidence in Chile's manufacturing industry that there is reason to believe that changes in severance pay are responsible for an increase in the gap between the value of the employees' marginal product and their wage. This gap measures in fact the allocation inefficiency, which means that the introduction of stricter termination regulations in Chile may have induced an increase in factor misallocation. The work of Lashitew (2016) provides further support to this claim by using plant-level data to show that there is a link between EPL strictness and factor-misallocation-induced productivity losses.

Taking into account the above relationship between EPL, TFP, and factor misallocation, our results introduce a new and important potential mechanism underlying the EPL-dependent response of economies to credit supply shocks. In particular, they lead to the conclusion that when a strict EPL economy experiences an adverse shock, there would be enhanced input misallocation which in turn would lower aggregate TFP and drive down real output. The recovery from such a shock is likely to be slower owing to this amplifying effect.

6 Robustness

This section examines the robustness of our main result, the differential response of output, from two perspectives. First, we analyze the robustness of the output response across EPL states to various alterations of our baseline specification: cut-off value selection for defining the EPL states, lag order selection, and alternative choices of output measure and samples. Second, we examine the causal interpretation of our central result by testing if determining the policy regimes according to other labor market institutions results in similar pattern of response.

6.1 Output's Response to Credit Supply Shocks Conditional on EPL

Cutoff Values. Our identification strategy hinges upon the initial state of an ordered variable. Any strategy of this kind would be potentially sensitive by design to the choice of cutoff values. In order to assure that our results do not arise form a specific choice of cutoff values, but indeed from a change in the intensity of the policy variable, we preform the same estimation routine described by Equation (1) with the only difference being that we now use different percentile values for the state dummies. Specifically, we assign the state of strict EPL to the top 5, 10, 15, 20, 30, 35, 40, 45 percentile values of the EPL index distribution, and the corresponding bottom percentile values to the state of lax EPL, where the remaining residual percentile range continues to cover the intermediate EPL state. Note that as the cut-off value increases, the number of observations assigned to the intermediate EPL state decreases while the number of observation assigned to the two extreme states of the distribution increases.

The results from this exercise are shown in Figure 4. For comparison purposes, we also include in this figure the results from the baseline estimation where the upper and lower quartiles are used to define the strict and lax EPL states, respectively. The results from Figure 4 indicate that the differential response pattern of output is robust to cutoff value selection as in all cutoff value specifications a significantly stronger output fall takes place in the strict EPL state. Specifically, in all cutoff value specifications but the 5th and 10th percentiles, which offer a relatively low sample size for the strict and lax states, there are significantly different than zero differential responses in output starting between 1 quarter to 5 quarters after the shock. Even in the 5th and 10th percentile cutoffs the significant differential response pattern is present and takes effect from the 13th or 14th quarter onwards. Moreover, for every cutoff value of choice except the 45th percentile value, the response magnitude is ordered according to the initial state of EPL strictness with the decline being greater the stricter the EPL state and the difference across states is quantitatively similar. The 45th percentile value offers the smallest intermediate group and it is therefore expected that responses in the intermediate EPL state would behave in a more erratic fashion using this cutoff value than the other ones.

Lag Order Selection. In order to prevent endogeneity, we must use a lagged value of the state dummies. Due to our assumption that EPL does not change within the same year, we must therefore include at least more than one year of lagged values in each estimation. Since the results may by influenced by the specific lag specification choice, we test their robustness by choosing a smaller lag order than our baseline of $L = 8$ resulting in a more parsimonious model specification. In Figure 5 we present the impulse responses of output to an increase in EBP for lag orders of 5, 6, and 7, which results in no meaningful change in the differential response pattern's magnitude or statistical significance.

Alternative Measure of Output. As mentioned earlier, we use output instead of output per-capita in order to be consistent with the components of output in our baseline estimation and due to the sizable difference in sample sizes between the two series. Figure 5 also presents the results from using output per-capita instead of real output and shows that the differential response pattern is robust to using this choice of output measure and that the ordered response magnitude and the statistical significance of the results are similar across the different lag specifications.

Excluding the Global Financial Crisis Period and the U.S. Our choice of EBP as a shock variable is naturally based on its large realizations in the 2008-2009 financial crisis period as these facilitate identification. However, one could ask if our identification strategy does not capture merely the implications of this particular crisis, with its unique characteristics and implications for the European markets (most of which have rather strict levels of EPL), thus limiting the ability to draw reliable policy implications from it.

In order to test if our results are indeed sensitive to the exclusion of the global financial crisis we repeat our estimation while excluding all observations from 2008:Q1 onwards from the sample. It is noteworthy that this exclusion is likely to lower the significance of any result because we exclude more than 20% of our original sample which also consists of the large adverse credit supply shock realizations associated with the global financial crisis of 2008-2009.

Additionally, the global crisis has started in the U.S. which may have caused the U.S. economy to respond differently from the rest of the world, not as a result of its labor market policy but because it had experienced the crisis in a different fashion. Thus, we wish to test if the inclusion of the U.S. in the original sample affects our results by estimating the specification from Equation (1) using a sample that excludes the U.S.

The results of the above two tests are also presented in Figure 5. We find that the differential response pattern is present and statistically significant for these two specification tests as well, supporting our conclusions regarding the structural implications of EPL.

6.2 Other Forms of EPL and Other Institutional Factors

Our interest in EPL stems from its cyclical implications. However, since the baseline measure of EPL is based on regular employment protection, it may be the case that our lacking of temporary workers and collective dismissals has a bearing on our empirical analysis. 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 regulatory measures distinct from EPL for regular employees that 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 implications, 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 section.

Not only other forms of EPL, but also additional labor market institutions may generate differential response patterns in output that may limit our ability to attribute a causal or structural interpretation to our results regarding EPL. Thus, we find it desirable to carry out the same identification procedure for state-dependent impulse response functions using the other forms of EPL and other labor market institutions mentioned above as state variables.

With this aim in mind, we add to our panel institutional data regarding temporary employment protection, employment protection from collective dismissals, union density, and collective bargaining coverage for the relevant countries and time periods[26] and estimate the state-dependent specification given by Equation (1).

Results for this estimation are shown in Figure 6 for the state-dependent responses

[26] See Appendix A for detailed descriptions of the data series used.

of real output. Union density does not generate any ordered response pattern or statistically significant differential response of output between the two extremes of the policy distribution. Collective bargaining coverage yields a differential response pattern only for the fifth year of the cycle. Prior to the fifth year, the EPL state variable does not generate differential responses that are either statistically significant or of the same order of magnitude as does our baseline specification using regular employment EPL. Protection from collective dismissals indicates that the two extremes of the distribution do respond differently with the strict protection policy group exhibiting a slightly stronger output response. However, the intermediate policy strictness group responds much stronger than the lax and the strict groups, which may indicate a non-linear effect on output that is different from the one we estimate using our baseline EPL measure.

Employment protection on temporary workers (EPT), on the other hand, generates a significant differences in responses. However, this time, the strict policy group is associated with a milder response of output to the shock. Being in the strict EPT state exhibit a significantly weaker response of output than the lax and intermediate policy states, but this time the differential response pattern is only significant from the impact horizon until about the two-year horizon. This response pattern is in the opposite direction to the one we have estimated for our baseline EPL measure, which may suggest that EPT is responsible for an alternative channel of shock transmission than that of EPL, i.e., a short-run shock absorbing mechanism associated with a smaller decline in real activity in the shock-driven recessionary cycle.

Although temporary employment is not the main focus of our analysis, its effects as an alternative form of employment protection are intriguing, and in light of our results' strength we believe that this issue deserves some discussion. The share of temporary workers of the total number of dependent employment is not large. On average, for the time frame of our sample, temporary workers consist about 12% of the total number of wage and salary workers.[27] 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 (see, 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 by no more than 1% to a one standard deviation credit supply shock, it is possible that most of the adjustment in inputs comes from temporary workers. (While it is beyond the scope of this paper to further explore the role of EPT as a shock absorber, we view our initial evidence on it as motivation for future work aimed at uncovering and studying the mechanisms underlying our EPT-based results.)

7 Conclusion

This paper has examined the relation between EPL and economic resilience using a state-dependent local projections based identification strategy within a panel fixed-effects setting. Our findings indicate that EPL strictness has the capacity to act as an amplifier to macroeconomic shocks. While diminishing the decrease in employment following an adverse credit supply shock, it severely hinders the recovery of real output to pre-shock levels. This sizeable and robust relative decline in real activity seems to arise from an input-misallocation-induced TFP decline that is present in the strict EPL state and is absent in the lax EPL one.

From a policymaking standpoint, our results indicate that relaxing EPL measures for the termination of regular employees may allow a faster recovery of real output in times of recessions. Our findings with regard to other institutional factors suggest that the ef-

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

fect on output recovery stems from this particular form of protection and that protecting temporary employees may, in fact, produce a similar effect to that of relaxing regular employment protection measures. From a theoretical standpoint, the results of this paper may prove of value for model builders in the construction of structural models that can accommodate the type of link between EPL, TFP, and varying factors' utilization conditional on a shock-induced business cycle.

Appendix A Data

A.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 several different scores 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. The method of calculation is shown in Table A1. The series is 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 OECD series of employment protection from collective dismissals which is an aggregate of scores on the definition, procedures and costs involved with collective dismissals according to the OECD's predetermined weights.

Sample. Our panel for these variables includes the EPR V1, and EPT V1 indicators' values for the years of 1985-2014 for 21 countries during 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; Denmark 1985-2013; Finland 1985-2013; France 1985-2013; Germany 1985-2013; Greece 1985-2013; Ireland 1985-2013; Italy 1985-2013; Japan 1985-2013; Netherlands 1985-2013; New Zealand 1990-2013; Norway 1985-2013; Portugal 1985-2013; Spain 1985-2013; Sweden 1985-2013; Switzerland 1985-2013; United Kingdom 1985-2014; United States 1985-2013.

Table A1: EPL - Components and Weights.

EPL index	Weights	OECD main series	Weights	OECD basic series
EPR v1 - regular contracts	33.3%	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	14.3%	Length of the notice period at 9 months tenure
			14.3%	Length of the notice period at 4 years tenure
			14.3%	Length of the notice period at 20 years tenure
			19.0%	Severance pay at 9 months tenure
			19.0%	Severance pay at 4 years tenure
			19.0%	Severance pay at 20 years tenure
	33.3%	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 the OECD and retrieved from http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm.

A.2 Credit Supply Shock.

Variables Definition. To measure global credit supply shocks, we make use of the Gilchrist and Zakrajek (2012) credit supply shock series. Gilchrist and Zakrajek (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 [28] is our measure of credit supply shocks in this paper. It is taken in monthly values from 1985:m1-2014:m12. Quarterly and annual values are averages of the corresponding raw monthly values for 1985:Q1-2014:Q4.

A.3 National Accounts Data

Variables Definitions. Output, consumption, investment, imports, exports and government expenditure are defined as the GDP measured by the expenditure approach, private final consumption expenditure, gross fixed capital formation, imports and exports of goods and services, and general government final consumption expenditure respectively. All six series are taken as volume indexes using OECD reference year and are seasonally adjusted. We use the data as log-first-differences. Output per-capita is defined as the quarterly GDP per capita in U.S. dollars, using constant prices, fixed PPP, and seasonally adjusted. The series are 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 21 countries during the following time periods: Australia 1985:Q1-2013:Q4; Austria 1988Q1-2013:Q4 (out-

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

put per capita 1995:Q1-2013:Q4); Belgium 1995:Q1-2013:Q4; Canada 1985:Q1-2013: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; Ireland 1997:Q1-2013:Q4 (output per capita 1998:Q1-2013:Q4); Italy 1985:Q1-2013:Q4 (output per capita 1995:Q1-2013:Q4); Japan 1994:Q3-2013:Q4 (output per capita 2007:Q3-2013:Q4); Netherlands 1988:Q1-2013:Q4 (output per capita 1995:Q1-2013:Q4); New Zealand 1990:Q1-2013:Q4 (output per capita 1991:Q1-2013:Q4); Norway 1985:Q1-2013:Q4 (output per capita 1995:Q1-2013:Q4); Portugal 1995:Q1-2013:Q4; Spain 1995:Q1-2013:Q4; Sweden 1985:Q1-2013:Q4 (output per capita 1993:Q1-2013:Q4); Switzerland 1985:Q1-2013:Q4 (output per capita 1991:Q1-2013:Q4); United Kingdom 1985:Q1-2013:Q4 (output per capita 1995:Q1-2013:Q4); United States 1985:Q1-2013:Q4.

A.4 Unemployment.

Variables Definitions. Our panel utilizes the OECD's harmonized unemployment (all persons) series in a monthly frequency. The series is taken as log-first-differences had been retrieved from the OECD's database at http://stats.oecd.org/.

Monthly sample. Our monthly panel for unemployment includes observations for the years of 1985-2014 for 19 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; 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; Ireland 1985:M1-2013:M12; Italy 1985:M1-2013:M12; Japan 1985:M1-2013:M12; Netherlands 1985:M1-2013:M12; Norway 1989:M1-2013:M12; Portugal 1985:M1-2013:M12; Spain 1986:M4-2013:M12; Sweden 1985:M1-2013:M12; United Kingdom 1985:M1-2014:M12; United States 1985:M1-2013:M12.

A.5 Population and Labor-Force 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 ratio between the employed population to the working age population (employment to population ratio), again for the same ages as mentioned above. The raw data includes three data series (employed, active, and working age population) expressed in thousands of persons. The resulting ratios are taken as log-first-differences. All raw series used for the creation of these ratio 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 21 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; 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; Ireland 1999:Q2-2013:Q4; Italy 1998:Q1-2013:Q4; Japan 1985:Q1-2013:Q4; Netherlands 2000:Q1-2013:Q4; New Zealand 1990:Q1-2013:Q4; Norway 2000:Q1-2013:Q4; Portugal 1998: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); United Kingdom 1999:Q2-2014:Q4; United States 1985:Q1-2013:Q4.

A.6 Vacancies.

Variables Definitions. We define vacancies as the ratio between the stock of vacancies normalized by the working age population from the previous subsection, which includes all persons aged 15 and over, other than for Spain, the United Kingdom, and the United States for which the lower bound is 16. The raw data includes two data series (total vacancy stock, and working age population) expressing numbers of persons and seasonally adjusted. The resulting normalized series is taken as log-first-differences. All raw series are from the OECD's database at http://stats.oecd.org/.

Sample. Our quarterly panel for vacancies includes observations for the years of 1985-2014 for 12 countries (Canada, Denmark, France, Greece, Ireland, Italy, Japan, Netherlands, and New Zealand are missing) during the following time periods: Australia 1985:Q1-2008:Q2 and 2009:Q4-2013:Q4; Austria 1999:Q1-2013:Q4; Belgium 1999:Q1-2004:Q1; Finland 2000:Q1-2013:Q4; Germany 2005:Q1-2013:Q4; Norway 2000:Q1-2013:Q4; Portugal 1998:Q1-2013:Q4; Spain 1999:Q1-2005:Q1; Sweden 2001:Q1-2013:Q4; Switzerland 2010:Q1-2013:Q4 (available only for Q2 for 1999-2009); United Kingdom 1999:Q2-2014:Q4; United States 2001:Q1-2013:Q4.

A.7 Real Wage.

Variables Definitions. We define the real wage as the ratio of total compensations in local currency and in current prices deflated using the country's own consumer price index using 1985 as a base year and dividing by the number of employed persons. The raw data includes three data series (the consumer price index, total compensations, and employed population) which are seasonally adjusted. The resulting ratio, the average real wage per employed person, is 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 17 countries (Canada, Japan, New Zealand, and the United States are missing) during the following time periods: Australia 1985:Q1-2013:Q4; Austria 1995:Q1-2013:Q4; Belgium 1995:Q1-1997:Q4, 1999:Q1-2013:Q4; Denmark 1995:Q1-2013:Q4; Finland 1998:Q1-2013:Q4; France 2003:Q1-2013:Q4; Germany 1991:Q1-2013:Q4; Greece 1995:Q1-2013:Q4; Ireland 1998:Q1-2013:Q4; Italy 1998:Q1-2013:Q4; Netherlands 1998:Q1-2013:Q4; Norway 2000:Q1-2013:Q4; Portugal 1998: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); United Kingdom 1999:Q2-2014:Q4; United States 1985:Q1-2013:Q4.

A.8 Capacity Utilization

Variables Definitions. We define capacity utilization as the rate of capacity utilization from the OECD's business tendency surveys for manufacturing industries. The raw data is in percentage points, seasonally adjusted, and used as log-first-differences. The series is from the OECD's database at http://stats.oecd.org/.

Sample. Our quarterly panel for this series includes observations for the years of 1985-2014 for 18 countries [29] during the following time periods: Austria 1996:Q1-2013:Q4; Belgium 1985:Q1-2013:Q4; Denmark 1987:Q1-2013:Q4; Finland 1991:Q1-2013:Q4; France 1985:Q1-2013:Q4; Germany 1985:Q1-2013:Q4; Greece 1985:Q1-2013:Q4; Ireland 1985:Q1-2008:Q3; Italy 1985:Q1-2013:Q4; Netherlands 1985:Q1-2013:Q4; New Zealand 1990:Q1-2013:Q4; Norway 1987:Q1-2013:Q4; Portugal 1985:Q1-2013:Q4; Spain 1985:Q1-2013:Q4; Sweden 1995:Q1-2013:Q4; Switzerland 1985:Q1-2013:Q4; United Kingdom 1985:Q2-2014:Q4; United States 1985:Q1-2013:Q4.

[29] Data for Canada is missing. Data for Australia and Japan is available however the range of values for these two countries is not comparable to the ones in the other countries. To illustrate according to the raw series the range of values for Australia is from -44 to 13, for Japan -36 to 13 and for all other countries in our sample from 47.4 to 93.4

A.9 Total Factor Productivity.

Variables Definitions. TFP is defined as the OECD's MFP (multifactor productivity) series. The raw data is an index using 2010 as a base year, seasonally adjusted, and used as log-first-differences. The series is from the OECD's database at http://stats.oecd.org/.[30]

Sample. Our panel for this variable includes values for the years of 1985-2014 for 19 countries (Greece and Norway are missing) during the following time periods: Australia 1985-2013; Austria 1996-2013; Belgium 1985-2013; Canada 1985-2013; Denmark 1985-2013; Finland 1985-2013; France 1985-2013; Germany 1985-2013; Ireland 1985-2013; Italy 1985-2013; Japan 1985-2013; Netherlands 1985-2013; New Zealand 1990-2013; Portugal 1985-2013; Spain 1985-2013; Sweden 1985-2013; Switzerland 1992-2013; United Kingdom 1985-2014; United States 1985-2013.

A.10 Hours Worked

Variables Definitions. Hours worked per-employed person are defined as the OECD's series average annual hours worked which is the total number of hours actually worked per year divided by the average number of people in employment per year. The series on total hours worked is the product of this series with the annual average of the number of employed persons series described above. The raw data is in numbers of hours and used as log-first-differences. The series is from the OECD's database at http://stats.oecd.org/.

[30] for more information on the series see http://www.oecd.org/sdd/productivity-stats/2352458.pdf.

Sample. Our panel for these variables includes values for the years of 1985-2014 for 21 countries the following time periods: Australia 1985-2013; Austria 1995-2013; Belgium 1985-2013 (Total hours missing for 1998); Canada 1985-2013; Denmark 1985-2013 (total hours missing for 1985-1989); Finland 1985-2013 (total hours missing for 1985-1997); France 1985-2013 (total hours missing for 1985-2002); Germany 1991-2013; Greece 1985-2013 (total hours missing for 1985-1988); Ireland 1998-2013; Italy 1995-2013 (total hours missing for 1995-1997); Japan 1985-2013; Netherlands 1985-2013 (total hours missing for 1985-1997); New Zealand 1990-2013; Norway 1985-2013 (total hours missing for 1985-2000); Portugal 1985-2013 (total hours missing for 1985-1998); Spain 1985-2013 (total hours missing for 1985-1998); Sweden 1985-2013 (total hours missing for 1985-2000); Switzerland 1991-2013 (total hours missing for 1991-1997); United Kingdom 1985-2014 (total hours missing for 1985-1998); United States 1985-2013.

A.11 Union Density

Variables Definitions. Union density is defined as the OECD's series on trade union density rates which is the ratio of union members divided by the total number of employees based on administrative data if such data is unavailable, survey data had been imputed instead. The series is available at an annual frequency, assumed identical within each calendar year, in a similar fashion to the EPL series, and taken from the OECD's database at http://stats.oecd.org/.

Sample. Our panel for this variable includes values for the years of 1985-2014 for 21 countries during the following time periods: Australia 1985-2013; Austria 1985-2013; Belgium 1985-2013; Canada 1985-2013; Denmark 1985-2013; Finland 1985-2013; France 1985-2013; Germany 1985-2013; Greece 1985, 1990, 1992, 1995, 1998, 2001-2002, 2004-2006, 2008, 2011,2013; Ireland 1985-2013; Italy 1985-2013; Japan 1985-2013; Netherlands 1985-2013;

New Zealand 1990-2013; Norway 1985-2013; Portugal 1985-1990, 1995, 1997, 2002-2004, 2006, 2008, 2010-2011; Spain 1985-2013; Sweden 1985-2013; Switzerland 1985-2013; United Kingdom 1985-2014; United States 1985-2013.

A.12 Collective Bargaining Coverage

Variables Definitions. Collective bargaining coverage is the OECD's series of the same name which is the ratio of employees covered by collective agreements, divided by all wage earners with a right to bargaining. The series is available at an annual frequency, assumed identical within each calendar year, in a similar fashion to the EPL series, and taken from the OECD's database at `http://stats.oecd.org/`.

Sample. Our panel for this variable includes values for the years of 1985-2014 for 21 countries during the following time periods: Australia 1985, 1990, 1998, 2000, 2002, 2004, 2006, 2008, 2010, 2012; Austria 1985, 1990, 1995, 2000, 2005, 2008, 2010, 2013; Belgium 1985, 1990, 1995, 2000, 2002, 2008, 2013; Canada 1985-2013; Denmark 1985, 1990, 1993, 1997, 2000, 2004, 2006-2007, 2009-2010, 2013; Finland 1985, 1989, 1995, 2000, 2002-2006, 2008-2013; France 1985, 1990, 1997, 2004, 2008-2009, 2012; Germany 1985, 1990, 1995-2013; Greece 1985, 1990, 1995, 2000-2013; Ireland 2000, 2005, 2009; Italy 1985, 1990, 1995, 2000-2013; Japan 1985, 1988, 1990, 1995, 2000, 2005-2013; Netherlands 1985-1990, 1992-1993, 1996, 2000-2013; New Zealand 1990. 1992-2003, 2007, 2010-2011; Norway 1985, 1990, 1994, 1998, 2002, 2006, 2009, 2013; Portugal 1985, 1990, 1995, 1999-2013; Spain 1985, 1990, 1993-2013; Sweden 1985, 1990, 1994-1995, 1998, 2000, 2002, 2005, 2007, 2011, 2013; Switzerland 1985, 1990-1992, 1994, 1996, 1999, 2001, 2003, 2005, 2007, 2009-2010, 2012-2013; United Kingdom 1985, 1990, 1994-2014; United States 1985-2013.

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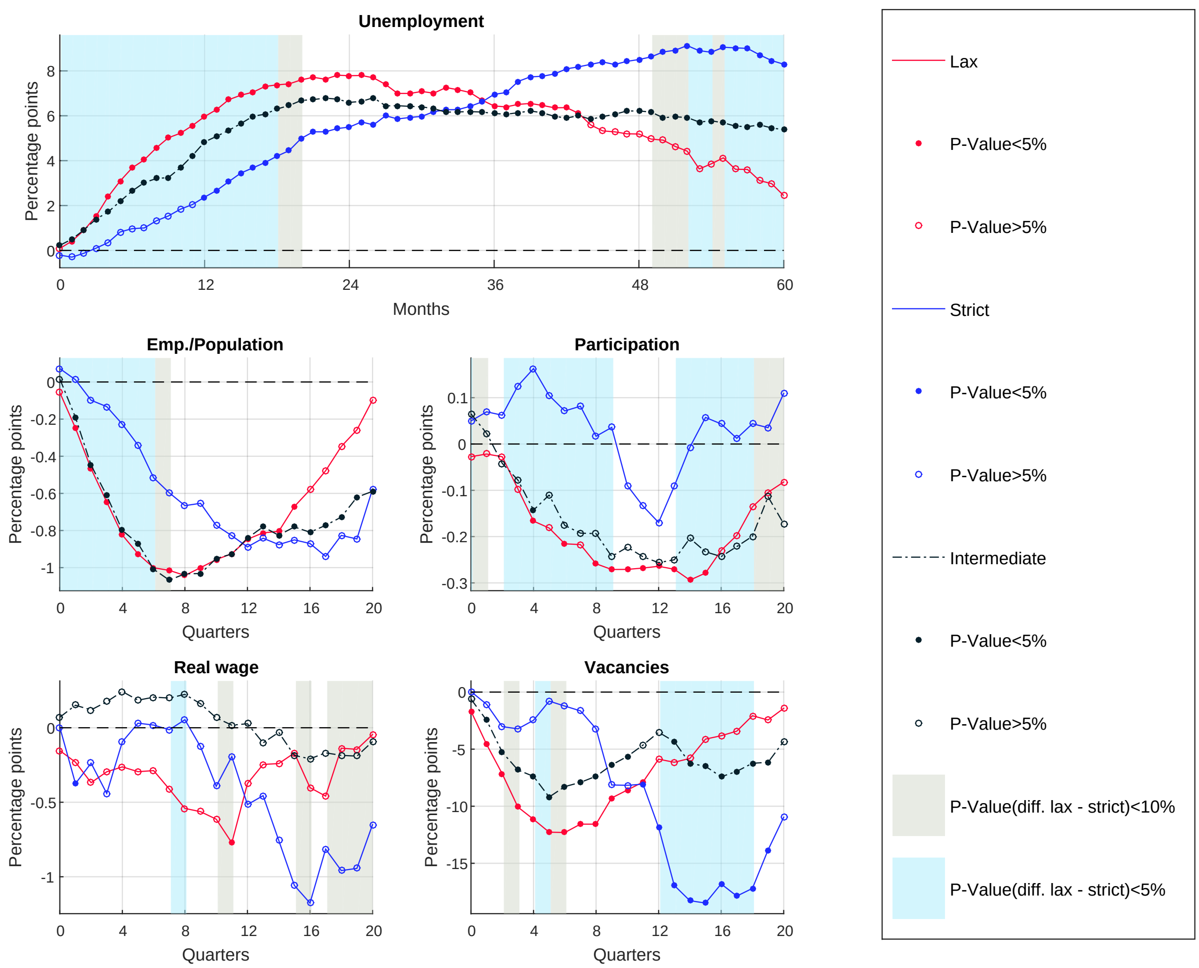
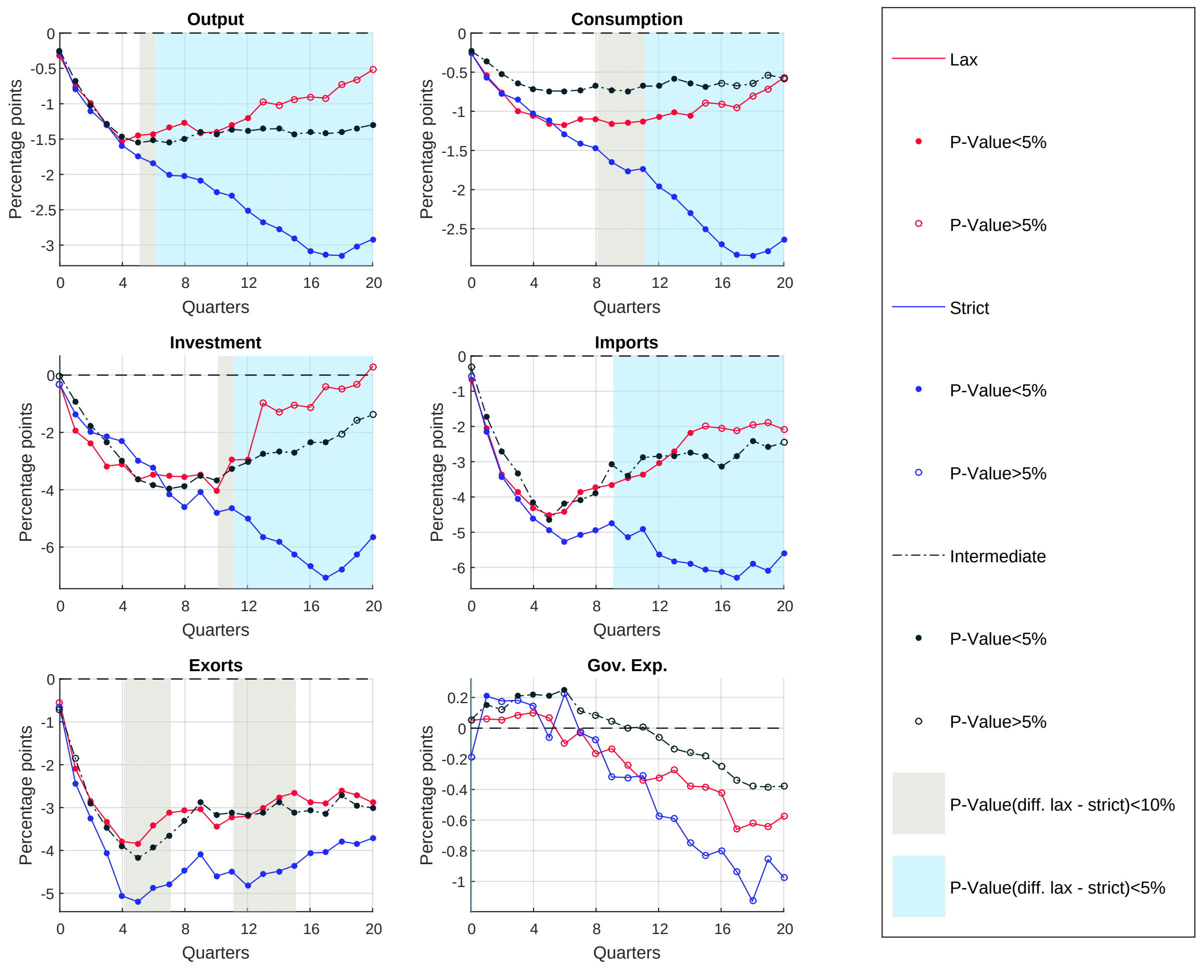
Figure 1: Impulse Responses to a One Standard Deviation Credit Supply Shock Under Different EPL Regimes - Labor Market Variables.



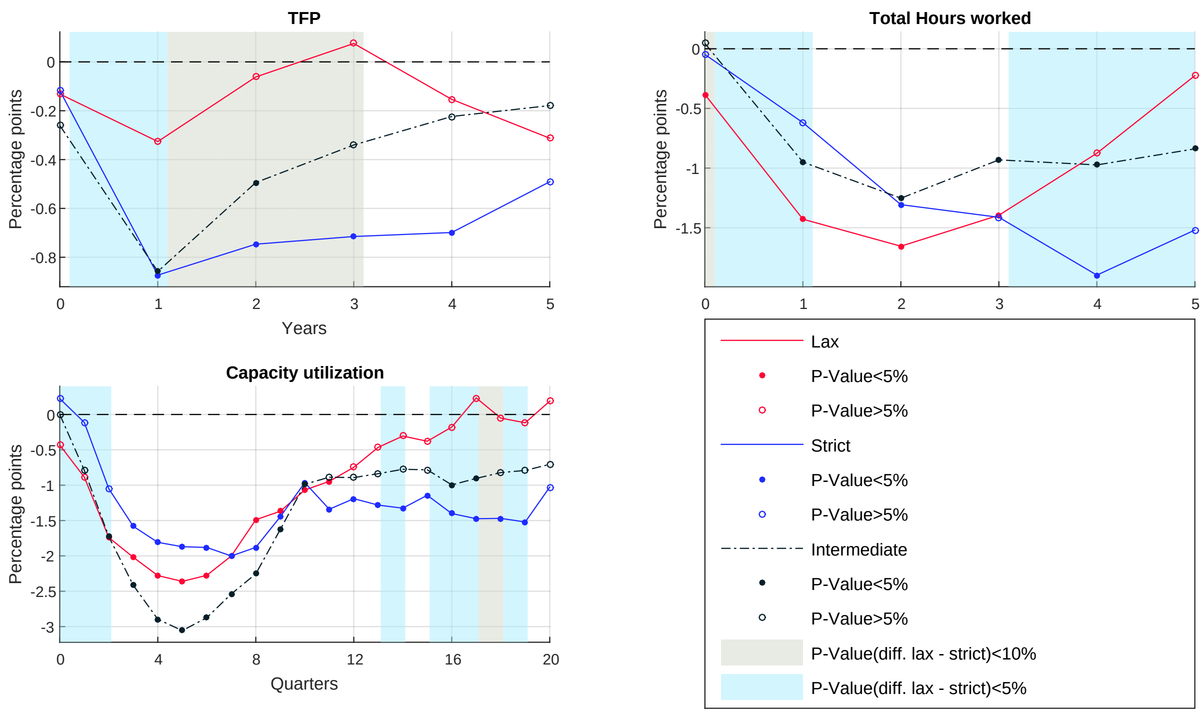
Notes: This figure shows the impulse response functions (IRFs) for each labor market outcome measure estimated using the state-dependent model described in Equation (1). The IRF for strict EPL regime is presented in blue, the IRF for the lax EPL regime in red, and the intermediate regime in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different from zero (p-value ≤ 0.05). Shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05 in light-blue shading and p-value ≤ 0.1 in grey). All inference is based on Driscoll and Kraay (1998) standard errors.

Figure 2: Impulse Responses to a One Standard Deviation Credit Supply Shock Under Different EPL Regimes - National Accounts.



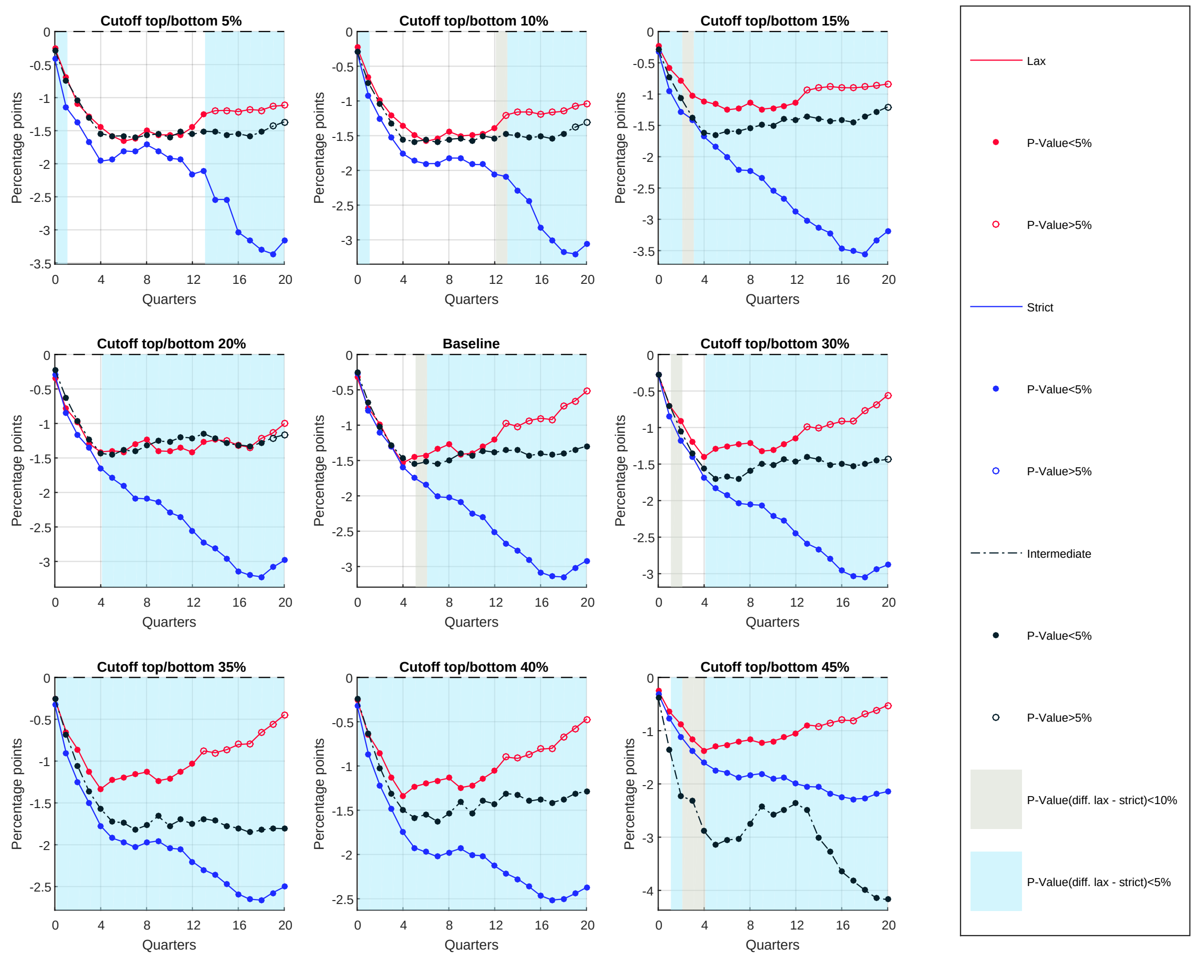
Notes: This figure shows the impulse response functions (IRFs) for each national accounts outcome measure estimated using the state-dependent model described in (Equation 1). The IRF for strict EPL regime is presented in blue, the IRF for the lax EPL regime in red, and the intermediate regime in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05). Shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05 in light-blue shading and p-value ≤ 0.1 in grey). All inference is based on Driscoll and Kraay (1998) standard errors.

Figure 3: Impulse Responses to a One Standard Deviation Credit Supply Shock Under Different EPL regimes - TFP, Hours Worked, and Utilization.



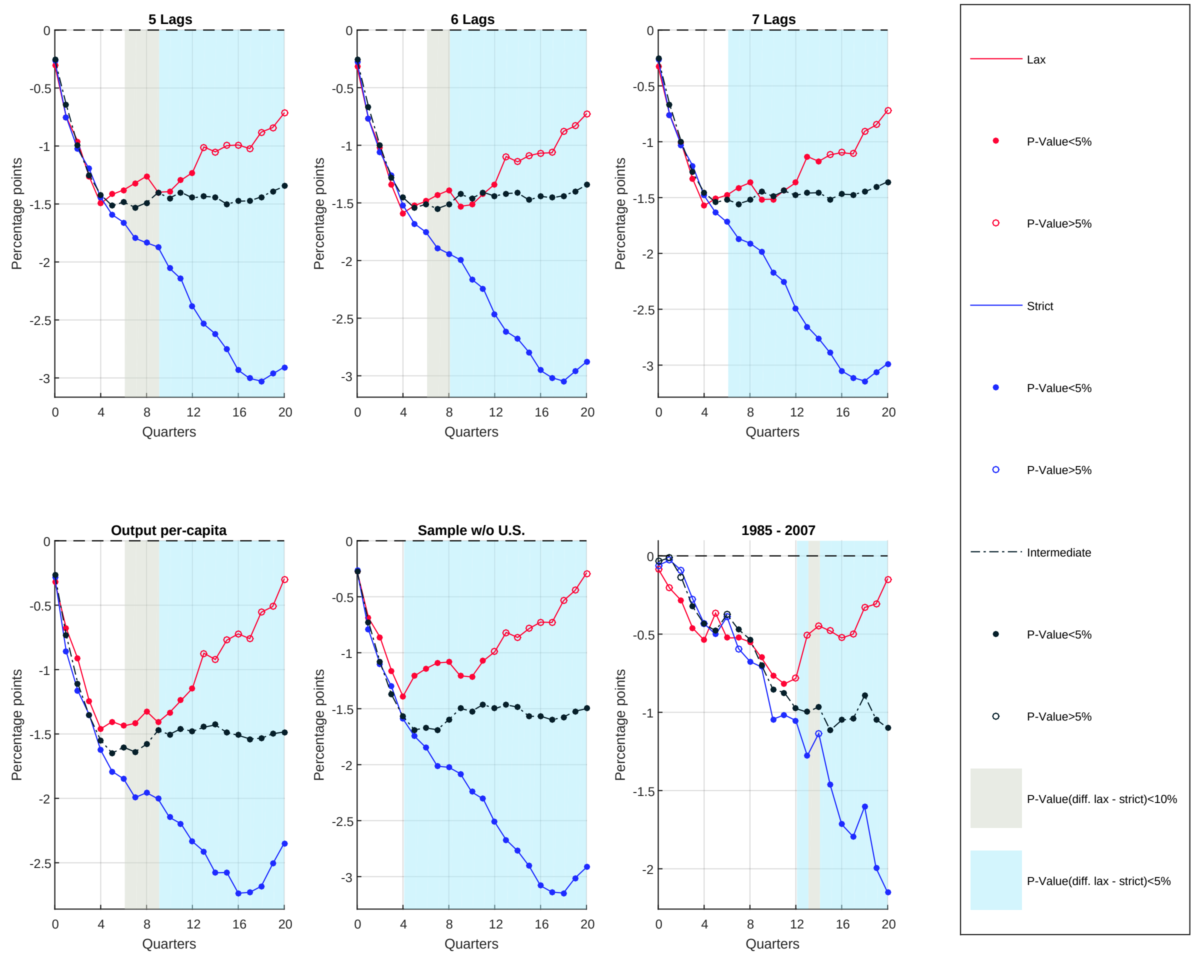
Notes: This figure shows the impulse response functions (IRFs) for TFP, hours worked, and utilization estimated using the state-dependent model described in Equation (1). The IRF for strict EPL regime is presented in blue, the IRF for the lax EPL regime in red, and the intermediate regime in black. Full data points represent horizons at which the point estimate for the IRF is statistically significantly different than zero (p-value ≤ 0.05). Shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05 in light-blue shading and p-value ≤ 0.1 in grey). All inference is based on Driscoll and Kraay (1998) standard errors.

Figure 4: Robustness to Different Cutoff Values.



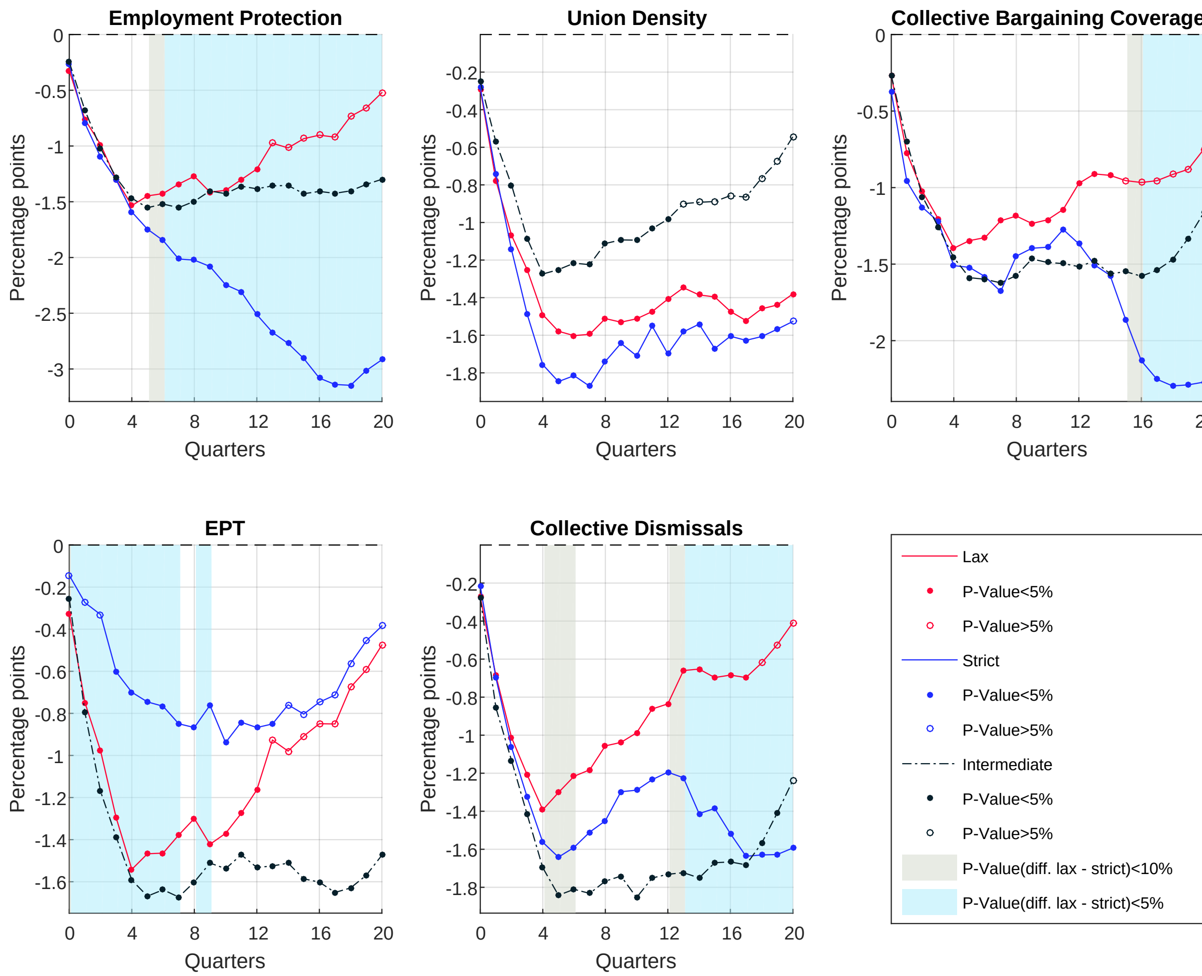
Notes: This figure shows impulse response functions (IRFs) for output estimated using the state-dependent model described in Equation (1) with different cutoff values for EPL regimes. The IRF for strict EPL regime is presented in blue, the IRF for the lax EPL regime in red, and the intermediate regime 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). Shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value $\leq$ 0.05 in light-blue shading and p-value $\leq$ 0.1 in grey). All inference is based on Driscoll and Kraay (1998) standard errors.

Figure 5: Robustness to Alternative Lag Specifications, Samples, and Output Measure.



Notes: This figure shows impulse response functions (IRFs) for output estimated using the state-dependent model described in Equation (1) for alternative lag specifications, output measure, and samples. The IRF for strict EPL regime is presented in blue, the IRF for the lax EPL regime in red, and the intermediate regime 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). Shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05 in light-blue shading and p-value ≤ 0.1 in grey). All inference is based on Driscoll and Kraay (1998) standard errors.

Figure 6: The Effect on Real Output Conditional on Different Labor Market Institutions.



Notes: This figure shows impulse response functions (IRFs) for output estimated using the state-dependent model described in Equation (1) with different labor market institutions underlying the determination of the state dummy policy regimes. The IRF for strict regime is presented in blue, the IRF for the lax regime in red, and the intermediate regime 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). Shaded areas indicate that the difference in response between the strict and lax groups is significantly different from zero (p-value ≤ 0.05 in light-blue shading and p-value ≤ 0.1 in grey). All inference is based on Driscoll and Kraay (1998) standard errors.