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Institutions and Unemployment: Do Interactions Matter?

Andreas Sachs

ZEW
Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

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Non-technical Summary

Distinct settings of labor market institutions like the employment protection or the unemployment benefit system have attracted considerable attention as a potential explanation for differences in the unemployment rates of industrialized countries over the last two decades. A plethora of theoretical and empirical studies have dealt with the identification and quantification of direct labor market effects of institutional reforms. However, while theory predicts that the interplay between individual labor market institutions is as well important to determine the impact of institutional reforms, empirical studies have widely neglected such interdependencies so far.

The main problem in empirical studies is that macroeconomic labor market models quickly become very large if interactions are taken into account. Hence, the estimation of a model considering a set of institutional interactions requires either exact and comprehensive theoretical predictions on which interactions to include or a large number of observations to receive reliable results. Unfortunately, theoretical studies mainly focus on broad concepts of institutions like the bargaining power or the firing costs, and empirical data-based models cannot be directly derived from theory. The low number of available observations requires the subjective selection of some interactions, what is also not an appropriate solution because neglecting potentially relevant information can severely bias the outcomes.

In this study, I use a bayesian model averaging framework to estimate reliable parameters for all available bivariate interaction terms. Using data on 14 institutional indicators of 5 institutional categories (product market regulation, employment protection, unemployment benefit system, labor tax system, bargaining system), 91 bivariate interactions are analyzed concerning the question whether these interactions can significantly contribute to the explanation of unemployment.

On the basis of the model averaging approach, I identify 22 robust and significant bivariate interaction terms. The empirical evidence emphasizes the importance of institutional interactions for the determination of unemployment. More concretely, taking interactions into

account significantly improves the explanatory power of the empirical model. The calculation of country-specific marginal effects of institutions sheds light on the question why institutional reforms might result in different outcomes in different countries in terms of unemployment. Furthermore, the results can give advice how reform-packages implemented to tackle labor market rigidities should be designed in order to decrease unemployment.

Das Wichtigste in Kürze

Arbeitsmarktinstitutionen wie der Kündigungsschutz oder das System der Arbeitslosenunterstützung sind in den vergangenen zwei Jahrzehnten häufig als Erklärungsfaktor für erhebliche Unterschiede in den Arbeitslosenquoten von Industrieländer herangezogen worden. Zahlreiche theoretische wie empirische Studien haben dabei die Identifikation sowie die Quanitifzierung der Arbeitsmarkteffekte von institutionellen Reformen zum Ziel gehabt. Obwohl sich aus der Theorie ableiten lässt, dass Wechselwirkungen zwischen verschiedenen Arbeitsmarktinstitutionen ebenfalls bedeutsam sind, wurden diese in empirischen Studien bisher weitestgehend vernachlässigt.

Das zentrale Problem empirischer Studien ist, dass makroökonomische Arbeitsmarktmodelle schnell sehr groß werden, sobald Interaktionen Berücksichtigung finden. Die Schätzung eines Modells mit einer Reihe von Interaktionen aus Institutionen erfordert entweder genaue und umfassende theoretische Vorhersagen darüber, welche Interaktionen bedeutsam sind, oder eine große Anzahl an Beobachtungen, um zuverlässige Resultate zu erhalten. Da theoretische Studien hauptsächlich breite institutionelle Konzepte wie zum Beispiel die Verhandlungsmacht oder Kündigungskosten nutzen, kann keine direkte Umsetzung in ein empirisches datengestütztes Modell erfolgen. Zudem stehen nur relativ wenige Beobachtungen zur Verfügung, weshalb eine subjektive Beschränkung auf wenige Interaktionen erforderlich ist, was die Ermittlung verlässlicher Schätzergebnisse verhindert.

In dieser Studie wird ein bayesianischer *model averaging* Ansatz genutzt, um verlässliche Parameter für alle verfügbaren bivariaten Interaktionsterme zu schätzen. Mit Hilfe von 14 institutionellen Indikatoren, die 5 Gruppen (Produktmarktregulation, Kündigungsschutz, System der Arbeitslosenunterstützung, Arbeitsbesteuerungssystem, Lohnverhandlungssystem) zugeordnet werden können, werden 91 bivariate Interaktionen darauf untersucht, ob sie signifikant zur Erklärung der Arbeitslosigkeit beitragen.

Insgesamt werden 22 Interaktionsterme als signifikant identifiziert. Die empirischen Ergebnisse unterstreichen die Relevanz von Interaktionen als Bestimmungsfaktor der Arbeitslosigkeit.

Mit anderen Worten kann die Berücksichtigung von Interaktionen den Erklärungsgehalt von Arbeitsmarktmodellen für die Arbeitslosigkeit signifikant erhöhen. Die Berechnung von marginalen institutionellen Effekten trägt zur Beantwortung der Frage bei, warum institutionelle Reformen in verschiedenen Ländern abweichende Einflüsse auf die Arbeitslosigkeit hervorrufen. Zudem helfen die Ergebnisse zu verstehen, wie Arbeitsmarktreformen ausgestaltet sein sollten, um den Arbeitsmarkt positiv zu beeinflussen.

Institutions and Unemployment: Do Interactions matter?*

Andreas Sachs†

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Abstract

Isolated effects of labor and product market institutions as well as the interaction between both aforementioned categories on unemployment have been extensively discussed in the empirical literature. However, interaction effects between individual labor market institutions have been widely neglected, mainly due to the infeasibility to correctly specify the model. In this paper, a model averaging approach is adopted to show that considering institutional interactions can improve the explanatory power of macroeconomic models explaining unemployment. The approach permits to tackle model specification problems directly related to the inclusion of a large number of interactions. Using a panel data set for 17 OECD countries from 1982 to 2005, 22 robust and significant interactions can be identified. Furthermore, country-specific marginal effects of institutional changes are calculated and their economic significance is analyzed for selected countries.

JEL *classification: C33, E02, E24*

Keywords: Unemployment, Institutions, Labor and Product Markets, Model Averaging, Institutional Interactions, Institutional Design

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†Corresponding author, Centre for European Economic Research (ZEW), P.O. Box 103443, D-68034 Mannheim, Germany, Phone: +49/621/1235-145, Fax: +49/621/1235-223, E-mail: sachs@zew.de

1 Introduction

The direct influence of labor market regulations on unemployment has been predicted in several theoretical models and confirmed in a number of empirical contributions. However, the interplay between individual labor market institutions has been widely neglected in the empirical literature, mainly due to the infeasibility to correctly specify the econometric model. The main problem is that if interactions are taken into account, the empirical model quickly becomes very large. In this paper, a model averaging approach is applied to overcome the problem of model mis-specification. The method helps to reasonably test a large number of interactions for significance, to show that taking interactions into account improves the explanatory power of the empirical model, and to deliver evidence on the functioning and performance of different institutional systems.

Several attempts have been made to capture direct and indirect effects of institutions on the labor market. Concerning direct effects, Saint-Paul (2004) and Nickell and Layard (1999) provide an overview on theoretical mechanisms while Nickell et al. (2005) and Baccaro and Rei (2007) are examples for empirical studies. Similarly, the interdependence of product and labor market regulation and its impact on the labor market has been found to be of significance by Blanchard and Giavazzi (2003) and Griffith et al. (2007), for instance. The dependence of macroeconomic shocks from labor market institutions and their joint effect on unemployment has also been analyzed by Blanchard and Wolfers (2000) and Nickell et al. (2005), though there seems to be no interdependence. Furthermore, the interplay between labor and financial market institutions was a central aspect of the studies by Wasmer and Weil (2004) or Gatti et al. (2010).

Interactions between individual labor market institutions have also been examined in a few studies. Belot and van Ours (2001, 2004) use a right-to-manage model to construct testable hypotheses for the empirical analysis. More specifically, they test interactions between the tax rate and the replacement rate, and the bargaining centralization with both the union density and the employment protection. They find that, depending on the particular specifica-

tion, all considered interactions contribute significantly to the explanation of unemployment. However, although the theoretical model predicted further interactions, the authors refrained from estimating them due to data limitations. The IMF (2003) estimated 4 variants of such unemployment equations, all of them including up to 7 interactions between several institutions. Nevertheless, the model specifications have been carried out on an ad-hoc basis, so that the results are probably sensitive to robustness checks.

Bassanini and Duval (2006) as well as Baccaro and Rei (2007) also estimated several institutional interactions. As mentioned by the authors, the results seem to be rather sensitive to the inclusion of further interactions and to the specific estimation strategy. Furthermore, both studies point out that the estimation of such a complex interaction network, i.e. a large set of institutional interactions, requires either exact and comprehensive theoretical predictions regarding institutional interactions or much more observations to receive reliable results. The main problem with interaction terms is that even if only a small number of institutional indicators is considered, the number of possible interactions is substantially larger. For instance, including 8 institutional indicators sums up to $\frac{8*7}{2} = 28$ interactions. Bassanini and Duval (2009) therefore concentrate on interactions between single institutions and the institutional framework as a whole. The results point to reform complementarities between labor market institutions as predicted by Coe and Snower (1997) without saying anything about interactions between individual institutions.

It can be learned from this brief literature overview that the empirical estimation of several institutional interactions requires the inclusion of a large number of interaction terms. Since empirical macroeconomic models are restricted in terms of number of observations, either a limited number of theoretically established interaction terms or an adequate estimation strategy to deal with a large number of interactions is required. Although the theoretical literature gives some guidance on the interplay of some specific labor market institutions like, for instance, Blanchard and Tirole (2008) or Boeri et al. (2003) on unemployment benefits and employment protection, or Daveri and Tabellini (2000) on labor taxes and bargaining power, a comprehensive theoretical model describing the interplay of more than just two in-

stitutions and providing clear predictions on significant interactions is missing. An exception is Coe and Snower (1997). Indeed, 5 different labor market policy fields are considered in their model. But the assumptions concerning the effects of deregulating reforms are simplified in a sense that deregulation is generally beneficial. This does not reflect the advances of the literature which draws a more complex picture of the functioning of labor market institutions.

In this study, I use a model averaging framework to estimate reliable parameters for all bivariate interaction terms which are robust to alterations of the model specification. Using data on 14 institutional indicators of 5 institutional categories (product market regulation, employment protection, unemployment benefit system, labor tax system, bargaining system), 91 bivariate interactions are analyzed concerning the question whether these interactions can contribute to the explanation of unemployment. While the focus is on labor market institutions, two indicators for the product market regulation are included as well to avoid neglecting potentially relevant information. The study is centered on comprehensively available annual data on 17 OECD countries for the period from 1982 to 2005. The method applied has been developed by Sala-i-Martin et al. (2004) (BACE - Bayesian Averaging with Classical Estimates) and has been formally extended to a panel by Moral-Benito (2010). The central idea is to estimate a large set of models containing a varying number of explanatory variables taken from the pool of all variables. The quality of a model j serves as a weighting coefficient for the variables k_j included in model j. Thus, variables which are incorporated in models with better fit receive higher weighting than variables in models that exhibit smaller explanatory power. The weights of a variable over all models are summed up and serve as a measure for evaluating the importance of the factor in explaining the dependent variable.

On the basis of the model averaging approach, I identify 22 robust and significant bivariate interaction terms. The empirical evidence emphasizes the importance of institutional interactions for the determination of unemployment. More concretely, taking interactions into account significantly improves the explanatory power of the empirical model. The calculation of country-specific marginal effects of institutions sheds light on the question why institutional reforms might result in different outcomes in different countries in terms of unemployment.

Furthermore, the results give advice how reform-packages implemented to tackle labor market rigidities should be designed to decrease unemployment.

The paper is organized as follows. Section 2 briefly explains the empirical strategy and introduces the BACE approach. Section 3 gives an overview on the data and data construction methods. In section 4, robust and significant interactions are identified on the basis of the model averaging approach. In section 5, marginal effects for institutional changes are calculated and country-specific labor market effects of institutional reforms are presented for different countries. Furthermore, the economic significance of the institutional interactions is discussed. Finally, section 6 concludes.

2 Empirical Strategy

The basic empirical model is

$$UE_{i,t} = \alpha_i + \lambda_t + Interactions_{i,t} + Inst_{i,t} + Controls_{i,t} + \varepsilon_{i,t} \tag{1}$$

where $UE_{i,t}$ represents the actual unemployment rate, α_i and λ_t are time- and country-specific effects, $Inst_{i,t}$ are 14 individual institutional indicators, and $Controls_{i,t}$ are 4 macroeconomic shocks as well as an indicator for the constraints to credit access. This factor appeared to be of importance in, for instance, Dromel et al. (2010). The factors of interest are contained in the vector $Interactions_{i,t}$. The model averaging approach applied in this paper enables to assess whether the variation of the set of explanatory variables changes the results of the variables under inspection. Here, the variables under inspection are 91 bivariate interactions. The variation comes therefore from building different combinations of interaction terms, and to look whether the significance of the variables of interest changes when the set of interactions (as explanatory variables) is altered. Note that the control variables and the 14 individual institutions appear in all regressions. The inclusion of the 14 institutional variables is necessary

since these factors are the constitutive terms of the interactions. According to Brambor et al. (2006), the inclusion of all constitutive terms is obligatory when estimating interaction models. The model averaging approach is explained in greater detail in the following section.

2.1 Bayesian Model Averaging

Model mis-specification can lead to severely biased results, mainly due to omitted variable bias, especially if theory does not provide a clear guide on which variables and interactions to include. For instance, according to an example provided by Bassanini and Duval (2006), the impact of the labor taxation might be independent of minimum wages. If, however, minimum wages are correlated with the bargaining power, and the labor taxes at the same time interact with the bargaining power, then the exclusion of the interaction between labor taxes and the bargaining power causes the interaction between labor taxes and minimum wages to be significant. However, there are a lot of potentially interacting factors and including all of them jointly in one model is infeasible due to limitations in terms of degrees of freedom. One possible solution to this problem is to avoid specifying a particular model. Rather, this model uncertainty is particularly taken into account by exploiting information of a large number of models. A particular model consists of the fixed regressors plus a random number of varying regressors like, for instance, institutional interactions. First, $P(M_j|y)$ is the weight of a model j in relation to the sum of the weights of all possible models. It is calculated as

$$P(M_j|y) = \frac{P(M_j)NT^{-k_j/2}SSE_j^{-NT/2}}{\sum_{i=1}^{2^K} P(M_i)NT^{-k_i/2}SSE_i^{-NT/2}}. \tag{2}$$

The term SSE considers the sum of squared errors of a regression to account for the quality of a model, and is corrected for degrees of freedom according to the Schwartz model selection criterion. N is the number of cross-sections, i.e. countries, T is the number of time periods, K is the total number of explanatory factors, and k_i and k_j are the number of explanatory variables in the particular models i and j. Note that the explanatory factors comprise only those which are varied conditional on the particular model, and not the variables which are

held fix in all estimations. Hence, given the basic empirical model of equation (1), only the interaction terms are variable while the individual institutional indicators as well as the shock terms are held fix. The sum of the weights $P(M_j|y)$ over all models a variable appears in gives the posterior inclusion probability of this variable.

Furthermore, $P(M_j)$ is the prior model probability related to model j. This probability is calculated as

$$P(M_j) = \left(\frac{\overline{k}}{K}\right)^{k_j} \left(1 - \frac{\overline{k}}{K}\right)^{K-k_j}. \tag{3}$$

In other words, $P(M_j)$ is a weighting factor to correct for the model size, i.e. for the number of explanatory variables with $\overline{k}$ being the prior model size. This term expresses the researcher's belief about the true model size, i.e. the true number of interaction terms in the model, before seeing the data. The prior model size is crucial for the determination of the prior inclusion probability. This probability is calculated as $\frac{\overline{k}}{K}$, i.e. the prior model size divided by the total number of explanatory factors which are varied. Models with a size close to the prior model size is given a higher weight. In doing so, I correct for the fact, that models with a large number of explanatory variables per se achieve a better fit than models with only few explanatory factors.[1]

3 Data

Annual data on 14 institutional indicators has been gathered for 5 institutional categories; the labor tax system, the employment protection legislation, the wage bargaining system, the product market regulation, and the unemployment benefit system. Each category comprises some indicators which capture a part of the particular institutional class. The bayesian model averaging approach applied in this paper requires to use a completely balanced data-set. Hence, the time period is restricted to 1982 to 2005, and the country sample includes 17 OECD countries.[2] Data availability constraints are also the reason for not considering alternative

[1] For a detailed description of the method I refer to Sala-i-Martin et al. (2004).

[2] The countries involved are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United

institutional categories like, for instance, migration policy, family policy, or the retirement system.

Additionally, control variables are taken into account to capture short-run fluctuations of the unemployment rate which can not be traced back to institutional rigidities. I generally follow Nickell et al. (2005) in constructing 4 shock variables, a labor demand shock, an import price shock, a total factor productivity shock, and the real interest rate. All variables which are used in the estimations are described in greater detail in the following.

3.1 Institutions

The labor tax system is characterized by the payroll tax (TX1), the income tax (TX2), and the consumption tax (TX3). They have been constructed according to the definition given in Nickell and Nunziata (2001). The payroll tax is $TX1 = \frac{ess}{ie-ess}$ with ess being the employers' social security contributions and ie equal to the compensation of employees. The incomes tax is calculated as $TX2 = \frac{it}{hcr}$ where it is the direct tax spending and hcr the household's current receipts. The consumption tax is $TX3 = \frac{tls}{fce}$ whit tls being the taxes less subsidies on products and imports, while fce is the households' final consumption expenditure. The indicators have been recalculated and some changes to the original series in Nickell and Nunziata (2001) exist, probably due to data revisions.

The employment protection legislation is covered by protection for regular (EPL1), and for temporary employment (EPL2). According to the OECD, the former index consists of information on procedural inconveniences for the employer when executing a dismissal, on notice periods and severance payments, and on further impediments which can complicate the execution of a dismissal. The latter index captures information on the relevance of fixed-term contracts compared to permanent contracts by including several dimensions of fixed-term contracts, and on the regulation of temporary work agencies. Both indices have a range from 0 to 6 where the value increases with the strictness of employment protection. Both series have been delivered by the OECD.

States. Further OECD countries like Ireland or South Korea had to be excluded due to some missing data.

The bargaining system is represented by an index for the bargaining coordination (BCO), an index for the minimum wage setting (MW), and the union coverage (UC). The bargaining coordination index reaches from 1 to 5 where 1 indicates fragmented bargaining at the company level, and 5 economy-wide bargaining. The minimum wage index has a range from 1 to 8 with 1 for no minimum wage and 8 for a national minimum wage set by the government. The union coverage is the share of employees whose wage bargaining is affected by wage bargaining agreements. Note that the 2 additional variables, the bargaining centralization and the union density, have not been considered in this paper due to the high correlation with the bargaining coordination and the union coverage, respectively. All information on the bargaining system comes from the Visser database (see Visser 2009).

The OECD provides information on product market regulation, as well. The ECTR database contains regulation indicators in energy, transport and communication sectors. The aggregate values for the entry barriers (EB) and the public ownership (POS) are considered in the empirical section. Both indices range from 0 to 6 where the value increases with the regulation of competition. I refer to Conway and Nicoletti (2006) for a more detailed description.

Finally, the approach to construct indicators for the unemployment benefit system has been taken from Nickell (2006). The unemployment benefits show the transfer payments during a period of unemployment, averaged over different family and income situations as a fraction of the last income. Detailed information on these situations can be found in OECD (1994), chapter 8. The first year benefits (UB1) capture the transfer payments during the first year of unemployment. Similarly, the second and third year benefits (UB2) show the transfer payments averaged over the second and third year of unemployment, and the fourth and fifth year benefits (UB3) refer to the fourth and fifth year of unemployment. Note that the tax benefit models provided by the OECD have to be used for updating. Unfortunately, the tax benefit models provide data on unemployment benefits which are incorrect for some countries. The particular time series have to be checked and adjusted according to the country-specific definitions available at the OECD, benefits and wages homepage. Information on the coverage of the unemployment benefit system (UBC) is delivered by the Fondazione Rodolfo

de Benedetti. The indicator is calculated as the fraction of job-seekers entitled to benefits over the total number of job-seekers. Observations are missing for Belgium (2000-2005), Italy (1982-1989 and 2003-2005), Sweden (1982-1994), Switzerland (1982-1984) and the United Kingdom (1996). In these cases the value for the first preceding or successive valid observation is taken for the missing observation. If both a proceeding and successive valid observation is available, the mean is taken.

3.2 Macroeconomic variables

The dependent variable is the harmonized unemployment rate taken from the OECD. Some data is missing for earlier periods for some countries. To ensure consistent time series, I calculate the growth rates of the unemployment rate as a percentage of civilian labor force (which is not harmonized) and extend the harmonized unemployment rates by concatenating the change of the country-specific unemployment rate. Only Austria from 1982 to 1992, Germany from 1982 to 1990 and Switzerland from 1982 to 1991 are affected by this adjustment.

The labor demand shock is the change in the residuals of a labor demand model which is

$$ln(TE_t) = \beta_0 + \beta_1 ln(TE_{t-1}) + \beta_2 ln(TE_{t-2}) + \beta_3 ln(TE_{t-3}) + \beta_4 ln(Y_t) + \beta_5 ln(LC_t) + \varepsilon_t. \quad (4)$$

TE is total employment, Y is the real GDP and LC are the real labor costs per employee. The real labor costs are calculated as the total labor costs of the total economy divided by the number of dependently employed workers. The real import price is the import price deflator divided by the GDP deflator. The shock is then the log change in the real import price times the import share in GDP. The real interest rate is the long-term interest rate minus the current inflation rate. The factor productivity shock has been constructed according to Bassanini and Duval (2006). First, the change in the log of TFP is calculated as

$$\Delta ln(TFP) = \frac{\Delta ln(Y) - \alpha \Delta ln(TE) + (1-\alpha)\Delta ln(K)}{\alpha} \quad (5)$$

with Y equal to the GDP in the business sector, TE is total employment, K the gross capital stock, and α the share of labor income in total business sector income. A value for the annual TFP is constructed by cumulating the changes in the log TFP's over years. Finally, I take the deviations from the TFP trend to construct an index for TFP shocks by applying the Hodrick-Prescott filter with a λ of 100. A money supply shock as in NICKELL ET AL. (2005) could not be constructed due to missing data. Nevertheless, the results in Nickell et al. indicate at most only slight importance of that shock. For the credit constraints I use data from BECK AND DEMIRG-KUNT (2009). More specifically, the indicator for private credit by deposit money banks and other financial institutions over GDP is used.

4 Identification of robust and significant institutional interactions

Model averaging enables the researcher to avoid a subjective decision on which variables to include in a model. Nevertheless, the number of explanatory variables is limited by the data availability. Only such interactions can be considered for which data is comprehensively available. Hence, 91 bivariate interaction terms are tested for significance within the bayesian model averaging approach.[3]

As explained in section 2, the BACE approach requires the determination of the prior model size from the researcher. In the following, different prior model sizes are used to evaluate the significance and robustness of the institutional interactions. The prior model sizes are set to values of 10, 20, 30, 40, and 50, what leads to prior inclusion probabilities of 0.11, 0.22, 0.33, 0.44, and 0.55.[4] Generally, an interaction term with a posterior inclusion probability above

[3] BRAUMOELLER (2004) states that once a model with more than one interaction is specified, attention has to be paid to implicit interactions. For the interaction models considered in this paper it would be necessary to include a full set of $\sum_{k=1}^{n} \binom{n}{k}$ interactions where n is the number of institutional indicators. Besides the bivariate interactions, higher-order interactions should therefore also be considered. Unfortunately, this would require the inclusion and interpretation of 16383 interactions. Obviously, this is infeasible and the problem of implicit interactions cannot be taken into account. The opportunity to gain information on bivariate interactions comes at the price of a possible bias due to the negligence of implicit interactions.

[4] This is calculated as $\frac{prior\ model\ size}{number\ of\ institutional\ interactions}$.

the corresponding prior inclusion probability is considered as significant dependent on the prior model size. Note, that the alteration of the prior model size is done to check the robustness of the outcomes. Therefore, an interaction term is only called robust and significant if its posterior inclusion probability is above the corresponding prior inclusion probability for all considered prior model sizes. The results are displayed in table 1 where the variables are sorted according to their posterior inclusion probability for a prior model size of 30 in a descending order. Only interaction terms which are significant for at least one prior model size specification are reported in order to avoid illegible tables.

The findings attach a significant effect on the unemployment rate to 22 interaction terms independent of the prior model size. Further 13 interaction terms have posterior inclusion probabilities above the prior inclusion probabilities for some prior model sizes, but not for all. Hence, these 13 interactions are not called significant.

The technical procedure of estimating posterior inclusion probabilities with a large number of explanatory factors can lead to slightly changing results for two runs with the same specification. While this is not relevant for most of the interactions, it can be of importance for variables with a posterior inclusion probability around the prior inclusion probability. Hence, the results have been generated twice for each prior model size to secure that the decision of significance is not driven by a slightly imprecise convergence process. While for few variables the results indeed change for some prior model sizes, the overall findings on significance and robustness remain unchanged. Hence, the 22 robust and significant interaction terms identified in this section build therefore the basis for the further analysis.

Table 1: Different prior model sizes, availability

Variable						
Model size	k = 10	k = 15	k = 20	k = 25	k = 30	k = 40
Prior incl. prob.	(0.11)	(0.16)	(0.22)	(0.27)	(0.33)	(0.44)
EPL2*UB2	0.999	0.999	0.999	0.999	0.999	0.999
TX1*MW	0.995	0.999	0.999	0.999	0.999	0.999
EB*POS	0.999	0.999	0.999	0.999	0.999	0.999
EPL2*UB3	0.999	0.999	0.999	0.999	0.999	0.999
TX1*TX2	0.992	0.997	0.998	0.999	0.999	0.999
UC*EB	0.884	0.983	0.996	0.999	0.999	0.999
TX2*MW	0.994	0.998	0.999	0.999	0.990	0.998
TX1*UB3	0.998	0.982	0.998	0.998	0.997	0.997
EPL1*UC	0.999	0.996	0.998	0.998	0.996	0.999
EPL1*UB1	0.887	0.918	0.969	0.982	0.985	0.997
BCO*UC	0.986	0.984	0.976	0.982	0.974	0.989
EPL2*MW	0.961	0.975	0.987	0.977	0.974	0.981
TX3*MW	0.608	0.882	0.928	0.970	0.955	0.987
TX1*UB2	0.829	0.818	0.926	0.963	0.965	0.970
MW*EB	0.696	0.900	0.892	0.904	0.945	0.950
TX3*EB	0.594	0.676	0.745	0.868	0.832	0.866
TX3*UB2	0.750	0.884	0.883	0.727	0.943	0.764
TX1*POS	0.460	0.595	0.646	0.576	0.838	0.822
POS*UB3	0.402	0.370	0.437	0.571	0.393	0.491
UC*POS	0.116	0.342	0.456	0.454	0.696	0.640
EPL1*EPL2	0.450	0.540	0.517	0.417	0.524	0.479
EPL1*EB	0.194	0.337	0.338	0.314	0.413	0.443
UC*UB1	0.109	0.107	*0.228*	*0.392*	0.301	*0.634*
TX3*UC	*0.217*	*0.455*	*0.467*	*0.379*	*0.541*	0.408
BCO*UB3	*0.186*	*0.272*	*0.334*	*0.363*	*0.379*	0.388
EPL1*UBC	0.105	*0.358*	*0.336*	*0.355*	*0.471*	0.400
EPL1*MW	*0.202*	*0.339*	*0.344*	*0.333*	*0.425*	0.404
UC*UB2	*0.283*	0.138	0.154	*0.306*	0.113	0.292
UB2*UB3	0.034	0.038	0.077	*0.297*	0.122	0.352
EPL1*UB3	*0.142*	0.135	0.172	0.183	0.264	0.356
BCO*UBC	*0.226*	*0.298*	*0.227*	0.164	0.181	0.212
EPL2*BCO	*0.189*	*0.166*	0.186	0.158	0.271	0.188
TX3*POS	*0.172*	*0.172*	0.185	0.124	0.180	0.175
EB*UB3	*0.145*	0.142	0.118	0.114	0.189	0.321
EPL2*EB	*0.124*	0.088	0.095	0.071	0.085	0.093

The dependent variable is the unemployment rate. The 5 control variables as well as the 14 institutional indicators have been included in all regressions. Overall, models consisting of combinations of up to 91 interaction terms have been considered. Fixed country- and time-specific effects are swept by using the Within transformation (see Baltagi 2003). Only variables with a posterior inclusion probability above the prior inclusion probability for at least one prior model size specification are displayed in the table. Prior incl. prob. is the prior inclusion probability.

4.1 Do interactions really help to explain unemployment?

The model averaging approach applied in this paper helps to evaluate whether bivariate interactions of institutional indicators are robustly and significantly related to the unemployment rate. But does the inclusion of interacting variables really boost the explanatory power of macroeconomic unemployment models? In other words, does the model including interactions perform substantially better in explaining unemployment than the benchmark model without interactions? A comparison between both models gives an indication of the importance of interactions between individual institutional indicators. Table 2 displays the outcomes of fixed effects-regressions with the unemployment rate as the left-hand variable.

The first model includes the 14 individual institutional indicators and the 5 control variables. The second model adds the 22 institutional interactions identified as robust and significant within the model averaging framework. Due to space constraints, the 5 control variables as well as the unemployment benefit coverage are not displayed. Two results stand out. First, the model fit of the interaction model (model 2), measured by the adjusted R-squared, is substantially better than the model fit of model 1. Second, all interaction terms show significance at least at the 5%-level, except for the interaction between the employment protection for regular and for temporary employment ($EPL1 * EPL2$) which is only significant at the 10%-level.

Table 2: Model comparison without and with interactions

Explanatory variables	Coefficient	Standard error	Coefficient	Standard error
	Model 1		Model 2	
Payroll tax (TX1)	0.02517***	(0.00362)	-0.02256**	(0.01098)
Income tax (TX2)	0.01458**	(0.00598)	-0.01234	(0.00801)
Consumption tax (TX3)	-0.02978***	(0.00476)	-0.00397	(0.00628)
Employment protection regular (EPL1)	0.09814**	(0.04254)	1.16299***	(0.17362)
Employment protection temp (EPL2)	-0.09648***	(0.01480)	-0.20253***	(0.05899)
Bargaining coordination (BCO)	-0.04360***	(0.01131)	-0.17733***	(0.03164)
Minimum wage (MW)	0.00606	(0.00729)	-0.06583	(0.03455)
Union coverage (UC)	0.00637***	(0.00167)	0.00867	(0.00423)
Entry barriers (EB)	-0.04389***	(0.01574)	0.05029	(0.04400)
Public ownership (POS)	0.05251**	(0.02240)	0.40932***	(0.05646)
First year benefits (UB1)	0.00358	(0.00141)	0.00875***	(0.00247)
Second/third year benefits (UB2)	0.00026	(0.00142)	-0.00441**	(0.00209)
Fourth/fifth year benefits (UB3)	-0.00754***	(0.00131)	0.02084***	(0.00405)
TX1*TX2	-	-	0.00370***	(0.00042)
TX1*MW	-	-	-0.00897***	(0.00114)
TX1*POS	-	-	0.00545***	(0.00171)
TX1*UB2	-	-	-0.00153***	(0.00013)
TX1*UB3	-	-	0.00191***	(0.00013)
TX2*MW	-	-	-0.00527***	(0.00118)
TX3*MW	-	-	0.00703***	(0.00144)
TX3*EB	-	-	-0.00567***	(0.00097)
TX3*UB2	-	-	-0.00048***	(0.00009)
EPL1*EPL2	-	-	-0.02667*	(0.02205)
EPL1*UC	-	-	-0.01187***	(0.00178)
EPL1*EB	-	-	-0.02260**	(0.01074)
EPL1*UB1	-	-	-0.00475***	(0.00113)
EPL2*MW	-	-	0.03272***	(0.00495)
EPL2*UB2	-	-	0.00876***	(0.00075)
EPL2*UB3	-	-	-0.00794***	(0.00104)
BCO*UC	-	-	0.00203***	(0.00042)
MW*EB	-	-	0.00906***	(0.00212)
UC*EB	-	-	0.00336***	(0.00050)
UC*POS	-	-	-0.00285**	(0.00088)
EB*POS	-	-	-0.05451***	(0.00620)
POS*UB3	-	-	-0.00302***	(0.00093)
R-squared	0.533103		0.812871	
Adjusted R-squared	0.511499		0.792475	

*The dependent variable is the unemployment rate. The 5 control variables as well as the unemployment benefit coverage are included in both models, but not displayed. *** means significance at the 1%, ** at the 5%, and * at the 10%-level.*

4.2 Are the findings in line with the literature?

The econometric analysis deliberately abstracted from using theoretical predictions for the construction of hypotheses. Nevertheless, a brief discussion and classification of the results is given in dependence on the existing literature. However, comparing the findings of this study with the previous literature is hindered by the distinct characterization of institutions. While theoretical studies refer to concepts like the bargaining power, firing taxes and costs, or the search intensity of the unemployed, empirical studies need to find appropriate observable measures for these concepts. For instance, the workers' bargaining power is usually described by the union density or union coverage, but could also be captured by minimum wage agreements. Furthermore, there exist several variables at distinct aggregation levels within the same institutional category. One could use the payroll, the income and the consumption tax, or the sum of all three factors (the tax wedge) to describe the labor tax system. While the more disaggregated variables can help to draw a more detailed picture of the impact of institutions, the interpretation is more difficult, especially when it comes to interactions. The analysis conducted in this paper uses disaggregated measures, when possible. When theory predicts a connection between, for example, the unemployment benefits and the employment protection, 6 interaction terms are affected. Hence, a comparison with the findings of the relevant theoretical and empirical literature might suffer from the fact, that it is sometimes infeasible to identify comparable interactions.

For example, Daveri and Tabellini (2000) theoretically predict and empirically confirm a positive interaction between the labor tax burden and the workers' bargaining power. The central idea is that additional costs of increasing labor taxes are distributed between employers and employees according to the workers' bargaining power. If the workers have a certain degree of power, they can shift the costs to the employer. Hence, the bargaining power should interact with factors that increase costs which are distributed between the employee and the employer. Hence, the higher the bargaining power, the more detrimental a cost increase, what is equal to a positive sign of the interaction term. The IMF (2003) was not able to confirm the findings of Daveri and Tabellini (2000). The signs of the coefficients of the interactions between

the union density and both the employment protection as well as the tax wedge are negative. Bassanini and Duval (2009) also find a negative, but insignificant effect of both interactions. I prefer to use the union coverage (UC) as an indicator for the workers' bargaining power since this factor better describes the unions range and power in the wage bargaining. Institutional changes which can produce additional labor costs are labor taxes as well as firing costs. While the former is represented by the payroll ($TX1$), the income ($TX2$) and the consumption tax ($TX3$), the latter is captured by the employment protection for regular as well as for temporary employment ($EPL1$ and $EPL2$). However, only one such interaction ($EPL1 * UC$) appears as significant, but has the wrong negative sign.

A second type of interaction has been established by Hall and Soskice (2001) and is based on the variety of capitalism approach. The central argument is that the effect of labor market institutions varies depending on the type of capitalism. The authors distinguish between liberal market economies and coordinated market economies. While the former type can be characterized as a market-driven economy, the latter type is more dependent on informal coordination of the market activities between the actors. In a nutshell, coordinated economies are rather able to internalize the negative impacts of institutional characteristics by focusing on the general, economy-wide consequences. If this hypothesis holds true, the bargaining coordination (BCO) should interact with other institutional factors. While this is the case for one interaction ($BCO * UC$), the sign is positive and therefore counterintuitive. An increase in the workers' bargaining power has worse consequences on the labor market for a high degree of coordination compared to a situation with a low level of coordination. This result is opposed to what has been estimated by Baccaro and Rei (2007) who found a negative coefficient of the interaction between the union density and the bargaining coordination. Similarly, the IMF (2003) presents a positive significant coefficient for the same interaction, and Belot and van Ours (2004) report a negative coefficient for the interaction between the union density and the bargaining centralization. While the deviation from the common result in the literature could be caused by the union density replacement by the union coverage, it could also be the consequence of the comprehensive estimation of all interactions.

The third type of interaction deals with the interplay between labor demand and supply. An institutional reform which raises labor demand only affects equilibrium unemployment if enough labor is supplied. In contrast, a reform fostering labor supply calls for sufficient labor demand to be effective. An example for this, mentioned by Belot and van Ours (2001), is a decrease of unemployment benefits which has no effect if not sufficient jobs are provided, for instance due to high employment protection. Since it is not feasible to disentangle the particular institutional impacts on labor demand and supply, a simplification conducted and it is assumed that the unemployment benefits mainly affect labor supply, while the employment protection, labor taxes, the minimum wage, the bargaining power, and the product market regulation are expected to shape labor demand. If the sign of the interaction term is negative, then the reforms are called complementary. In this case, a reduction of an institutional value is more beneficial if the value of the conditioning variable is low. Given that a high level of the conditioning variable is actually hindering labor demand, a negative sign is expected for the interaction terms. Indeed, $TX1 * UB2$, $TX3 * UB2$, $EPL1 * UB1$, $EPL2 * UB3$, $POS * UB3$ have the expected sign. In contrast, $TX1 * UB3$ and $EPL2 * UB2$ show a positive sign. The findings of Bassanini and Duval (2009) concerning this type of interaction as well do not point to consistently negative interaction term coefficients. While the interaction between the unemployment benefits and the tax wedge is positive, and negative the one between the unemployment benefits and the union density, the interactions between the unemployment benefits and both the employment protection as well as the product market regulation are insignificant. Similarly, the IMF (2003) reports a negative coefficient for the interaction between the unemployment benefits and the employment protection, and a positive one for the interaction between the unemployment benefits and the tax wedge.

5 Conditional effects of institutions

The results of the previous estimations show that each institutional indicator is important as an interaction partner for some other institution, except for the bargaining coverage (UBC).

The indicators which appear most frequently as interaction partners are the payroll tax (TX1), the minimum wage (MW), and the entry barriers (EB) with 5 appearances in interaction terms. Furthermore, the union coverage (UC) and the public ownership (POS) are included in 4 interaction terms. The least important interaction partners, given the appearances in interaction terms, are the bargaining coordination (BCO) and the first year unemployment benefits (UB1). Form the results presented in table 2, it is generally possible to deduce the impact of an institutional change on the unemployment rate conditional on other institutional factors. This will be done in the following.

5.1 Calculating marginal effects

The calculation of marginal effects of institutional changes needs to consider both the direct as well as the conditional effect. Hence, both the coefficients of the individual indicators of model 2 in the upper part of table 2 as well as the interaction terms coefficients in the lower part of model 2 of table 2 are required.[5] The coefficients of the individual effects show the impact of the particular variable given that the conditioning variable(s) are zero. This can be seen from the following equation.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X2 + \beta_3 X_1 X_2 + \epsilon \tag{6}$$

gives an estimation equation with two institutional factors X_1 and X_2 as well as an interaction between both factors $X_1 X_2$. Then, the marginal effect of, for instance, X_1 is

$$\frac{\partial Y}{\partial X_1} = \beta_1 + \beta_2 X_2. \tag{7}$$

β_1 gives the effect of X_1 for $X_2 = 0$, while β_2 shows the dependence of a change in X_1 on X_2. Given the equations (6) and (7), the results from table 2 provide enough information to calculate the marginal effects of changes in all institutional indicators. The marginal effect of an

[5] Basically, the values for the interaction coefficients could also be calculated within the model averaging framework. A comparison between the both methods shows minor differences. The results presented in the following would therefore be marginally affected.

indicator is calculated from the individual indicator coefficient plus the coefficients estimated from the interactions in which the particular indicator takes place. For example, the marginal effect of bargaining coordination (BCO) is

$$\frac{\partial UE}{\partial BCO} = -0.17733 + 0.00203\ UC. \tag{8}$$

Equation (8) implies that the bargaining coordination has a negative impact on unemployment as long as the union coverage (UC) is zero what is an irrelevant case. For union coverage values larger than zero the effect becomes less negative or even positive. Obviously, some descriptive statistics are required to gather more information on the marginal effect of a variable conditional on the value of another variable. Therefore, table 3 delivers some statistics for the individual indicators.

According to table 3, the threshold value for union coverage is $\frac{0.17733}{0.00203} = 87.4$, what is within the range of possible values. The interpretation for this is that for values lower than 87.4 for the union coverage, an increase of the bargaining coordination has a negative impact on unemployment. For union coverage values above 87.4, the effect of a bargaining coordination increase on unemployment becomes positive. A closer look at the data reveals that there are 91 observations below 87.4 for the union coverage and 317 above. Hence, whether an increase in the bargaining coordination has a positive or a negative impact on unemployment is clearly a country- and time-specific issue. Similar to this, marginal effects can be calculated for all institutional indicators. However, while the exercise is easy for indicators included in only one interaction, it is more difficult for indicators that interact with more than one indicator. The marginal effect of the income tax ($TX2$), for instance, can be calculated from the direct effect, and the effects conditional on the minimum wage (MW) and the payroll tax ($TX1$). Hence, two threshold levels have to be calculated. Taking the income tax example, the relevant equation to calculate the marginal effect of an income tax increase is

$$\frac{\partial UE}{\partial TX2} = -0.01234 + 0.00270\ TX1 - 0.00527\ MW. \tag{9}$$

Table 3: Descriptive Statistics over all countries and years

Variable	Mean	Median	S.D.	Min	Max
Payroll tax (TX1)	12.95	13.73	9.36	0.00	32.36
Income tax (TX2)	15.74	15.91	6.64	0.01	33.80
Consumption tax (TX3)	19.34	20.44	6.54	1.61	33.53
Employment protection regular (EPL1)	1.98	1.87	0.85	0.17	3.88
Employment protection temp (EPL2)	2.15	1.88	1.44	0.25	5.38
Bargaining coordination (BCO)	3.19	4.00	1.28	1.00	5.00
Minimum wage (MW)	3.50	2.00	2.86	0.00	8.00
Union coverage (UC)	67.90	75.00	24.84	13.70	99.00
Entry barriers (EB)	3.57	3.81	1.63	0.35	6.00
Public ownership (POS)	3.83	4.08	1.31	0.83	6.00
First year benefits (UB1)	49.08	52.65	20.33	1.00	88.80
Second/third year benefits (UB2)	25.43	25.90	20.19	0.00	68.50
Fourth/fifth year benefits (UB3)	14.10	15.45	13.94	0.00	68.50

The underlying time frame ranges from 1982 to 2005. Averages over all years and all 17 countries have been constructed.

If the minimum wage value was known, it would be feasible to calculate the threshold level for the payroll tax. Similarly, for a known value of the payroll tax, the threshold level for the minimum wage could be calculated. The first coefficient again only shows the effect of the income tax for both the payroll tax and the minimum wage being jointly zero.

In order to tackle this problem, the mean values for all conditioning variables are taken except of the one conditioning variable of interest. If one is interested, for instance, in the interaction between the income tax and the minimum wage, the mean value for the payroll tax over all countries and years is inserted in equation (9). The mean value of the payroll tax is 12.95. Hence, the marginal effect of the income tax (TX2) reduces to

$$\frac{\partial UE}{\partial TX2} = -0.01234 + 0.00270 * 12.95 - 0.00527\ MW = 0.02263 - 0.00527\ MW \qquad (10)$$

and the threshold level for the minimum wage is now $\frac{0.02263}{0.00527} = 4.3$.

Table 4: Calculation of threshold levels

Variable	Conditioning variable	Individual coefficient	Interaction coefficient	Threshold level
Payroll tax (TX1)	TX2	-0.02256	0.00370	10.85
	MW		-0.00897	5.16
	POS		0.00545	3.59
	UB2		-0.00153	50.19
	UB3		0.00191	*-0.47*
Income tax (TX2)	TX1	-0.01234	0.00370	14.88
	MW		-0.00527	1.69
Consumption tax (TX3)	MW	-0.00397	0.00703	4.54
	EB		-0.00567	2.00
	UB2		-0.00048	10.25
Employment protection regular (EPL1)	UC	1.16129	-0.01187	77.80
	EB		-0.02260	*8.55*
	UB1		-0.00475	77.79
	EPL2		-0.02667	*6.34*
Employment protection temp (EPL2)	MW	-0.20253	0.03272	4.82
	UB2		0.00876	30.81
	UB3		-0.00794	8.08
	UB3		-0.02667	5.35
Bargaining coordination (BCO)	UC	-0.17733	0.00203	87.35
Minimum wage (MW)	EB	-0.06583	0.00906	5.17
	TX1		-0.00897	11.14
	TX2		-0.00527	12.30
	TX3		0.00703	21.40
	EPL2		0.03272	2.61
Union coverage (UC)	EB	0.00867	0.00336	4.30
	POS		-0.00285	2.50
	BCO		0.00203	4.40
	EPL1		-0.01187	1.75
Entry barriers (EB)	TX3	0.05029	-0.00567	*-35.45*
	EPL1		-0.02260	*-9.88*
	MW		0.00906	*31.78*
	POS		-0.05451	*-0.96*
Public ownership (POS)	TX1	0.40932	0.00545	*-9.22*
	UC		-0.00285	*133.33*
	EB		-0.04077	4.90
	UB3		-0.00302	54.19
First year benefits (UB1)	EPL1	0.00875	-0.00475	2.07
Second/third year benefits (UB2)	TX1	-0.00441	-0.00153	5.52
	TX3		-0.00048	11.14
	EPL2		0.00876	2.66
Fourth/fifth year benefits (UB3)	TX1	0.02084	0.00191	7.32
	EPL2		-0.00794	2.89
	POS		-0.00302	5.52

The table contains the estimated coefficients of model 2, table 3 with the mean values of table 4.

Since the minimum wage index can only be a natural number from the set $MW = \{1, 2, ..., 8\}$, values of 1,2,3 and 4 assign a positive impact on unemployment to an income tax increase, while values of 5,6,7, and 8 mean a negative marginal effect of an income tax reform on unemployment, given that the payroll tax is at its mean.

Table 4 contains the threshold levels for each combination of interaction partners. If there is more than just one interaction partner, the mean values are taken to calculate the threshold level for the indicator of interest. Table 4 has to be interpreted as follows. The first and second column show the variables shaping the interaction term, where the first column contains the variable of interest for which the marginal effect is calculated. The second column shows the conditioning variable. The third column displays the direct or individual effect for the variable of interest, and the fourth column the corresponding coefficient of the interaction term with the conditioning variable. Note that the median values for the remaining conditioning values are taken for those variables of interest with more than one conditioning variable. The calculation is carried out in accordance to the equations (6) and (7). The last column contains the threshold level for the conditioning variable, i.e. the value at which the marginal effect of an increase of the variable of interest changes its sign, given that all other relevant conditioning variables are at their mean.

For most of the conditioning variables the threshold level is within the frontiers of actually possible values. Only for 8 values which are written in italics in table 4, the threshold levels are not in the range of possible values when the conditioning values are set to their mean. This emphasizes the empirical relevance of interaction terms for shaping institutional characteristics and conducting institutional reforms. Whether an institutional reform increases or decreases unemployment depends on the level of the conditioning institution, given that the other conditioning variables are at their mean.

5.2 Marginal effects of institutional reforms for selected countries

In principle, it is possible to calculate country-specific marginal effects for all institutional indicators. Instead of using averaged data, calculations can be based on the indicator values for

a specific country as well. Germany is used as an example to show exemplarily the economic content of the results presented in this paper. First of all, the country specific descriptive statistics for the individual institutions are required. The indicator values are presented in table 5.

Table 5: Descriptive Statistics for Germany

Variable	Mean	Median	S.D.	Min	Max
Payroll tax (TX1)	14.31	14.98	1.41	12.31	16.07
Income tax (TX2)	17.18	17.34	0.72	15.55	18.23
Consumption tax (TX3)	16.79	17.15	1.34	14.74	18.54
Employment protection regular (EPL1)	2.66	2.68	0.12	2.58	3.00
Employment protection temp (EPL2)	2.96	3.63	1.00	1.25	3.75
Bargaining coordination (BCO)	4.00	4.00	0.00	4.00	4.00
Minimum wage (MW)	1.00	1.00	0.00	1.00	1.00
Union coverage (UC)	69.32	69.20	5.20	63.00	76.80
Entry barriers (EB)	3.77	4.15	1.72	0.77	5.71
Public ownership (POS)	3.52	3.94	1.06	1.86	4.67
First year benefits (UB1)	38.09	38.35	1.43	35.40	40.40
Second/third year benefits (UB2)	22.01	23.10	4.81	0.00	24.40
Fourth/fifth year benefits (UB3)	22.01	23.10	4.81	0.00	24.40

Averages over the period from 1982 to 2005 for Germany.

With the descriptive statistics for Germany, the calculations can be carried out with the mean value over time as well as with the 2005 values, both for Germany. The results on the impact of institutional changes enable to draw a clear picture of which institutional reforms might be beneficial for the german labor market. Table 6 presents these marginal effects.

A positive value of the marginal effect means that an increase in the particular indicator raises the unemployment rate. For the mean value, 6 indicators have a positive and 7 indicators a negative sign. If only the indicator values for 2005 are used, the results change slightly. While increases of the consumption tax (TX3) as well as the entry barriers (EB) show a negative marginal effect on unemployment for the mean institutional values, it becomes positive for the values for 2005. In contrast, the positive sign of the second and third year benefits (UB2) for the mean values changes to a negative one for the 2005 values.

Table 6: Marginal effects for Germany for different values

Variable	Mean value	Marginal effect (mean)	2005 value	Marginal effect (2005)
Payroll tax (TX1)	14.31	0.04430	15.29	0.02305
Income tax (TX2)	17.18	0.02106	15.70	0.02370
Consumption tax (TX3)	16.79	-0.02419	18.54	0.00045
Employment protection regular (EPL1)	2.66	0.10824	3.00	0.27893
Employment protection temp (EPL2)	2.96	-0.21996	1.25	-0.24680
Bargaining coordination (BCO)	4.00	-0.03661	4.00	-0.04944
Minimum wage MW)	1.00	-0.02330	1.00	-0.09236
Union coverage (UC)	69.32	-0.00697	63.00	-0.01767
Entry barriers (EB)	3.77	-0.03208	0.77	0.01983
Public ownership (POS)	3.52	0.09115	1.86	0.33493
First year benefits (UB1)	38.09	-0.00222	39.87	-0.00349
Second/third year benefits (UB2)	22.01	0.00283	0.00	-0.01181
Fourth/fifth year benefits (UB3)	22.01	0.00165	0.00	0.01939

Institutional marginal effects for Germany according to equation (12).

It is likely that the marginal effects of two countries with substantially distinct institutional systems show even more heterogeneity. This exercise is carried out in the following. In order to facilitate the comparison of similar reforms in institutionally different countries, marginal effects are also calculated for France, the United States, Japan, and Sweden. For all 4 countries, only the values for 2005 are taken since the construction of mean values might cause the negligence of valuable information. The tables 7 and 8 display the marginal effects for all indicators for France and the United States in table 7, and Japan and Sweden in table 8.

This overview again emphasizes the importance of country-specific institutional characteristics for the overall effect of institutional indicators. For instance, the income tax (TX2) level in France and the United States is largely comparable with values of roughly 14 and 13 %. However, the impact of an increase in the income tax on the unemployment rate is completely different. While an increase in the income tax in France increases the unemployment rate, the effect goes in the opposite direction for the United States. According to table 4, the impact of an income tax change depends on the payroll tax (TX1) and on the minimum wage (MW).

Table 7: Marginal effects for France and the United States

Variable	France		United States	
	2005 value	Marginal effect	2005 value	Marginal effect
Payroll tax (TX1)	26.73	-0.01301	6.41	-0.03968
Income tax (TX2)	14.32	0.02827	13.28	-0.03719
Consumption tax (TX3)	24.62	0.01457	9.99	0.04272
Employment protection regular (EPL1)	2.47	-0.22195	0.17	0.85993
Employment protection temp (EPL2)	3.63	0.09300	0.25	0.05248
Bargaining coordination (BCO)	2.00	0.01552	1.00	-0.14952
Minimum wage (MW)	6.00	-0.05237	8.00	-0.09246
Union coverage (UC)	95.00	-0.01772	13.70	0.01091
Entry barriers (EB)	1.40	0.04426	1.68	0.04334
Public ownership (POS)	3.94	0.25108	1.40	0.31214
First year benefits (UB1)	60.78	-0.00151	29.45	0.00711
Second/third year benefits (UB2)	37.49	-0.00237	5.56	-0.01071
Fourth/fifth year benefits (UB3)	17.79	0.00697	5.56	0.01968

Institutional marginal effects for France and the United States according to equation (12).

Both countries have rather rigid minimum wage settings for which reason the payroll tax is the crucial factor. France with a value of 27 % has a much higher payroll tax level than the United States with about 6 %. Similarly, the impact of an increase in the bargaining coordination (BCO) has a distinct impact in Sweden and in Japan although the degree of coordination is the same. Again, the variation in the conditioning variable between both countries, the union coverage (UC) which is at 92 % in Sweden and at about 16 % in Japan, delivers the explanation for this effect. Another interesting point is the connection between the employment protection and the unemployment benefits. Table 4 shows that the impact of the first year benefits (UB1) only depends on the employment protection for regular employment (EPL1). The interplay between both variables, the unemployment benefits as well as the degree of employment protection, has been emphasized in the literature (see Blanchard and Tirole 2008). A look at the tables 7 and 8 points out the distinct effect of an employment protection reform in countries with different levels of first year unemployment benefits. While an increase in the employment protection for regular employment in France and in Sweden (with benefit levels of roughly 60

Table 8: Marginal effects for Japan and Sweden

Variable	Japan		Sweden	
	2005 value	Marginal effect	2005 value	Marginal effect
Payroll tax (TX1)	0.01	-0.07722	23.34	0.02578
Income tax (TX2)	0.01	-0.05448	14.22	0.04545
Consumption tax (TX3)	13.90	0.04466	31.66	0.00019
Employment protection regular (EPL1)	1.87	0.83447	2.86	-0.17206
Employment protection temp (EPL2)	1.00	0.00427	1.63	-0.21923
Bargaining coordination (BCO)	3.00	-0.14401	3.00	0.00943
Minimum wage (MW)	8.00	0.08117	1.00	-0.04681
Union coverage (UC)	16.41	-0.00310	92.00	-0.02190
Entry barriers (EB)	1.84	-0.00632	0.51	-0.02307
Public ownership (POS)	1.47	0.28044	3.40	0.33928
First year benefits (UB1)	22.32	0.00074	74.99	-0.00297
Second/third year benefits (UB2)	0.00	-0.00336	3.09	-0.01948
Fourth/fifth year benefits (UB3)	0.00	0.00846	0.00	0.01943

Institutional marginal effects for Japan and Sweden according to equation (12).

and 75 %) are linked to a fall in the unemployment rate, the same kind of reform increases unemployment in the United States and Japan (with benefit levels of roughly 30 and 22 %).

5.3 Economic significance and heterogeneity over countries

In order to check whether the results are economically significant, a closer look is taken at the fourth and fifth column of table 6 which contains the marginal effects for all 14 institutional indicators for Germany. The values for all conditioning variables are the observations for 2005. For the interpretation of coefficients it has to be taken into account that the unemployment rate has been divided by 10 for all estimations due to computational reasons. A look at table 6 points out that most of the coefficients are not only statistically but also economically significant. For instance, an increase in the payroll tax (TX1) by 1 percentage point increases the unemployment rate by 0.23 percentage points. An increase in the employment protection for regular employment (EPL1) by one unit, i.e. from 2 to 3, for example, increases the unemployment rate by roughly 2.7 percentage points. In contrast, a 1 percentage point increase

in the employment protection for temporary employment (EPL2) lowers the unemployment rate by about 2.4 percentage points. The impact of a reform of the unemployment benefit system is relevant as well. An increase by 1 percentage point in the first (UB1), and the second and third year benefits (UB2) lowers the unemployment rate by 0.03 and 0.12 percentage points, respectively. In contrast, raising the fourth and fifth year benefits (UB3) by 1 percentage point increases the unemployment rate by 0.19 percentage points. Interestingly, the product market still seems to be over-regulated. A competition-enhancing reform of the public ownership (POS) as well as the entry barriers (EB) would result in a lower unemployment rate in Germany. The minimum wage (MW) as well as the bargaining coordination (BCO) results should be taken with care. Both measures are just indexes that can take 8 and 6 values, respectively, and are rather crude measures. Furthermore, the minimum wage index says nothing about the level of the minimum wage. Yet, information on the level is crucial for a reasonable quantitative assessment of its labor market effect.[6] In this sense, the beneficial minimum wage effect is contradictory to most empirical microeconomic studies summarized by Neumark and Wascher (2006) what seems to underline the shortcoming of minimum wage indicators used in the macroeconomic literature.[7]

The heterogeneity in the institutional impact is present for most of the indicators. Exceptions are the consumption tax (TX3) and the second and third year benefits with a negative coefficient, and the public ownership (POS) with a positive coefficient for all five countries. Nevertheless, the calculation of marginal effects for some more countries also shows heterogeneity for these factors as well.

[6]The OECD provides a measure for the minimum wage relative to the average of full-time workers. Unfortunately, the series are not comprehensively available for the period and countries included in this study.

[7]Recently, Dube et al. (2010) found a positive employment effect through an minimum wage increase in restaurants and other low-wage sectors by exploiting a more comprehensive data-set. Whether this result holds true only for the United States and the specific sectors or whether it can also be applied to other countries and sectors is still unclear.

6 Conclusions

The identification of robust and significant bivariate interaction terms between individual institutions is carried out with the help of a bayesian model averaging approach. 91 institutional interactions consisting of bivariate combinations of 14 institutional indicators are tested for significance. Overall, 22 interaction terms robustly contribute to the explanation of the unemployment rate for 17 OECD countries from 1982 to 2005.

Except for the unemployment benefit coverage (UBC), all remaining 13 indicators are involved in at least one interaction term. The central institutional indicators seem to be the payroll tax, the entry barriers, and the minimum wage setting which take part in 5 interaction terms. Using the observations for 2005 for Germany, France, the United States, Japan, and Sweden, it is shown that similar reforms can have different effects on the labor market due to the dependence on other institutional factors.

The results imply that institutional reforms conditional on the institutional system are qualitatively as well as quantitatively important and can significantly contribute to reduce the unemployment rate. The findings are beneficial for policy-making by delivering a fundament for the macroeconomic ex ante evaluation of institutional reform decisions conditional on the institutional arrangement.

7 References

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