Shocks and endogenous institutions – An agent-based model of labor market performance in turbulent times

Christian W. Martin* and Michael Neugart†

February 18, 2008

Abstract

We develop an agent-based model of labor market regulation to study the consequences of employment protection legislations for labor market performance. Unlike most of the existing accounts of labor market regulation we endogenize the institutional setting. Workers cast their vote on labor market regulation depending on the past payoffs that accrued to them when one of two competing parties with different labor market policy platforms was in power. We find that employment protection systems per se do not harm employment in the long-run. However, we identify important interaction effects with exogenous shocks. In more turbulent times, employment protection systems affect labor market performance for some periods even after the shock has subsided.

Keywords: agent-based model, labor market institutions, voting, employment

*Universität Hamburg, Centre for Globalisation and Governance, Allendeplatz 1, D-20146 Hamburg, Germany, phone: +49 (0)40 42838-7062, e-mail: christian.martin@uni-hamburg.de

†Wissenschaftszentrum Berlin für Sozialforschung (WZB), Reichpietschufer 50, 10785 Berlin, phone: +49 (0)30 25491-119, e-mail: neugart@wzb.eu

1 Introduction

For more than a decade, researchers and policymakers have been concerned primarily with restrictive labor market institutions as the driving force of high unemployment rates. Freeing labor markets from state intervention such as generous mandatory severance payments, the conventional wisdom went, would create jobs and reduce unemployment. Despite the high popularity of this thesis (see, e.g. Nickell (1997), Elmeskov et al. (1998), Heckman and Pages (2000), Belot and van Ours (2004), or Nickell et al. (2005)) the empirical evidence for a positive relation between high unemployment rates and employment protection legislation is rather mixed (OECD (2004)). In fact, most studies find no direct effects of employment protection legislation on employment or unemployment rates. Instead, some studies have identified a more complex relationship between labor market institutions and employment rates, see e.g. Blanchard and Wolfers (2000), and Bertola et al. (2002).[1]

Besides for their rather inconclusive empirical results, these studies have attracted criticism for a number of other reasons as well. Simple cross section plots of single institutions against levels of unemployment are not backed by the results of more sophisticated regression techniques (see Baker et al. (2005)). If panel effects are controlled for, results are frequently sensitive to definitions of variables and specification of the models. Furthermore, the degrees of freedom may be insufficient as these studies typically employ no more than around 20 countries with usually around half a dozen observations per country. This low number of observations is particularly problematic if one wants to assess the effect of institutional settings that typically characterize welfare states. For example, consider a case where countries have

[1]While the papers cited above focus on the empirical evidence with respect to the effect of employment protection legislation on employment various theoretical papers come to the following results: Lazear (1990) makes the proposition that mandated severance payments do not have an effect on labor market performance. In calibrated versions of matching models Garibaldi (1999) and Mortensen and Pissarides (1999) argue that an increase in firing costs reduces labor market flows and the unemployment rate. Blanchard and Portugal (2001) argue that countries with more stringent employment protection may have the same unemployment rate, but may be confronted with longer durations of unemployment.

four types of institutions: employment protection, unemployment benefits, union coverage and active labor market policies. If the variable capturing those institutions can take on two values, say "high" and "low", there are already 16 different possible institutional configurations. It is obvious that if one allows for more institutions and finer levels of distinction, the degrees of freedom reduce drastically (see also Freeman (2005)).

Finally, and maybe most importantly, it is typically difficult to take into account the endogeneity of labor market institutions. In a number of countries, labor market institutions changed as a response to the poor performance of labor markets. After all, labor market institutions are meant as a social insurance against the risk of unemployment. As the risk changes, it is quite straightforward to expect a change in the demand for insurance by the electorate. Thus, the assumption of exogenously given and fixed labor market institutions is problematic for both theoretical and empirical reasons: if labor market institutions change in response to employment rates, endogeneity problems will distort empirical estimates. On a theoretical level, any discussion that fails to take into account the endogenous nature of labor market institutions misses a central point: the inherently political properties of labor market institutions and the ensuing dynamics. Assuming exogenous labor market institutions will consequently result in a misunderstanding of the driving forces behind the impact of institutions on labor market outcomes.

Given these shortcomings of the existing literature, this article follows a different approach for evaluating the impact of employment protection legislations. We take up a suggestion put forward by Freeman (2005) and use agent-based computer simulations to assess the impact of labor market institutions on levels of unemployment. In our model, labor market institutions are endogenous in the sense that they may change with labor market performance as voters switch votes between parties offering different employment protection. We also take into account the possible interaction between institutions and exogenous shocks, as has been put forward by Blanchard and Wolfers (2000) and Bertola et al. (2002).

Specifically, our agent-based model consists of three types of actors: voters who are identical with the workforce of the economy, two ideologically

motivated political parties competing for electoral support with either a "regulation" or a "de-regulation" platform, and firms that may or may not be subject to regulation and adjust their labor demand accordingly. Voters cast their votes against the backdrop of their experiences with one of the parties in power and their ideological leaning towards one of the two competing parties. With this simulation framework in place, we ask two questions: "Does variation of the parameters, especially those related to employment protection legislation, systematically change the employment rate?" and "If the economy is hit by a shock, do shocks and employment protection legislation interact with respect to the performance of the employment rate?" Our answer to the first question is "no", while it is "yes" to the second one.

As will become clear, agent-based models have a number of advantages as opposed to models that strive for closed form solutions.[2] Most importantly, the programming environment allows us to take the notion of endogenous labor market institutions seriously. We consider this an important feature of our model, in particular with respect to the policy relevance of our findings. Labor market institutions are subject to political decisions and should, in our view, be modelled as such. The role of labor market institutions in explaining unemployment is far from being settled - and too important from a policymaker's point of view to be ignored. Taking labor market institutions as endogenous to their effects and modelling the political process in which these institutions are altered allows us insights into the dynamic interaction that produces both labor market institutions and outcomes. Thus we bring together so far two rather separate strands of the agent-based modelling literature: on the one hand agent-based models of the labor market (see, e.g., Tesfatsion (2001b), Pingle and Tesfatsion (2003), Neugart (2004), Fagiolo et al. (2004), Richiardi (2006), or Neugart (2007)), and on the other hand those attempts of building agent-based models of collective decision making (see, e.g., Kollman et al. (1997), Martin and Plümper (2005), or Fowler and Smirnov (2005)).

The remainder of the paper proceeds as follows: In the next section, we

[2]For a survey on agent-based computational modelling see Tesfatsion (2001a) or Tesfatsion (2006).

describe the setup of the model and discuss its properties. Section 3 analyzes the results and section 4 concludes.

2 The model

2.1 Description of the model

The economy

In this section, we describe the basic setup of our model along the lines of the pseudocode given in figure 1. The labor market consists of a fixed number of local labor markets (*numLocal*) allocated on a circle in order to avoid end-point problems that would occur in case of an allocation on a line. Initially, firms are randomly allocated to local labor markets. There is a fixed number of voters/workers denoted by $numVoters$ in the economy. Also voters/workers are randomly allocated to one of the local labor markets initially.

Voters/workers search for jobs by sending applications to vacancies posted by firms in their neighborhood. In other words we assume that voters/workers do not consider to move for a job which is "too far away" from their current residency. If there are more applicants than vacancies, the firm randomly chooses one of the applicants. A hired worker earns a wage *wage*. We assume that the wage is fixed across the economy.[3] If no voter/worker could be found for the vacancy, it stays empty until the next period's application round.

Parties and voting behavior

Labor market institutions are modelled as a result of the political process. There are two political parties competing for office. The parties are distinguished by their ideologically motivated and fixed positions on labor market policies. While the first party, denoted R, runs on a regulatory labor

[3]One could, for instance, think of a monopoly union that sets the wage once and for all, leaving the "right-to-manage" to the firms, see Oswald (1985).

market policy platform, the second party, D, takes a de-regulatory stance. Parties can commit credibly to their respective policies and enact them once in power.[4] Specifically, if party R is in power, it enacts a policy that makes it mandatory for firms to dole out severance payments to laid off workers. If, on the other hand, party D is in power, no such policy is enacted.

Voters vote retrospectively, based on their experiences with both parties. That is, a voter compares the average benefits that accrued to him during the incumbent's time in office with the average benefits he enjoyed while the challenger party was in office. Additionally, voters hold ideological beliefs that benefit one of the two competing parties. Half of the voters/workers has an ideological leaning towards one party, and the rest favors the competing party. Thus, whether voters/workers vote for the incumbent party or for the challenger in subsequent periods depends on the relative payoffs that accrued to the voter/worker during the legislative periods that he compares, and the ideological leaning of the voters/workers towards one of the two parties. That is, a voter/worker for whom the payoffs in terms of income plus possible severance payments is equal for the incumbent and the challenging party will more likely vote for the party of his ideological disposition. Moreover, given the ideological leaning, the party that offered the relatively larger payoffs can be more sure that a particular voter/worker will not vote for the competing party. Formally, this may be expressed in the following way: denote with X_i^j the average payoff to the voter/worker of type $j = R, D$ from party $i = R, D$ during the respective legislative period. That is

$$X_i^j = \frac{1}{legislativePeriod} \sum_{t=1}^{legislativePeriod} x_{i,t}^j$$

[4]This is an assumption that is typically made in political economics models of the partisanship type as opposed to assuming opportunistic candidates, see e.g. Persson and Tabellini (2002) or Mueller (2003).

with

$$x_{i,t}^{j} = \begin{cases} wage & \text{if A} \\ severancePayment & \text{if B} \\ wage{+}severancePayment & \text{if C} \\ 0 & \text{otherwise} \end{cases}$$

where (A): voter/worker j is employed at end of period t, (B): voter/worker j was laid off at beginning of period t, party R is in power, and is still unemployed at end of period t, and (C): voter/worker j was laid off at beginning of period t, party R is in power, and is employed at end of period t. Then, assuming, for example, that party R is in power, a voter of type R will cast his ballot for the incumbent with probability

$$p^R = e^{\lambda\delta X_R^R}/(e^{\lambda\delta X_R^R} + e^{\lambda X_D^R}),$$

while a voter/worker of type D will cast the ballot for the incumbent party R with probability

$$p^D = e^{\lambda X_R^D}/(e^{\lambda X_R^D} + e^{\lambda\delta X_D^D}),$$

with $\delta > 1$ as the ideological leaning of a voter/worker, and $\lambda > 0$ reflecting to which extent differences in the payoffs between the challenger and the incumbent drive the casting of votes. Note, that the voting behavior of our agents resembles those in probabilistic voting models where due to a randomly distributed ideological component in voters' preferences, competing parties maximize expected vote shares, see Lindbeck and Weibull (1987).

The voting mechanism assumes that voters/workers base their decisions on a comparison of average payoffs that accrued to them during the incumbent's legislative period compared to the challenger's performance. While the average payoff of the initial party assigned into power can easily be calculated, the average payoff of the challenger cannot (by construction of the model). No other government has been in power so far. That is why we generate a "hypothetical" challenger's payoff by letting two legislative periods elapse without voting in our simulation. The average payoff of the first legislative period is taken as the incumbent's average payoff while the average payoff

of the second legislative period is stored by each individual voter/worker as the challenger's payoff. Those two average payoffs are compared by each individual voter/worker when casting a ballot for the first time.

Elections

Which party comes to power is decided by majority voting in elections that are timed regularly and exogenously. We denote the length of a legislative period with $legislativePeriod$. There is no vote abstention, and voters/workers vote sincerely for their most preferred party. In case both parties receive an equal number of votes, the incumbent stays in power. Once a party is voted into office it installs its policy which becomes effective immediately.

Job destruction and creation

Local labor market are hit by exogenous shocks with a certain likelihood that we denote with $rate$. A firm that resides in such a local labor market has to close down and dismiss its voters/workers.[5]

We assume that a number of firms identical to the number that had to close down opens up in local labor markets other than those hit by the shock. The labor markets to which firms relocate are assigned by a random process. This feature of the model can be interpreted as an asymmetric shock to the economy where some firms close down and new firms are created holding the aggregate number of firms constant.

However, the labor demand of a newly created firm is determined by the policies in place at that time. Specifically, a firm opening up when party R is in power posts less vacancies than under the alternative scenario of party D holding office.[6] We denote the number of jobs offered under party R by $numVacRigid$, and the number of jobs offered under party D by

[5]Note, that whether we model job destruction as a shock hitting a local labor market versus shocks hitting individual firms possibly located in different local labor markets is not crucial for our results.

[6]Note, that the assumption that only newly created firms adapt to the political party in power by adjusting their vacancies implies specific assumptions on the beliefs of the firms. In particular, that beliefs are formed once and for all at the time when the firm is created.

$numVacFlex$ with $numVacRigid < numVacFlex$. Put differently, newly created firms react to the policy of party R by reducing labor demand. [7]

2.2 Simulation set-up

In table 1 we specify the parameters of the simulation model. Our artificial society consists of 200 voters. There are 20 distinct local labor markets in the economy and 20 distinct firms. Each firm posts 10 vacancies if it is allocated to a local labor market which is not regulated. As noted earlier, firms react to government legislation by posting less vacancies. In case party R is in power, firms that open up will only post 9 or 8 vacancies if the parameter *feedback* is set to one or two, respectively. Thus, a fully regulated economy with a feedback parameter set to 1 yields a labor demand that is 10% lower than in a fully deregulated economy. An unemployed voter/worker searches for a new job in adjacent local labor markets. For example, with $numSectorsSearched = 9$ applications are sent to all firms of the current residency and to all firms posting vacancies in the four local labor markets to the left and right of the worker's current residency. There are two ideologically motivated parties. A legislative period lasts for 24 iterations. Thus, with a quarterly calibration, the legislative period amounts to six years. The parameter $\lambda = 0.1$ controls to which extent the comparison of voters' payoffs translate into their voting behavior, and $\delta = 10$ captures the ideological leaning of the voters.

Exogenous variation is introduced by letting the number of initially regulated firms vary between 5 and 15 regulated firms. Severance payments paid to the voter/worker laid off from his job are either equal to the quarterly wage ($wage = 1$), or – in another scenario – four times the quarterly wage. This occurs to be a plausible range for the size of severance payments. In Germany, for instance, workers can, as a rule of thumb, expect to receive

[7] Alternatively, one might have considered firms reacting to parties' policies by offering different wages in stead of adjusting vacancies. Currently, however, we assume that wages remain constant under both the regulation and the de-regulation scenario, rather than allowing for lower wages under rigid labor market policies. This assumption may be justified by the compelling evidence on firms' reluctance to cut wages as for example expressed in Bewley (1999).

Table 1: Parameter settings

Parameter	Value
Number of time steps	$numOfTimeSteps = 768$
Number of local labor markets	$numLocal = 20$
Number of voters/workers	$numVoters = 200$
Wage	$wage = 1$
Maximum vacancies per firm	$maxVacancy = 10$
Local search of workers	$numLocalSearched = 9$
Number of parties	$numParties = 2$
Duration of legislative period	$legislativePeriod = 24$
Ideological leaning of voters	$\delta = 10$
Uncertainty of voting behavior	$\lambda = 0.1$
Probability for random shock to sector	$rate = 0.02$
Initial number of regulated sectors	$initialRegulation = \{5, 15\}$
Negative feedback on labor demand	$feedback = \{1, 2\}$
Party in charge in first period	$initialParty = \{0, 1\}$
Severance payments to worker	$severancePayment = \{1, 4\}$

severance payments in the size of half of a monthly pay per year of seniority (see e.g. Hümmerich (1999)). Given that the exogenous rate at which jobs go sour in our simulation exercise is 0.02, which implies an average duration of a job of roughly 12 years, on average a person would get 1.5 quarterly wages as severance payments.

For each set of parameters we conduct 500 runs. Each run consists of 768 iterations (quarterly time steps). Stored are the values of the endogenous variables at time step 768.

We ask two different questions within our simulation framework. The first one is related to various parameters characterizing the employment protection system. We analyze to which extent varying those parameters changes the employment rate in our artificial economy. The second issue which we address are potential interaction effects between shocks hitting the economy and the employment protection system which may show up in a distinct employment performance. We address the second question with a difference in difference approach as illustrated in figure 2. We compare employment rates before and after a period during which the shock rate was increased

for a treatment group (this is the "first" difference), with the difference in employment rates at those specified time steps for a non-treatment group where the shock rate remained constant throughout the experiment (this is the "second" difference). In this experiment we vary the shock rate, and also look at the differences in differences of the mean employment rates for various time lags after the shock reversed.

3 Results

Besides analyzing the outcome variables from searching a parameter grid, an agent-based computational model also allows us tracing the time paths of the labor market development together with the decisions of the voters. This is what figure 3 illustrates for a run with 768 time steps. The upper panel shows the type of policy which is currently executed. Recall that a value of one denotes that the regulation party R is in power and zero that the deregulation party D is in power. The second panel informs on the number of firms that reduced their labor demand due to regulatory action. The last panel shows the evolution of the employment rate. For this simulation, 5 firms operated under regulation initially and party R was in power at time step $t = 0$. As mentioned earlier, between the first and the second legislative period a government change was imposed. This is why we start with iteration 48 in figure 3. There are several government changes during the simulation run. Consequently, the number of regulated firms and the employment rate vary. For example, from iteration 143 onwards there is a comparably long phase where the deregulation party is in power. During that time the number of firms that operate with reduced labor demand declines and employment rates are high. From iteration 238 onwards several government changes occur. However, until iteration 380 the regulation party is in power more often and the number of regulated firms increases. Consequently, employment rates drop until voters decide to throw the regulation party out of office again.

In table 2 we show the mean employment rates over the 500 repeated runs for specific combinations of parameters. We vary the type of initial party and initial regulation, as well as the parameters describing the employ-

ment protection system and its repercussions on the performance of firms. That is, the level of severance payments and the degree to which firms react in their demand for labor (*feedback*) as a response to the imposition of severance payments which take values as indicated in table 1. Mean employment rates for all cases of our parameter grid are around 86%. For all pair wise combinations of employment rates t-tests cannot reject the null hypothesis of identical mean employment rates. It occurs that on average the (endogenous) employment protection system does not harm labor market performance. The reason is simply that voters learn about the negative consequences in terms of firms' labor demand and eventually vote regulation parties out of office if the costs of having such an insurance device outweigh the positive aspect of severance payments for those who are laid off. Thus, our simulation, at least in this respect, coincides with the findings from empirical studies employing macro data which tend to find no effects of employment protection on employment rates as was discussed in the introduction. Unlike studies that employ solely empirical evidence, however, our simulation lends these observations a possible causal foundation: Labor market institutions have, on average, no influence on labor market performance because voters eventually grasp the effects of labor market institutions that impose costs on firms and thus reduce labor demand.

However, a closer look at labor market performance after policy changes reveal some quite interesting effects of different policies. In order to disentangle these effects we single out cases of policy changes from the deregulation party to the regulation party and vice versa. We compare employment rates before the policy change with employment rates four periods after the policy change took place. The results of this analysis on a more disaggregated level are shown in table 3. Rows one and two show the effects on the employment rates in percentage points for a policy changes from party D to party R and from party R to party D, respectively. Note, that the sum of observations in table 3 equals 500 – the number of repeated runs. Focussing on the first row and second column in table 3 we see that had party D stayed in power we would have observed a mean decrease in the employment rate by -0.30 percentage points. In all cases in which the party D was thrown out of office

we observe a mean decrease of employment by -2.21 percentage points after 24 iterations. Thus we get an overall decrease of the employment rate by comparing the treatment cases with the counterfactuals of -1.90 percentage points. The second row looks at the events where party R is thrown out of office by party D. As expected we observe an increase in the employment rates simply because the regulation party depressed labor demand and the policy change increases labor demand as newly entering firms post relatively more vacancies than those firms that entered before the policy change.

We can thus distinguish between long run and short run effects: Over the long run, there are, on average, no effects of labor market institutions on labor market performance. Yet, in the short run, policies clearly impact on employment rates. A change from deregulation to regulation policies decrease labor demand, while the opposite is true for policy changes that go from regulation to deregulation.

While a closer look at the dynamics of the employment rate over the course of the simulation showed that aggregate effects hide important features of this artificial economy, the question still remains to what extent turbulent times drive labor market performance in a world of endogenous labor market institutions. We turn to this issue now. We test the interaction hypothesis with our experiment spelled out earlier and illustrated in figure 2. The results are summarized in tables 3 and 4 which refer to the cases where the deregulation party and the regulation party were in power as the shock rate is increased, respectively. In both tables we report the difference in difference mean employment rates. That is we calculate the difference in employment rates before and after the period of a higher shock rate for the treatment group. We also calculate the difference in employment rates for the non-treatment group. The two differences are subtracted from each other which yields the reported numbers. We calculate the difference in difference mean employment rates for various time lags that we measure in legislative periods (24 iterations). This is the piece of information given in the first column of tables 3 and 4. Thus, the second row denoted with 1 measures the difference in difference mean employment rates after one legislative period elapsed after the shock rate returned to its initial value. We run experiments

with various parameter combinations. The length of the phase with an increased shock rate can be 1, 2, 3, or 4 legislative periods. Furthermore, as in the previous analysis we vary the parameters describing the characteristics of the employment protection system and its repercussions on the behavior of firms. Negative entries to the tables imply that the employment rates of the treatment group decreased as a response to the increased shock rate compared to the non-treatment group. Stars indicate values significantly different from zero. Note also, that the entries in the tables refer to the cases where there was no government change between the period preceding the phase of higher shock rates and the first period of the phase with higher shock rates. As revealed by our results in the previous paragraph, had we not singled out those cases we would not only measure the response of employment rates to the increased shock rate. Our results would be blurred by government changes between those two periods based on voters' evaluation of policies of the past.

Even though the results of our experiments do not make an entirely clear case, some patterns stand out. Consider the difference in difference mean employment rates measured right after the shock rate reached its initial level again. At a shock length of two legislative periods we observe a drop in the employment rate between 2.18 and 2.78 percentage points. This drop is statistically significantly different from zero for all proliferations of the employment protection system and the feedback parameter. The reason why we observe a negative impact is that voters react to the change in the economic environment by throwing the current government out of office. They vote for the regulation party which imposes severance payments on firms that dismiss workers, and firms react to that by posting less vacancies. For no other shock length we get such a strong effect. For shorter durations of the shock the change in the economic environment and a possible change in government policies might just not have worked its way through the decisions of firms to respond in terms of lower labor demand. Contrarily, longer phases of shocks give voters the chance to realize that voting for a regulation of the labor market has negative consequences in terms of the number of jobs coming to the market. They might have already learned that regulation harms them

more than receiving transfers in case of dismissals. As one goes down the respective rows in table 3, the effect on the employment rate vanishes as the time lag after the reversal of the shock rate increases. This is also true for a shock length of two legislative periods where the initial effect was strongest. Thus, one may conclude from this exercise that there is scope for interaction effects with some persistence in employment rates. More importantly, these results indicate a certain validity of the argument that voters learn about the negative impact of labor market regulation on labor demand and adjust their voting behavior accordingly.

Comparing table 4 with table 3 we observe a difference in terms of the signs in the difference in difference mean employment rates. As spelled out before the only difference in terms of the cases that we compare is that now the regulation party was in power when the shock hit. What occurs is the same type of reaction and learning of voters as we have observed before. However, the effects carry the opposite sign as this time the deregulation party is voted into office. Severance payments are abolished and firms eventually react to this new regulatory framework by posting more vacancies. This is why we mostly see an increase in the employment rates as a response to the more turbulent times that our voters face. But eventually, as the time lag increases with respect to the reversal of the increased shock rate, the interaction effect washes out – an observation like in the previous experiment.

4 Conclusions

Theoretical as well as empirical results on the effects of employment protection legislations are inconclusive. As outlined, existing studies suffer from various shortcomings generating unsatisfactory answers to this pressing policy question. This paper has addressed some of these shortcomings, particularly the lack of existing accounts to consider the endogeneity of labor market institutions. In our agent-based simulation model voters participate in the labor market and receive payoffs which depend on whether they have jobs or not. Additionally, we consider the institutional environment in which labor markets and their participants are embedded. Confronted with market

outcomes and based on their ideological leaning towards one of the competing parties, voter cast their vote for the regulation or the deregulation party. The outcome of the political process affects labor market allocations and thus feeds back on voters' payoffs.

Based on this approach, our results suggest that the existence and proliferation of an employment protection system may not necessarily harm employment performance on average. Interacting the employment protection system with the economic environment, however, shows some effects. In particular employment rates decrease if at the offset of more turbulent times the deregulation party was in power. This is so, as voters blame the incumbent for the currently malperforming economy. Thus, they vote for the alternative which is the regulation party. This party immediately installs an employment protection system depressing labor demand even further. Conversely, with the regulation party in power, exogenous economic shocks spark higher employment performance as voters react by installing the party with the deregulation platform. Interaction effects eventually wash out as turbulent times become a thing of the past.

In its attempt of endogenizing labor market institutions, our model is certainly an improvement over existing accounts that treat institutional configurations of labor markets as given and fixed. Yet, we are very much aware that our model is highly stylized. Nevertheless, it may serve as a starting point for future work that incorporates several features that we were so far not able to tackle. Examples of such improvements include voting over sets of labor market institutions, multi-party competition that would more amply match the European context, or simply endogenizing wage setting. Going forward in these directions may eventually equip policymakers with the kind of information they need in order to judge the consequences of policies, may they be good or bad.

Acknowledgements

We would like to thank the participants at the Workshop on Computational Political Economics at the Center for Interdisciplinary Research in Biele-

feld, the Third International Complexity Meeting in Aix-en-Provence, the Midwest Political Science Association 64th Annual National Conference in Chicago, and the Workshop on Microsimulations of Demographic Change and the Labor Market held at the Vienna Institute of Demography for their suggestions that helped us to improve the paper.

References

Baker, D., A. Glyn, D. Howell, and J. Schmitt (2005): *Fighting unemployment – the limits of the free market orthodoxy*, Oxford University Press, chap. Labor market institutions and unemployment: a critical assessment of the cross-country evidence, 72–113.

Belot, M. and J. van Ours (2004): "Does the recent success of some OECD countries in lowering their unemployment rates lie in the clever design of their labor market reforms?" *Oxford Economic Papers*, 56, 621–642.

Bertola, G., F. Blau, and L. Kahn (2002): "Comparative analysis of labour market outcomes: lessons for the U.S. from international long-run evidence," in *The Roaring Nineties: Can Full Employment Be Sustained?*, ed. by A. Krueger and R. Solow, Russell Sage and Century Foundations, 159–218.

Bewley, T. (1999): *Why wage don't fall during a recession*, Cambridge, MA: Harvard University Press.

Blanchard, O. and P. Portugal (2001): "What hides behind an unemployment rate: comparing Portuguese and US labor markets," *American Economic Review*, 90, 187–207.

Blanchard, O. and J. Wolfers (2000): "Shocks and institutions and the rise of European unemployment: the aggregate evidence," *The Economic Journal*, 110, 1–33.

Elmeskov, J., J. Martin, and S. Scarpetta (1998): "Key lessons for labour market reforms: evidence from OECD countries' experience," *Swedish Economic Policy Review*, 5, 205–252.

Fagiolo, G., G. Dosi, and R. Gabriele (2004): "Matching, bargaining, and wage setting in an evolutionary model of labor market and output dynamics," *Advances in Complex Systems*, 7, 157–186.

Fowler, J. and O. Smirnov (2005): "Dynamic parties and social turnout: an agent-based model," *American Journal of Sociology*, 110, 1070–1094.

Freeman, R. (2005): "Labour market institutions without blinders: the debate over flexibility and labour market performance," NBER Working Paper 11286.

Garibaldi, P. (1999): "Job flow dynamics and firing restrictions," *European Economic Review*, 42, 245–275.

Heckman, J. and C. Pages (2000): "The cost of job security regulation: evidence from Latin American labour markets," NBER Working Paper 7773.

Hümmerich, K. (1999): "Die arbeitsgerichtliche Abfindung - Ein Beitrag zur Abfindungspraxis und zur gesetzlichen Neuregelung," *Neue Zeitschrift für Arbeitsrecht*, 342–358.

Kollman, K., J. Miller, and S. Page (1997): "Political institutions and sorting in a Tiebout Model," *American Economic Review*, 87, 977–992.

Lazear, E. (1990): "Job security provisions and unemployment," *Quarterly Journal of Economics*, 55, 699–726.

Lindbeck, A. and J. Weibull (1987): "Balanced-budget redistribution as the outcome of political competition," *Public Choice*, 51, 272–297.

Martin, C. and T. Plümper (2005): "Number of parties, endogenous partisan preferences, and electoral turnout rates: a stochastic equilibrium analysis," *Social Science Computer Review*, 23, 347–359.

Mortensen, D. and C. Pissarides (1999): "Unemployment responses to 'skill biased' technology shocks: the role of role of labour market policy," *The Economic Journal*, 109, 242–265.

Mueller, D. (2003): *Public choice III*, Cambridge University Press.

Neugart, M. (2004): "Endogenous matching functions: an agent-based computational approach," *Advances in Complex Systems*, 7, 187–201.

——— (2007): "Labor market policy evaluation with ACE," *Journal of Economic Behavior and Organization*, forthcoming.

Nickell, S. (1997): "Unemployment and labour market rigidities: Europe versus North America," *Journal of Economic Perspectives*, 11, 55–74.

Nickell, S., L. Nunziata, and W. Ochel (2005): "Unemployment in the OECD since the 1960s: what do we know?" *The Economic Journal*, 115, 1–27.

OECD (2004): *OECD Employment Outlook*.

Oswald, A. (1985): "The economic theory of trade unions: an introductory survey," *Scandinavian Journal of Economics*, 87, 160–193.

Persson, T. and G. Tabellini (2002): *Political economics: explaining economic policy*, MIT Press.

Pingle, M. and L. Tesfatsion (2003): "Evolution of worker-employer networks and behaviors under alternative unemployment benefits: an agent-based computational study," in *Innovations in Economic and Financial Networks*, ed. by A. Nagurney, Edward Elgar Publishers, 256–285.

Richiardi, M. (2006): "Toward a non-equilibrium unemployment theory," *Computational Economics*, 27, 135–160.

Tesfatsion, L. (2001a): "Introduction to the special issue on agent-based computational economics," *Computational Economics*, 18, 1–8.

——— (2001b): "Structure, behavior and market power in an evolutionary labor market with adaptive search," *Journal of Economic Dynamics and Control*, 25, 281–293.

——— (2006): "Agent-based computational economics: a constructive approach to economic theory," in *Handbook of Computational Economics*, ed. by K. Judd and L. Tesfatsion, North-Holland, vol. 2.

Appendix

The model is programmed in RePast. The code is available from the authors (neugart@wzb.eu or christian.martin@uni-hamburg.de).

```
Create local labor markets

Create firms and allocate them randomly to local labor markets

Create voters/workers and allocate them randomly to local labor markets

Create parties and set one into power

for k periods

      Job Destruction
      for each local labor market
            with probability rate local labor market is hit by shock
            voters/workers are laid off
            if regulation party in power
                  then voters/worker receives severance payment
            else
                  no severance payment
            firms hit by shock are re-located randomly and open up vacancies in
            accordance with regulation policy
      end each local labor market

      Applying
      for each unemployed voter/worker
            sends applications
      end each unemployed voter/worker

      Hiring
      for each vacancy
            if voters/workers applied
                  firm selects voter/worker randomly
            else
                  vacancy is not filled
      end each vacancy

      Voters/workers learn
      for each voter/worker
            calculates average payoffs
            for each party
                  calculates new voting probability
            end each party
      end each voter

      Elections
      if period k is election period
            calculate votes for incumbent party
            if incumbent party wins
                  winning policy is current policy
            else
                  winning policy is challenger's policy
      else
            no elections

      Policy implementation
      if current party is regulation party
            regulate
      else
            deregulate

end k periods
```

Figure 1: Pseudocode

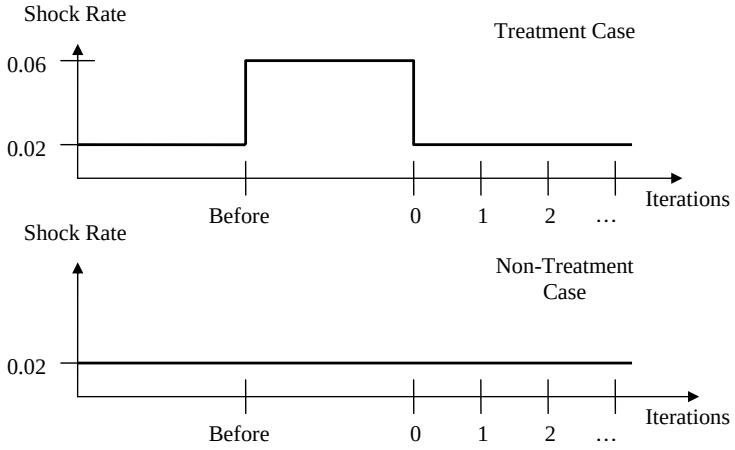
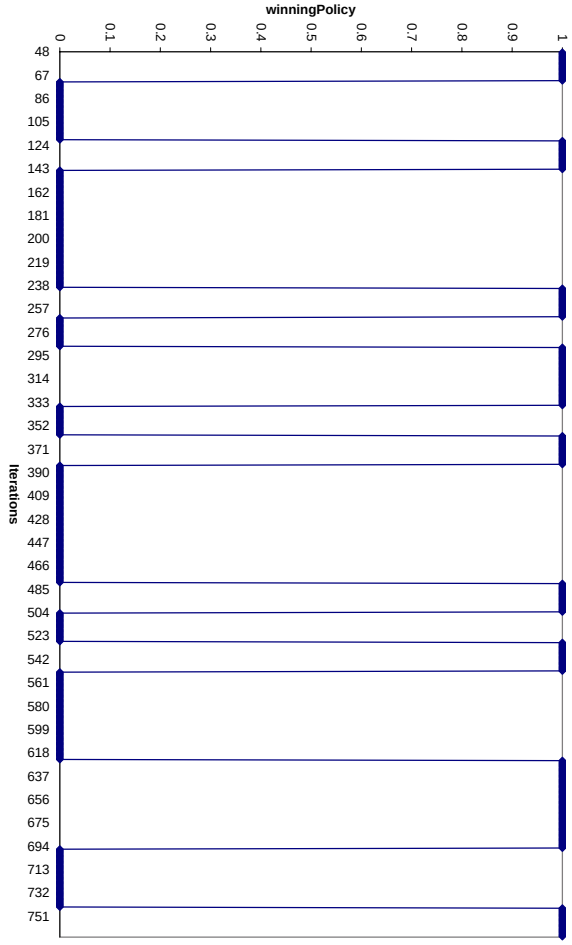
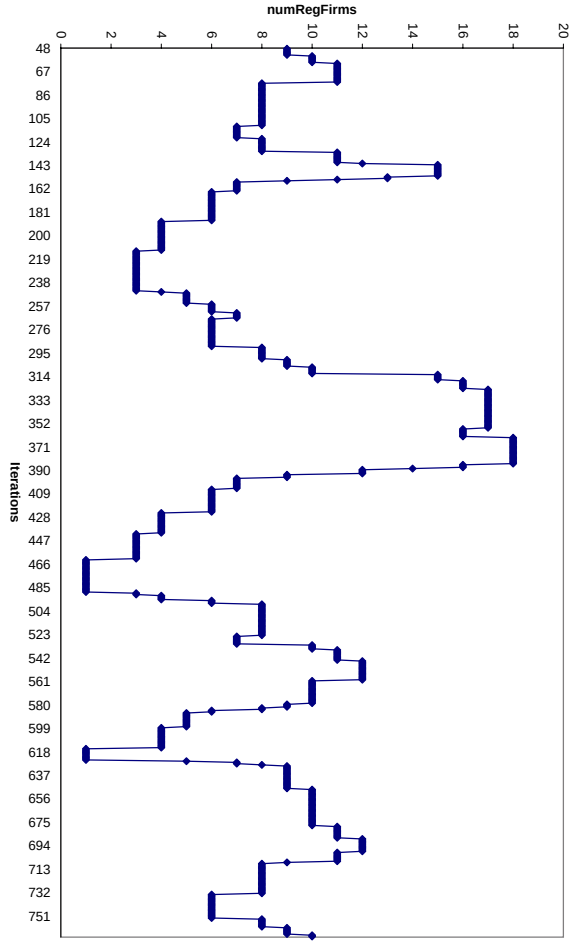


Figure 2: Design of experiment

Table 2: Mean employment rates

Type of Initial Party	Type of Initial Regulation	Severance Payment			
		Low Feedback		High Feedback	
		Low	High	Low	High
Deregulation	Low	86.56	86.07	85.71	85.85
	High	86.00	85.77	85.10	85.91
Regulation	Low	86.09	86.09	85.92	85.62
	High	85.40	86.09	85.75	86.25


winningPolicy
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Iterations
48
67
86
105
124
143
162
181
200
219
238
257
276
295
314
333
352
371
390
409
428
447
466
485
504
523
542
561
580
599
618
637
656
675
694
713
732
751


numRegFirms
0
2
4
6
8
10
12
14
16
18
20
Iterations
48
67
86
105
124
143
162
181
200
219
238
257
276
295
314
333
352
371
390
409
428
447
466
485
504
523
542
561
580
599
618
637
656
675
694
713
732
751

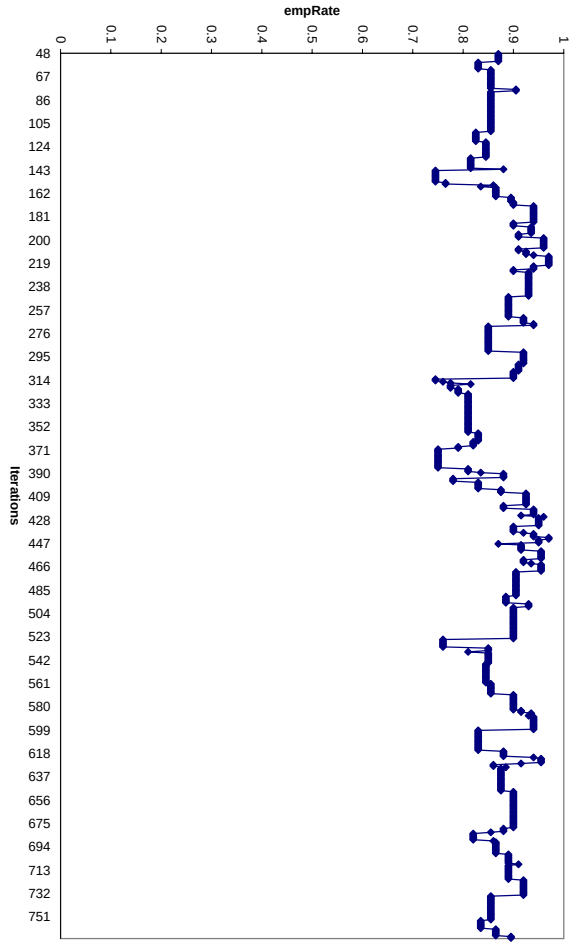


Figure 3: Time series on (from top to down) the type of government in power, the number of regulated firms, and the employment rate; parameters: $maxVac = 10$, $rate = 0.02$, $\lambda = 0.1$, $\delta = 10$, $wage = 1$, $numSectorsSearched = 9$, $severancePayment = 1$, $initialParty = 0$, $legislativePeriod = 24$, $initialRegulation = 5$, $feedback = 1$

Table 3: Impact of policy change on employment rates

Policy changes from...	Change in employment rate (in percentage points)		
	All cases *with* policy change	All cases *without* policy change	Overall effect
...party D to party R	-2.21	-0.30	-1.90***
	N=107	N=157	
...party R to party D	5.58	-3.00	8.59***
	N=112	N=124	

Notes: The t-test is on the null hypothesis of a zero difference in difference mean employment rate; $***$ denotes a significance level of 1%. Parameters were chosen such that $feedback = 2$, $initialParty = 0$, $initialRegulation = 5$, and $severancePayment = 4$. Employment rates are measured one iteration before the policy change (no change) at iteration 480 and 24 iterations after the policy change.

Table 4: Difference in difference in employment rates (in percentage points) if *deregulation party D* was in power in legislative period where shock rate was increased.

		Severance Payment			
		Low		High	
		Feedback		Feedback	
Diff. in Employment Rates After ...	Length of Shock	Low	High	Low	High
0	1	0.48	-0.39	0.02	0.03
	2	-2.18***	-2.78***	-2.23***	-2.25***
	3	-1.92***	-0.67	-2.99***	-0.50
	4	-0.31	0.27	-0.77*	0.02
1	1	0.35	0.00	0.46	-1.27**
	2	1.94***	-2.03***	-1.00*	-0.68
	3	0.38	-0.51	-1.23**	-0.64
	4	0.17	1.00*	-0.21	0.82
2	1	1.16**	-0.44	0.80	-0.31
	2	-1.00**	-1.17**	-0.38	-0.35
	3	-0.69	0.15	-0.13	-0.35
	4	-0.18	0.48	-0.05	0.88*
3	1	1.06**	0.12	0.62	-0.76
	2	-1.29**	-0.96*	-0.33	-0.96*
	3	-0.16	-0.45	-0.43	-0.05
	4	-0.47	0.01	-0.16	1.04*
4	1	0.54	0.36	0.35	-0.94*
	2	-1.25**	-0.30	0.58	-0.15
	3	-0.10	0.10	-0.46	0.38
	4	0.53	-0.16	0.10	0.86

Notes: The t-test is on the null hypothesis of a zero difference in difference mean employment rate; $***$, $**$, and $*$ denote significance levels of 1%, 5%, 10%, respectively. Other parameters $initialParty = 0$, $initialRegulation = 5$.

Table 5: Difference in difference in employment rates (in percentage points) if *regulation party* R was in power in legislative period where shock rate was increased.

		Severance Payment			
		Low		High	
		Feedback		Feedback	
Diff. in Employment Rates after ...	Length of Shock	Low	High	Low	High
0	1	-1.33***	1.40***	-0.78*	-0.75*
	2	1.00	2.45***	-0.65	-0.71
	3	3.33***	4.00***	1.75**	2.43***
	4	2.55***	2.41***	0.53	1.61**
1	1	-0.90	-0.56	-0.76	-1.64***
	2	1.13	2.86***	1.18*	0.13
	3	2.74**	3.33***	1.08	1.60***
	4	2.05***	2.42***	0.06	2.07**
2	1	0.75	0.50	1.18*	0.70
	2	0.16	3.92***	0.4	0.15
	3	0.16**	2.50***	0.99	1.94***
	4	0.23***	1.40**	-0.18	1.03
3	1	0.45	-0.30	0.85	-0.38
	2	-1.56**	2.22***	-0.39	-0.21
	3	1.16	1.05	-0.16	0.73
	4	0.31	0.16	-0.28	-0.30
4	1	0.70	-0.21	0.18	-0.36
	2	0.12	0.53	0.06	0.00
	3	0.78	0.20	-0.47	1.63**
	4	-0.26	-0.20	-0.90	-0.69

Notes: The t-test is on the null hypothesis of a zero difference in difference mean employment rate; $***$, $**$, and $*$ denote significance levels of 1%, 5%, 10%, respectively. Other parameters $initialParty = 0$, $initialRegulation = 5$.