Thumbscrew for Agencies or for Individuals? How to Reduce Unemployment

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This paper investigates the extent to which an increase in operating effectiveness of public employment agencies on the one hand and a reduction of unemployment benefits on the other are able to reduce unemployment. Using the recent labour market reform in Germany as background, we outline the range in which both instruments can become useful tools. We conclude that the role of unemployment benefit reduction for unemployment reduction is almost negligible. Enhanced effectiveness of public employment agencies, to the contrary, explains a substantial part of the observed post-reform unemployment decline.

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1 Introduction

Understanding the determinants of unemployment has always been at the center of economic research and public interest alike. This is true in "old times" when oil price shocks hit OECD countries, just as much as today in the aftermath of the financial crisis.

It is widely accepted by now that labour market institutions such as unemployment benefit system, trade unions, minimum wages, employment protection legislation and labour taxes stand among the key determinants of unemployment in OECD countries (see e.g. Blau and Kahn, 1999, and Nickell and Layard, 1999). Despite their apparent heterogeneity, all of these institutions have one salient trait in common: whatever the degree of coordination frictions, they shape the incentives of the market participants. Just in contrast to that stands another important labour market institution: public employment agencies. Whatever the distribution of incentives across market participants, public employment agencies reduce the degree of coordination frictions (Petrongolo and Pissarides, 2001).

While the employment effects of unemployment benefits, unions, employment protection and taxation have been quite extensively studied to this date, there is surprisingly little evidence on the role of public employment agencies (PEAs) in reducing equilibrium unemployment. The purpose of the present paper is to fill this gap.

Using the unique setup of a German labour market reform of 2003-2005 we quantify the effect of a reform-induced increase in operating effectiveness of the Federal Employment Agency (a PEA) on the observed post-reform decline of the aggregate unemployment rate. We furthermore compare the increase in operating effectiveness of PEAs with the reduction of generosity of unemployment benefits, the latter being likewise a part of the reform. We find that organizing the work of PEAs in a more efficient way has scored much better than creating pecuniary incentives through unemployment benefits. In fact, re-organization of the agency accounts for well above 25 % of the observed unemployment decline, while benefit reduction is responsible for just about 2 %. Adding all other components of the reform plus economic growth allows us to explain the observed unemployment decline in the first three post-reform years almost completely.

To reach our conclusions, we build on the search and matching model of Launov and Wälde (2013). Our model shares a number of elements with the existing search and matching literature. Workers are ex-ante heterogeneous in skills, as in Mortensen and Pissarides (1999) and Postel-Vinay and Robin (2002), and ex-post heterogeneous in duration of their unemployment spells. The model allows for time-dependent unemployment benefits, as in Albrecht and Vroman (2005) and Coles and Masters (2006), to capture the differences between unemployment insurance (UI) and unemployment assistance (UA) payments. Benefits are proportional to past wages, as in Chéron and Langot (2010), and there is a fixed time limit on UI. Workers optimally choose search effort, as in Cahuc and Lehmann (2000) and Lehmann and van der Linden (2007), and experience negative duration dependence of their exit rates out of unemployment due to Bayesian learning. Time dependence of benefit payments introduces a semi-Markov dynamics into the model which requires us to compute aggregate unemployment rate using Volterra integral equations.

We quantify this model using the estimates from the existing literature as well as our own estimates of the structural parameters. Parameters form the existing literature relate to reduced-form estimates of the change in matching productivity of PEA induced by the

reform, where the relevant conceptual framework for reduced-form estimation of matching productivity of the agency is the empirical stock-flow model of Coles and Smith (1998) and Gregg and Petrongolo (2005). We use the structure of our model to establish the link between these reduced-form estimates and the primitive parameter responsible for matching productivity of PEA in our equilibrium matching model. Effectively this means a recovery of the structural form from a reduced form. The appropriate reduced-form estimates are provided by Fahr and Sunde (2009) and Klinger and Rothe (2012). Our own estimates of structural parameters come from Launov and Wälde (2013). With these we simulate, both simultaneously and independently, the response of equilibrium unemployment rate to the increase in the effectiveness of PEA and to the reduction of unemployment benefit generosity. We conclude by simulating the entire reform together with economic growth.

The closest to our paper structural literature on PEA as a determinant of unemployment comprises Pissarides (1979), Fougère et al. (2009) and Jung and Kuhn (2012). Pissarides (1979) considers a theoretical equilibrium search model with two types of vacancies: those advertised through the agency and sampled by unemployed at one cost, and those advertised privately and sampled by unemployed at another cost. He shows that by reducing sampling cost at the agency one simultaneously discourages private search. The resulting increase in matches through the agency and reduction of matches through private search lead to an ambiguous effect on the aggregate unemployment rate. Left aside for years, the topic has been re-addressed only by Fougère et al. (2009). In a one-sided job search model Fougère et al. (2009) similarly allow for fixed costs when searching through the agency and variable costs when searching privately. This again implies that an increase in the productivity of PEA can increase or decrease the expected exit rate from unemployment. However, setting up a structural estimation of their model with French data, they find that more productive PEA unambiguously increases the exit rate from unemployment. We see this as a justification to work with a model setup where we abstract from fixed costs. Our quantitative model predicts, in line with Fougère et al. (2009), that more productive PEAs are desirable. In addition to their findings, we compute the equilibrium effects on the unemployment rate.

In a somewhat different vein from the above two papers, Jung and Kuhn (2012) consider the effectiveness of PEA in matching unemployed with vacant jobs to argue that too low effectiveness of PEA in Germany largely explains the difference in "ins" and "outs" of unemployment between Germany and the US in 80s and 90s. This indirectly supports the reform of PEA addressed in our paper, with Jung and Kuhn (2012) calling for evaluation of the equilibrium effect of this reform. We provide such an evaluation and show that the reform has indeed contributed to the reduction of the unemployment rate substantially.[2]

Our paper is further related to three different strands of the applied literature that deals with labour market policies and institutions. First, we add to the fairly rich structural literature on the quantification of the employment effects of institutions. To give just a few recent examples from this literature, Pries and Rogerson (2005) and Yashiv (2004) simulate the impact of a wide array of institutions, such as unemployment insurance, hiring subsidy, labour taxes and minimum wages, on the equilibrium unemployment rate. Addressing single insti-

[2]Lastly, a literature emerges that deals with equilibrium consequences of particular aspects of PEAs activity. Cahuc and Le Barbanchon (2010) is one example we are aware of. They analyse the quantitative employment effect of counselling.

tutions, Cahuc and Malherbet (2004) calibrate the employment effect of the experience-rated system of financing unemployment benefits. Immervoll et al. (2007) perform microsimulations on the influence of in-work benefits and L'Haridon and Malherbet (2009) look into the effect of employment protection through layoff tax and payroll subsidy. Boeri and Burda (2009) investigate the impact of endogenous coverage of collective bargaining and Bentolila et al. (2012) assess the role of temporary contracts and firing costs. Finally, Flinn (2006) provides a structural estimation of the employment effect of a minimum wage policy and Launov and Wälde (2013) do the same for the length and level of unemployment benefits. We contribute to this literature by evaluating an – as we show – tremendously important institution which, surprisingly, has largely been overlooked so far. This institution is the employment agency itself.[3]

Second, we add to the existing reduced-form econometric literature on the effectiveness of PEA as compared to other search methods. This literature predominantly follows the pioneering contributions of Holzer (1988) and Blau and Robins (1990). It considers a multitude of job search techniques of unemployed workers, such as search through the agency itself, search through friends or relatives, direct application without referral, search through advertisements and so on. It investigates the contribution of PEAs to generating contacts with firms and to generating job offers (and acceptance of the latter) that come out of such contacts. Conclusions on the effectiveness of the agency in performing these tasks vary.[4] Irrespective of the conclusions, the reduced-form nature of this literature makes it hard to infer about the effect of PEAs on the equilibrium unemployment rate. We contribute to this literature by looking beyond the simple significance of the agency and estimate its equilibrium impact on the dynamics of unemployment.

Third, we add to the debate on the impact of reduced benefit generosity on the unemployment rate in Germany. Predictions on the true size of this impact vary tremendously in the literature. In the first three years after the reform, just right before the onset of the Great Recession, the observed unemployment rate has declined by about 3.9 percentage points. At the highest extreme, Krause and Uhlig (2012) find that reduced generosity alone has led to a fall of the unemployment rate by as much as 2.8 percentage points, explaining over 2/3 of the observed decline. A somewhat more conservative value of a 1.2 percentage point reduction is reported by Krebs and Scheffel (2011). At the lowest extreme, Launov and Wälde (2013) find that the reduction of benefits is responsible for less than 0.1 percentage points of the decrease of the unemployment rate – explaining almost nothing of the post-reform change in unemployment. We replicate all the extreme and intermediate results above and explain their nature. We show that large effects in the literature hinge on assumptions about the direct effect of UA benefits reduction. Using estimates of the direct effect that is consensual in the literature, we confirm that only a tenth of a percentage point of the reduction of the unemployment rate can be attributed to the reduced generosity. Surprisingly, it was the

[3] The analysis of PEAs, the quantification of their effect on the reduction of the unemployment rate and the comparison with other components of the Hartz reforms in Germany is the central difference to Launov and Wälde (2013). The latter also do not discuss implications for other European countries and do not explain why different evaluations of labour market reforms in Germany come to different conclusions.

[4] See Weber and Mahringer (2008) for the most recent application and summary of this literature over the preceding twenty years. The most notable recent contribution outside this summary is Graversen and van Ours (2008).

reform of PEAs that really reduced the unemployment rate rather than the reform of the benefit system.

The paper is organized as follows. Section 2 presents an overview and background of recent labour market reforms in Europe aimed at tackling rising unemployment. It also presents stylized facts about German unemployment and provides detailed description of the comprehensive labour market reform of 2003-2005 (the so-called Hartz reform). Section 3 describes the model we use to reach all of our conclusions. Here we also address the assessment strategy tailored specifically to the purposes of this paper. In Section 4 we present our results on the effect of improving PEAs and reducing unemployment benefits to reduce aggregate unemployment. Section 5 explains why different studies on the impact of reducing unemployment benefits lead to different results and even succeeds in reconciling them. Section 6 concludes.

2 European unemployment and reforms

2.1 Reforms in European countries

Rising and persistent unemployment in Europe has a long history. Recent theory (Ljungqvist and Sargent, 1998; 2008) identifies the interaction of shocks and generous labour market institutions of a welfare state as a primary reason for such phenomenal dynamics. In this theory generous unemployment benefits prevent laid-off workers from quickly accepting jobs where new skills need to be developed, while at the same time old skills become gradually obsolete with the change of economic environment induced by the shock. As a result structural unemployment accumulates, adding to persistence, and unemployment rate keeps going up.

Consistent with this theory European governments have responded with reducing generosity of benefit systems, with Sweden (Carling et al., 2001), Denmark (Geerdsen 2006), the UK (Petrongolo, 2009) and Norway (Røed and Westlie, 2012) being notable examples, among others. Gradually reducing benefits has brought a good deal of success in some of the countries, as for instance in the Netherlands and the UK (Nickell and van Ours, 2000). Nevertheless, this success was far from being shared by all other countries.

2.2 Hartz reform in Germany

2.2.1 Stylized facts

Germany is no exception among its European neighbours. Since early 1970s it has experienced a steady increase in unemployment, peaking in March 2005 and calling for restructuring of the (supposedly) generous institutions of the welfare state.

The long awaited political response has arrived in early 2000s with a comprehensive labor market reform: the *Hartz reform*. The reform has been introduced step by step between 2003 and 2005. It consisted of four different packages (Hartz I to IV) which affected nearly all central institutions of the German labour market. Remarkable about the structure of the reform is that its third package (Hartz III) was almost exclusively devoted to reshaping operational regulations of the Federal Employment Agency (a PEA), while its last pack-

age (Hartz IV) focused almost exclusively on the monetary compensation scheme for the unemployed workers.

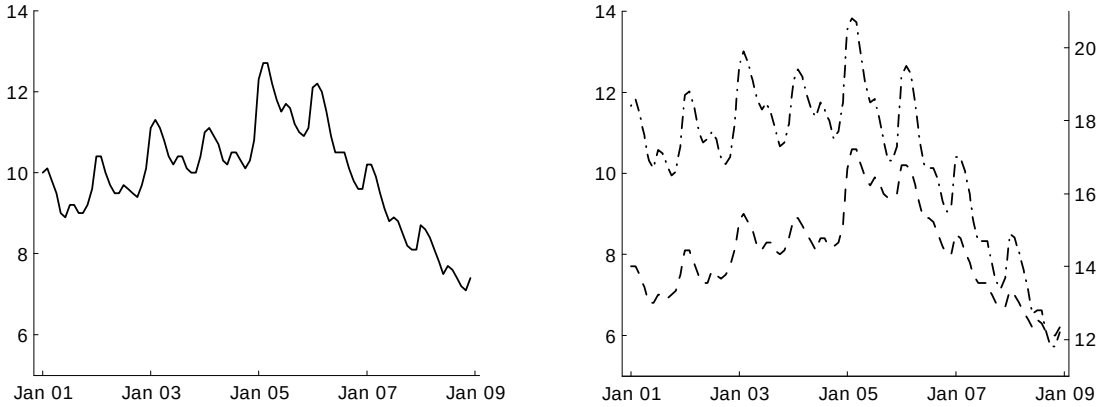

Figure 1 *Monthly unemployment rate (Source: Bundesagentur für Arbeit) around the time of the Hartz reforms*

By simply looking at the data there appears an impression that the Hartz reform in its entirety has contributed positively to the reduction of the unemployment rate. Figure 1 shows the dynamics of monthly unemployment rate between January 2001 and December 2008. One can see that after a relatively stable phase of 2001 to 2004 a strong decline has emerged starting from 2005. This applies both to Germany as a whole (the left panel) and to East and West Germany separately (the right panel). The most intriguing message of this figure, though, is that the beginning of the fall of unemployment coincides with the date, Hartz IV legally came into effect. In terms of numbers, within three years after the introduction of Hartz IV the unemployment rate in Germany has gone down from 11.71 % in 2005 to 7.80 % in 2008, i.e. by 3.91 percentage points. The same applies to East and West Germany with 5.57 and 3.45 percentage points reduction, respectively.

It would be tempting to state that the unemployment benefit reform under arrangements of Hartz IV has become a turning point in tackling unemployment. Yet, temporal coincidence does not imply causality. As it takes time for PEAs to adjust to new rules under arrangements of Hartz III, the drop in unemployment could actually be the result of more effective PEAs. Or of any other measure of the Hartz reforms. Hence, the actual contribution of Hartz IV, of Hartz III and indeed of any other Hartz package, is far from being clear. Providing the clarification is the raison d'être of the present paper.

2.2.2 Institutional framework of the reform

The Hartz reforms have been designed to substantially refurbish the institutional organization of the German labour market. To give a clear idea of what is the place of the two institutions of our interest, Hartz III and IV, in the entire set of policy measures foreseen by the reform, here is a brief overview of all its core packages.[5]

[5] See WIPOL (2006) for an extensive overview (in German).

Hartz I has created a variety of training and employment-stimulating measures. It has established personnel service agencies which would serve as intermediaries between job searchers and employers and coordinate loan work placement. It has introduced training vouchers to take advantage of further occupational training, and implemented special rules for job market integration of workers over 50 years of age. On top of that, Hartz I has strengthened sanctions in case of voluntary job quits. This package has become effective as of January 2003.

Hartz II has developed new rules for so-called "mini-" and "midijobs". Workers in minijobs were allowed to earn up to EUR 400 tax-free per month. A linear tax rule was introduced for midijobs paying up to EUR 800 per month. Hartz II has also modified the program for start-up subsidies to enhance transitions to self-employment. It became effective simultaneously with Hartz I.

Hartz III has laid out the internal administrative reform of the Federal Employment Agency - a PEA responsible for processing all claims by unemployed - as an entity. It has brought in a set of new regulations and revised distribution of responsibilities within the agency. Most importantly, it has created a special division - a "Job Center" - as a unified address for benefit claimants. Creation of job centers allowed to increase contact time per unemployed worker and provide specialized advice for the long-term unemployed. This part of the reform has also reduced the weight of active labour market policies. Hartz III has become effective as of January 2004.

Hartz IV has abolished the proportionality of the former UA benefits to the previous net earnings. A fixed UA benefit (called *Arbeitslosengeld II*; ALG II) was introduced instead, low enough to generate a reduction of assistance payments on average. It has furthermore reduced the duration of entitlement to UI benefits (the latter now called *Arbeitslosengeld I*; ALG I) for workers over 45. The severity of this reduction of the entitlement length is increasing with age. This package has become effective as of January 2005.

From this overview it is easy to see that the third package can be completely attributed to the reform of PEA. There are also some elements of PEA improvement, e.g. the introduction of personnel service agencies, in the *first* package of the Hartz reform. The composition of Hartz I seems to be too complex, however, to allow for an identification of the effect of personnel service agencies within the entire spectrum of Hartz I measures. For this reason we will take a conservative stance and measure the effect of a PEA reform by the effect of Hartz III exclusively.

It is also easy to see that reduction of unemployment benefit generosity was the prerogative of Hartz IV. Unique design of the reform that clearly separates intervention into PEA from intervention into benefit system allows us easy identification of the effects in a structural model considered next.

3 The model and assessment strategy

3.1 The model

We formulate a Mortensen-Pissarides matching model with time-dependent unemployment benefit payments. Workers in our model are risk averse and ex ante heterogeneous with re-

spect to observed skill distribution and unobserved search productivity distribution. Firms operate within skill-specific markets, each opening vacancy for a particular skill level. Wages are set by collective bargaining, and the government runs the budget by financing unemployment benefits through the labour tax. The model is borrowed from Launov and Wälde (2013). The questions we analyze with it, the assessment strategy and the quantitative analysis are new.

Equilibrium in our model is defined by a set of skill-specific triples comprising wage, unemployment rate and labour market tightness, such that optimality conditions for the worker and firm behaviour are satisfied and the government budget is balanced. Aggregation with respect to skills provides the economy-wide equilibrium unemployment rate.

- Unemployment benefit system

We explicitly formalize the actual two-step unemployment compensation system with UI benefits (b_{UI}), UA benefits (b_{UA}) and the time limit on the UI benefits. Let s denote the duration of unemployment and let $\bar{s}$ denote the duration of entitlement to UI benefits. The benefit system in our model is given by

$$b(s) = \begin{cases} b_{UI}, & \text{for } 0 \leq s \leq \bar{s} \\ b_{UA}, & \text{for } s > \bar{s} \end{cases} \tag{1}$$

where $b_{UI} > b_{UA}$. This system reflects both pre- and post-Hartz IV institutional environments, where before the reform both b_{UI} and b_{UA} are proportional to the net wage paid by the last job, and after the reform b_{UA} is replaced by the fixed ALG II amount.

Eligibility to UA benefits is means tested, with π^{UA} denoting the probability (for the econometrician) of passing the means test. As means tests relate to family income and further individual circumstances which are usually known to workers beforehand, workers know with certainty whether they will pass this test.

- Workers

Workers are ex ante heterogeneous with respect to skills and search productivity. The skill distribution $\{\pi(k)\}_{k=1}^{K}$ takes K distinct levels and is known to the worker upon entry into the market. The distribution of search productivity takes two distinct levels: 'low' and 'high', where π^{χ} is the population share of high-productive workers. The worker does not know with certainty, how productive she is in search. Instead, at the beginning of each unemployment spell she has a prior belief about being a high-productive type. We denote this subjective probability by $p(0)$. This belief is subject to constant Bayesian updating throughout the unemployment spell, becoming $p(s)$ for $s > 0$.

Unemployed workers of skill k receive benefits $b(s)$ and exert search effort $\phi_k(s)$ to look for jobs. Instantaneous utility of unemployment $v(b(s), \phi_k(s))$ strictly increases in benefits and strictly decreases in effort, as search brings disutility. We assume that the instantaneous utility function takes a CRRA form $v(b(s), \phi_k(s)) = \frac{1}{1-\sigma}\left[b(s)^{1-\sigma} - 1\right] - \phi_k(s)$.

While search effort brings disutility, it also increases the chances of contact with a vacancy available on the corresponding skill market. Contacts with firms arrive to workers at the objective rate $\mu_k(s;\chi) = ((1-\chi)\eta_0 + \chi\eta_1)[\phi_k(s)\theta_k]^{\alpha}$, $\eta_1 > \eta_0$, where χ is an indicator

variable that takes the value of 1 if the worker is highly productive in search (and $\chi = 0$ if low), and θ_k denotes the tightness of the market for skill k. Since unemployed workers do not know their search productivity type with certainty, their subjectively perceived contact rate is given by $\mu_k(s; p(s)) = \eta(s)[\phi_k(s)\theta_k]^\alpha$, where $\eta(s) = (1 - p(s))\eta_0 + p(s)\eta_1$ is the probabilistic description of their perceived type. Upon successful contact with a firm, unemployed workers get a job that pays the net wage w_k.

Let $V_k(b(s), s)$ denote the value of unemployment at unemployment duration s, given the unemployment benefit $b(s)$. Furthermore, let $V(w_k)$ denote the value of a job at wage w_k. Unemployed workers choose search effort $\phi_k(s)$ to maximize their value of unemployment given their subjective probability of being a highly productive searcher. The Bellman equation for the value of unemployment reads

$$\rho V_k(b(s), s) = \max_{\phi_k(s)} \left\{ v(b(s), \phi_k(s)) + \frac{d}{ds} V_k(b(s), s) + \mu_k(s; p(s)) [V(w_k) - V_k(b(s), s)] \right\}, \tag{2}$$

where ρ is the rate of time preference. The first component under the max-operator shows the instantaneous utility of unemployment net of search costs. The second component is the deterministic change in the value of unemployment due to anticipation of the expiration of entitlement to UI and due to changes in the subjective probability of being highly productive in search. The last component is the expected gain form the transition to employment.

The belief $p(s)$ of being high-productive in search falls over time,

$$\frac{d}{ds} p(s) = -p(s)(1 - p(s))[\mu_k(s; 1) - \mu_k(s; 0)] < 0, \tag{3}$$

reflecting Bayesian updating of prior beliefs to take into account the fact that the individual has not yet found a job. The longer the duration in unemployment, the less the individual believes to be good at searching for a job.

Once employed, individuals of skill type k receive the net wage w_k and do not search for jobs anymore, enjoying the utility $v(w_k) = \frac{1}{1-\sigma}\left[w_k^{1-\sigma} - 1\right]$. The worker-firm match is destroyed at the exogenous rate λ_k. Whenever loosing the job, an individual starts the new unemployment spell with the restored entitlement to UI benefits. Consequently, Bellman equation for the value of employment writes

$$\rho V(w_k) = v(w_k) + \lambda_k [V_k(b(0), 0) - V(w_k)]. \tag{4}$$

The first component on the right hand side shows the instantaneous utility of employment and the second component reflects the capital loss due to job destruction.

The solution to the worker's problem is the optimal path of search effort, $\phi_k(s)$. This path is determined by two forces: the known time limit to UI at $\bar{s}$ and Bayesian updating of individual beliefs. Depending on which is stronger, the path can either have an inverted U shape or decrease monotonically with time, determined by the size of b_{UI} and b_{UA}. This solution is fundamentally different form the constant endogenous search effort level in a Mortensen-Pissarides setup without the known time limit to UI benefits and/or Bayesian updating.

- Firms

A worker-firm pair on the skill market k produces output A_k. Firms pay the gross wage $w_k^{gross} = w_k/(1-\kappa)$, where κ is the tax rate to finance unemployment benefits. Let $J(w_k)$ denote the value of a producing firm and let J_{0k} denote the value of the vacant firm on the corresponding skill market. Then the value of the producing firm solves

$$\rho J(w_k) = A_k - w_k/(1-\kappa) - \lambda_k [J(w_k) - J_{0k}]. \tag{5}$$

The difference $A_k - w_k/(1-\kappa) \equiv \Pi_k$ on the right hand side of this Bellman equation shows the instantaneous profit. The remaining term illustrates the expected capital loss of the firm due to exogenous job destruction.

Vacant firms do not produce, incurring instead the flow cost γ_k of advertising the vacancy. Vacancies meet unemployed workers at rate $\bar{\mu}_k/\theta_k$, where $\bar{\mu}_k$ is the expected entry rate of unemployed of skill group k into employment. Since $\phi_k(s)$, and hence $\mu_k(s;\chi)$, are time-dependent for the reasons described above, the distribution of unemployment duration is no longer exponential, as in the textbook model. The expected entry rate is given by

$$\bar{\mu}_k = \pi^\chi \int_0^\infty \mu_k(s;1) f_k(s;1)\, ds + (1-\pi^\chi) \int_0^\infty \mu_k(s;0) f_k(s;0)\, ds, \tag{6}$$

where $f_k(s;\chi)$ is the equilibrium probability density of unemployment duration of the workers with skill level k and search productivity χ. We assume free entry into any of k markets which amounts to value of the vacant job being equal to zero, $J_{0k} = 0$. This shrinks the Bellman equation for the value of the vacant firm to $\gamma_k = \theta_k^{-1} \bar{\mu}_k J(w_k)$ where γ_k denotes the period vacancy costs and the right-hand side captures the expected value of future production.

- Government

The government finances unemployment benefits through labour tax revenues. Let N_k denote the fixed size of the labour force of skill k. Let L_k denote the endogenous size of employment of this skill, such that $U_k \equiv N_k - L_k$ is the size of unemployment. Then, the measures of UI and UA recipients are given by $U_k^{UI} = (N_k - L_k)[\pi^\chi \int_0^{\bar{s}} f_k(s;1)\, ds + (1-\pi^\chi) \int_0^{\bar{s}} f_k(s;0)\, ds]$ and $U_k^{UA} = (N_k - L_k)[\pi^\chi \int_{\bar{s}}^\infty f_k(s;1)\, ds + (1-\pi^\chi) \int_{\bar{s}}^\infty f_k(s;0)\, ds]$, respectively.

The measure U_k^{UI} receives b_{UI} and the measure U_k^{UA} receives b_{UA}. These are paid by the labour tax levied on the gross wage $w_k/(1-\kappa)$ of the employed workforce L_k. Consequently, the budget of the government is given by $\Sigma_{k=1}^K b_{UI} U_k^{UI} + \Sigma_{k=1}^K b_{UA} U_k^{UA} = \Sigma_{k=1}^K \kappa \frac{w_k}{1-\kappa} L_k$. The government chooses the tax rate κ such that this budget is balanced at any time.

- Equilibrium

Equilibrium is characterized by the set $\{w_k, u_k, \theta_k\}_{k=1}^K$ of skill-specific wages (w_k), unemployment rates (u_k) and tightness parameters (θ_k) which satisfy the optimal solutions of workers' and firms' problems such that the government budget is balanced.

Wages are set according to collective bargaining, where we explicitly account for the fact that UI and UA benefits are (prior to the reform) proportional to previous net wage. The corresponding equation reads

$$\begin{aligned} & (1-\beta)\, v\left(w_k\right)+\beta m_{w_k}\left(.\right) w_k \qquad (7) \\ = \; & (1-\beta)\, v\left(b_{UI,k}, \phi_k\left(0\right)\right)+\beta\left(1-\kappa\right) m_{w_k}\left(.\right)\left[A_k+\gamma_k \theta_k \frac{\mu_k\left(\phi_k\left(0\right)\theta_k, p_0\right)}{\bar{\mu}_k}\right], \end{aligned}$$

where

$$m_{w_k}\left(w_k, b_{UI}, \phi_k\left(0\right)\right) \equiv v_w\left(w_k\right)+\frac{\lambda_k}{\rho+\mu_k\left(\phi_k\left(0\right)\theta_k, p_0\right)} v_w\left(b_{UI,k}, \phi_k\left(0\right)\right) \qquad (8)$$

The equation is more general than textbook versions due to risk-aversion, benefit levels proportional to the wage and the non-stationarity of unemployment benefits. If we had risk-neutrality and wage-independent unemployment benefits, the marginal effect of the wage on utility in (8) would be unity. The left-hand side of (7) would then equal w, the net wage. In our more general setup, an increase in the wage increases utility in (8) by the slope at the current wage w_k plus the marginal effect of a higher wage on future utility when the individual is unemployed again and income is given by the benefit $b_{UI,k}$. This future utility also depends on effort $\phi_k\left(0\right)$ and affects current utility in expectation, where λ_k is the rate with which the individual loses the current job, and in its present value, where discounting takes place at the time preference rate plus the job arrival rate $\mu_k\left(\phi_k\left(0\right)\theta_k, p_0\right)$ with which an individual would then find a job again.

The right hand side of (7) shows the contribution of utility from benefits when just having lost the job and the tax-rate weighted effect of the production side. As in the standard setup, higher benefits yield higher wages, as does higher productivity. The effect of more vacancies per unemployed worker, i.e. of higher θ_k, is weighted by the arrival rate once unemployed divided by the average arrival rate. This latter generalization is due to the non-stationary nature of benefit payments.

An essential insight of our model, as well as its main contribution to the theoretical literature, is the derivation of the equilibrium unemployment rate for a non-stationary benefit system (1). This nonstationarity implies a semi-Markov setup, where instantaneous transition probabilities from unemployment to employment are no longer independent of unemployment duration. The equilibrium unemployment rate in such case is found via the solution to a system of Volterra integral equations.

The expression for the long-term unemployment rate following from this setup reads

$$u_k=\frac{p_{eu}^k}{p_{eu}^k+\int_0^\infty p_{ue}^k\left(s\right) dF^k\left(s\right)}, \qquad (9)$$

where p_{eu}^k is the steady-state probability of being unemployed conditional on having had a job. Similarly, $p_{eu}^k\left(s\right)$ is the probability that an originally employed individual is unemployed in s. The distribution of unemployment spells in skill group k is denoted by $F^k\left(s\right)$. Interestingly (and necessarily), the standard expression $u_k=\lambda^k/\left(\lambda^k+\mu^k\right)$ is a special case of our setup. When all job-finding rate is constant at μ^k, the probabilities are given by $p_{eu}^k=\lambda^k/\left(\lambda^k+\mu^k\right)$ and $p_{ue}^k=\mu^k/\left(\lambda^k+\mu^k\right)$.[6]

[6] This marks the end of our borrowing from Launov and Wälde (2013). The following is independent work

3.2 Assessment strategy

With the help of the model just described, we simulate the contribution of each package of the reform, as well as that of economic growth, to the reduction of the unemployment rate from the beginning of 2005 up to the onset of the Great Recession.[7] We quantify the structural parameter responsible for (a change of) effectiveness of matching in our model by using the reduced-form estimates of the (change of) effectiveness of matching available from the literature. We then use the existing reduced-form estimates to separately pin down the impact of Hartz I-II and the impact of the reform of PEA (Hartz III). After that we determine the role of reduced benefit generosity (Hartz IV) via simulating the transition to the ALG II system with fixed UA benefits and the reduction of entitlement to UI benefits as defined by the legislation. The influence of economic growth over the mentioned period is modeled by a permanent increase of the worker-firm output A_k.

- The impact of Hartz I-II and Hartz III

Given that we have a theoretical model, it is fairly easy to establish a link between the *reduced-form* estimates and the *structural* estimates of the effectiveness of matching in our model. The aggregate matching function that is consistent with and can be derived from our model has the form

$$m(U,V) = \Omega U^{1-\alpha} V^{\alpha},$$

where U and V are the numbers of unemployed workers and vacancies, respectively, and Ω is a scaling constant which contains the matching effectiveness parameter among others. In more detail, Ω is given by

$$\Omega = \sum_{k=1}^{K} \pi(k) \left[\pi^{\chi} \int_0^{\infty} \eta_1 \left[\phi_k(s)\, \theta \right]^{\alpha} f_k(s;1)\, ds + (1-\pi^{\chi}) \int_0^{\infty} \eta_0 \left[\phi_k(s)\, \theta \right]^{\alpha} f_k(s;0)\, ds \right].$$

It illustrates the expected job offer arrival rate where expectation is with respect to the distribution of skill groups and the distribution of beliefs about own search productivity. In this expression, for $\chi = \{0,1\}$, η_{χ} is defined as

$$\ln \eta_{\chi} = \zeta_0 + \mathbf{x}'\boldsymbol{\zeta} + \chi\nu,$$

where $\mathbf{x}$ stands for the observed individual characteristics of the unemployed worker (excluding intercept), ν reflects the contribution of the unobserved search productivity type, and the intercept ζ_0 represents the exogenous macroeconomic conditions that determine the speed of the matching process. Thus the parameter ζ_0 in our model has the same meaning as the intercept term in the empirical marketplace model of Coles and Smith (1998).

The parameter ζ_0 suggests a simple link between the structural and reduced-form parameters of the effectiveness of matching. Let us emphasize the dependence of the matching function on the effectiveness of matching by writing $m(\zeta_0; U, V)$. Let us define by δ the percentage change in the number of matches induced by the reform, where δ can be estimated

with new results, employing, however, the equilibrium solution algorithm from the original model.

[7] As argued by Krause and Uhlig (2012), most of the transition to the new steady state took no longer than three years.

by a reduced-form approach. Then the structural counterpart of δ is the parameter $\tilde{\zeta}_0$ which solves

$$m\left(\zeta_0 + \tilde{\zeta}_0; \tilde{U}, \tilde{V}\right) = \delta m\left(\zeta_0; U, V\right)$$

with $\tilde{U}$ and $\tilde{V}$ standing for post-reform unemployment and vacancies, respectively. The parameter $\tilde{\zeta}_0$ measures the reform-induced change in the speed of matching measured in terms of the structural model. Hence it can be used to pin down the change in the equilibrium unemployment rate implied by the reform.

As noted in the introduction, two studies provide estimates of δ for the packages of interest. Fahr and Sunde (2009) find a 9 % increase in the number of matches due to Hartz I-II and 6.5 % increase in the number of matches due to the reform of PEA. Klinger and Rothe (2012) report 7.3 % and 3.5 % increase respectively. We will use both of these sets of estimates in the analysis to follow.

Finally note that quantifying $\tilde{\zeta}_0$ needs to be done numerically. There are two reasons for that. The first one is the necessity of pinning down unemployment and vacancies in the post-reform equilibrium. The second one is the fact that despite the seeming log-linearity of the matching function in ζ_0 the structural relationship between $m\left(U, V\right)$ and ζ_0 is anything but log-linear. This obtains because the endogenous search effort $\phi_k\left(s\right)$ also depends on η_0 and η_1, both of which enter $\phi_k\left(s\right)$ in a complex nonlinear way.

- The impact of Hartz IV

To simulate the effect of Hartz IV, we look at each of the K heterogeneous groups in turn. We consider the observed distribution of UA payments immediately before the reform and the observed distribution of ALG II payments immediately after the reform. The difference in the mean values of these distributions marks the group-specific change in benefit level due to the introduction of the ALG II system. In this way we naturally get the winners and losers of the reform, documented otherwise in existing studies.[8]

We deal with the reduction of entitlement length in a similar way. Within each of the K heterogeneous groups, we consider two different distributions of the entitlement length. The first one is the actual distribution immediately before the reform. The second one is the hypothetical distribution computed on the same sample according to post-reform rules. The difference in the means of these two distributions marks the group-specific reduction of the entitlement imposed by the reform.

We simulate the regime switch from UA to ALG II benefits and the reduction of the entitlement to UI simultaneously.

- The impact of economic growth

The worker-firm match in the model produces the output A_k for any k. According to AMECO (2012), between 2005 and 2008 the economy has grown by 4.4 %. Keeping all the parameters of the model fixed, we convey this growth effect via increasing A_k by a factor of 1.044 for all k.

[8] We find that about 1/4 of all unemployed win from the new benefit scheme, obtaining higher payments than what they would have got without the reform. This aligns e.g. with the result of Goebel and Richter (2007) who find that about 1/3 of all unemployed improve their position after the introduction of ALG II.

4 Efficient agency or more benefit cuts?

We now present a detailed discussion of equilibrium effects of the reform of PEA and of adjustments of unemployment benefits. We measure these effects by looking at the unemployment rate and at social welfare.

4.1 Impact on equilibrium unemployment

4.1.1 Specifications

We undertake a comparative statics analysis to determine the contribution of each package of the reform, as well as the contribution of the economic growth, to the reduction of the unemployment rate between 2005 and 2008. This analysis is performed under two different specifications. *Specification I* takes the estimates of the increase in matching effectiveness due to Hartz I-II and Hartz III provided by Fahr and Sunde (2009). *Specification II* borrows the respective estimates from Klinger and Rothe (2012). Interestingly, for any given package of the reform, point estimates of Fahr and Sunde (2009) and Klinger and Rothe (2012) lie within the confidence intervals of each other. Thus, performing the comparative statics exercise at these two point estimates is likely to narrow down the range within which the true decline of the aggregate unemployment rate is located.

Apart from taking two different reference points for matching effectiveness, we also consider two different ways of simulating policy effects. The first one is the out-of-sample *prediction* of the unemployment rate from the structural model. The second one is the exact *calibration* of the observed unemployment rate. Both alternatives take up the parameter estimates reported in Launov and Wälde (2013, table 1) as a common basis.

For performing the comparative statics analysis by means of the out-of-sample prediction, we collect individual data from the last three years before the introduction of the reform (years 2001 to 2003) and take the labour market tightness data of 2005.[9] Remarkably, our model has very good predictive properties. The predicted aggregate unemployment rate in the pre-reform steady state amounts to 10.68 %, which falls short of the actually observed unemployment rate of 11.71 % by just 1.03 percentage points. To asses whether this prediction error is of any importance we resort to the alternative method of exact calibration. When setting up the analysis by calibration, instead of taking the actual data on the labour market tightness, we choose the tightness ourselves so as to match the observed aggregate unemployment rate of 11.71 % exactly. The entire reform is simulated subsequently both in the predicted and in the calibrated pre-reform steady states.[10]

No matter the choice of specification or the way of computing the pre-reform steady state, we always simulate the reform step by step. First we consider the introduction of Hartz I-II. Then we introduce Hartz III. This is followed by Hartz IV and, lastly, by the positive productivity shock to the output.

[9] It turns out that the distribution of individual data is fairly stable over time. The labour market tightness, in contrast, fluctuates considerably. As we try to describe the evolution of the unemployment rate between 2005 and 2008, we pick the tightness of 2005 as a starting point.

[10] A complete characterization of these two pre-reform steady states is in tab. A.1 of the Appendix.

4.1.2 The reform and the fall of unemployment

Table 1 reports all comparative statics results. It shows in particular the contribution of each package of the reform, as well as the cumulative effect of the reform, measured in percentage points reduction of the aggregate unemployment rate.

Let us first emphasize the remarkable explanatory power of our analysis. Considering the out-of-sample prediction, one can notice that the observed decline of the aggregate unemployment rate is actually bracketed by the predictions of Specifications I and II. While the observed decline of the unemployment rate was documented to be equal to 3.91 percentage points (see page 6), the simulated cumulative reduction according to Specifications I and II has made 4.67 and 3.64 percentage points, respectively. This implies that, conditional on the reduced-form estimates of the impact of Hartz I-III on match effectiveness, our model is capable of explaining the entire reduction of the unemployment rate by the Hartz reform and output growth alone. Notably, this finding is robust to the particular choice of the pre-reform steady state. In the simulation with the unemployment rate targeted exactly, the calibrated reduction of the unemployment rate again lies to the right and to the left of the observed reduction, taking Specification I and II respectively.

	Prediction			**Calibration**		
	u (%)	change (%pt)	cumul.	u (%)	change (%pt)	cumul.
Specification I						
Before the Reform	10.68	-	-	11.71	-	-
Hartz I-II	7.91	2.77	2.77	8.86	2.85	2.85
Hartz I-III	6.35	1.56	4.33	7.22	1.64	4.49
Hartz I-IV	6.25	0.10	4.43	7.12	0.10	4.59
Hartz & Growth	6.01	0.24	4.67	6.82	0.30	4.89
Specification II						
Before the Reform	10.68	-	-	11.71	-	-
Hartz I-II	8.38	2.30	2.30	9.34	2.37	2.37
Hartz I-III	7.44	0.94	3.24	8.37	0.97	3.34
Hartz I-IV	7.35	0.09	3.33	8.28	0.09	3.43
Hartz & Growth	7.04	0.31	3.64	7.91	0.37	3.80

Table 1 *Simulated reduction of the unemployment rate*

Apart form making us confident that we are correctly picking the dynamics of the unemployment rate, this finding can also help discriminate between the existing reduced-form estimates of the impact of the first three packages of the reform. Since one would always expect to have some residual decline unexplained by the model, our model suggests that

point estimates of Klinger and Rothe (2012) should lie closer to the true increase in match instances than those of Fahr and Sunde (2009).

Let us now consider the impact of the reform of PEA and that of the reshaping of the unemployment compensation scheme. From tab. 1 we can see a substantive contribution of the increased effectiveness of the employment agency to the reduction of the unemployment rate. The simulated effect is roughly 1.5 percentage points in the first specification and 1 percentage point in the second one. Looking at the share the reform of the agency holds in the entire simulated decline of the unemployment rate, one can readily find that this share amounts to 33 % according to the first specification and roughly 25 % according to the second specification. Recalling our definition of the reform of PEA in Section 2.2.2, where we were disregarding the elements of the first package aimed at the reduction of coordination frictions, these results allow concluding with confidence that the increase in the operating effectiveness of the Federal Employment Office has caused the unemployment rate to fall by more than 25 %.

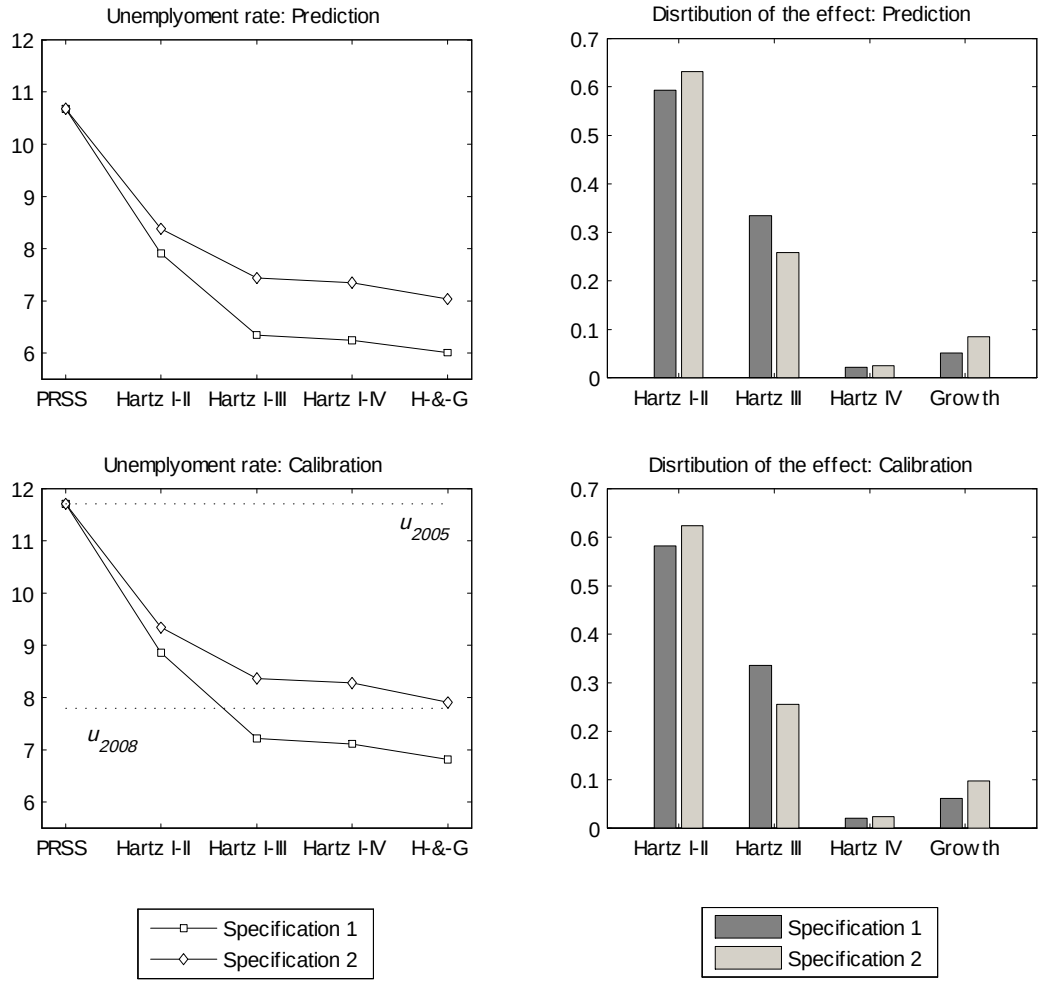

Figure 2 *Impact of the Hartz reform on the equilibrium unemployment rate*

Nothing of this kind can be seen for the reform of the benefit system. No matter the choice of specification and no matter the choice of the simulation approach, the impact of the net UA reduction together with the shorter entitlement to UI remains anything but sizeable. In fact Hartz IV is capable of explaining only 0.09 to 0.10 percentage points of the reduction in the equilibrium unemployment rate. Its share in the explained variation of the equilibrium unemployment is only slightly above 2% - more than ten times weaker than the impact of the improvement of PEA.

Figure 2 visualizes all the effects. The two panels on the left of this figure show the cumulative effect of Hartz I-II, Hartz I-III, Hartz I-IV and Hartz I-IV plus economic growth on the reduction of the unemployment rate for the prediction (upper-left panel) and the calibration (lower left panel). The two panels on the right of fig. 2 show the share of Hartz I-II, Hartz III, Hartz IV and of economic growth in the simulated decline of aggregate unemployment, similarly for the prediction (upper-right) and the calibration (lower-right). From both panels on the left of fig. 2 we see that after a sharp decline due to Hartz I-II and the reform of the Federal Employment Agency, the contribution of the benefit reform is next to nonexistent, being mapped by a nearly flat line.[11] It is also interesting to note that economic growth over the reference period, despite being sizable in German terms, is only the third biggest contributor to the simulated unemployment dynamics. Its share in explained reduction of unemployment is just about 10%.

4.2 Welfare consequences

As is clear from tab. 1 and fig. 2, the Hartz reform has had a profound impact on the dynamics of the aggregate unemployment rate. The vehicle of this effect, however, was not the unemployment benefit package. Since the role of Hartz IV in reducing unemployment appears to be extremely modest, one would similarly expect that welfare consequences of the reduction of benefit generosity, so heatedly debated around the time of reform implementation, would also be very small. In contrast, welfare implications of the restructuring of the Federal Employment Agency should be significant, contributing thereby to a large welfare effect of the Hartz reform in its entirety. The analysis below makes this case.

We consider two aggregate statistics: the lifetime value of an unemployed worker (measured at the start of the unemployment spell, $V(b_{UI}, 0)$) and the lifetime value of an employed worker, $V(w)$. As before, we use two specifications for the impact of Hartz I to III and simulate two pre-reform steady states: one predicted and one calibrated. The evolution of all the statistics with the step-by-step introduction of the reform is illustrated in fig. 3. All values in fig. 3 are normalized to the pre-reform steady state, so that vertical axis shows the cumulative percentage change after each next step of the reform, concluding with the impact of the economic growth.

[11] For the calibrated values on the lower left panel, we also draw two horizontal lines that mark the observed unemployment rates in 2005 and 2008. They clearly show that, conditional on the estimates of match effectiveness of Klinger and Rothe (2012), the model reflects the drop in the unemployment rate very well.

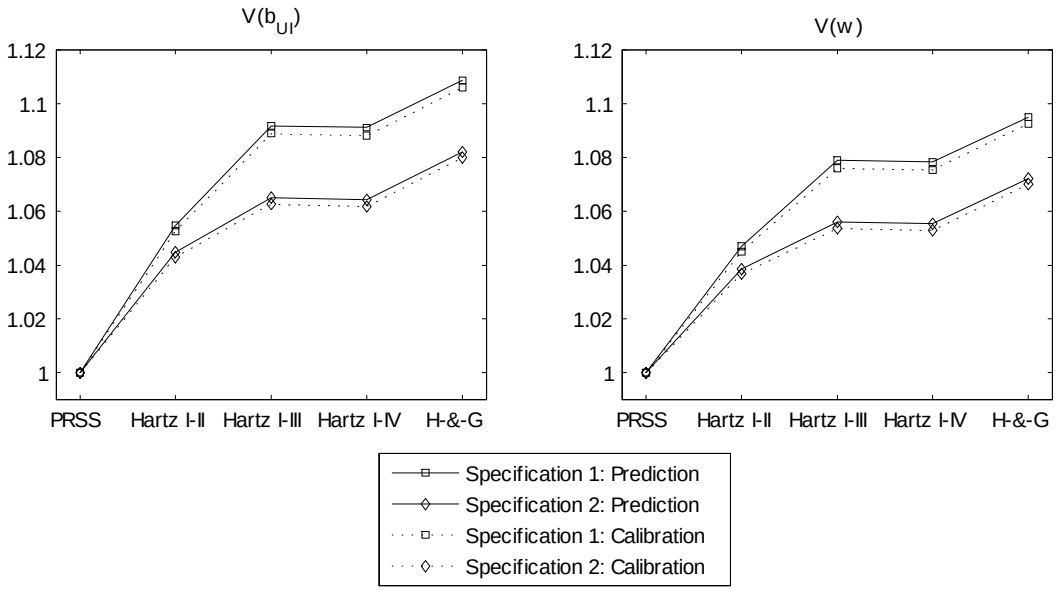

Figure 3 *Impact of the Hartz reform on welfare*

It becomes evident that the Hartz reform as a whole has contributed strongly to the increase in welfare of the labour supply side. The value of unemployment has gone up by 6 to 9 % in comparison to the pre-reform equilibrium. The value of employment has increased by 5 to 8 %. This net effect on $V(b_{UI}, 0)$ and $V(w)$ comprises both a positive effect of Hartz I-III and a negative effect of Hartz IV. Indeed, the reduction of benefit generosity has negatively affected welfare of workers in aggregate terms, since monetary conditions for long-term unemployed have become less advantageous. However this outcome is an order of magnitude lower than the impact of Hartz I-II and that of the improvement of PEA. Negative contribution of Hartz IV amounts to less than 0.001 % of the lifetime value of unemployment/job before the reform, which translates into a nearly flat region in the plots for $V(b_{UI}, 0)$ and $V(w)$. Consequently, the transition to the new unemployment benefit scheme and the reduction of entitlement can be viewed as virtually welfare-neutral.

At this point it should also be clear why both unemployed and employed workers benefit from the reform. For the unemployed workers Hartz I-III increases the expected capital gain from finding a job via increasing the chance of contacting a vacant firm. The latter is to large extent a consequence of the improved effectiveness of matching technology. For the employed workers, the expected capital loss from job destruction goes down, as Hartz I-III increases the value of unemployment though the channel just mentioned.

Lastly, economic growth contributes further 1.7 to 1.8 % to the rise of each of the welfare measures. All above results are robust to the particular way of simulating the pre-reform steady state, be it prediction or calibration.

4.3 Reform implications

What do we learn from this analysis for future reforms? There is a discussion in Germany on a second Hartz-type reform and - much more importantly - there is a discussion at the

European level on how to fight the highest unemployment rate in the Euro area ever since the Euro was introduced in 2002.[12] How can policy measures be informed by our findings?

In some trivial sense, anything that increases the outflows from and reduces the inflows into unemployment is desirable. It is less trivial to suggest measures that actually increase outflows and reduce inflows. The most challenging task consists in quantifying the effects of the suggested measures.

Our analysis makes a strong case (surprising even to us) for an increased effectiveness of PEAs. What speaks in favour of more effective PEA as opposed to a cut of benefits for long-term unemployed? First, the strong direct effect on the increase of outflows from unemployment.[13] A more efficient PEA does not only increase outflow of long-term unemployed workers, it benefits all unemployed workers. Second, the neutrality of a such a policy measure with respect to distributional considerations. While a cut of benefits for long-term (or all) unemployed workers should increase outflows (if only modestly as we have found), it increases income inequalities and poverty.

Is there a direct recommendation for "any" country with high unemployment? We would say no when it comes to *detailed* reform measures. Our findings very strongly suggest, however, that any country should first study potentials in making its PEAs more effective before thinking about reducing unemployment benefits. Effectiveness of PEAs increased in Germany as (i) bureaucracy decreased considerably after centralizing all the claims made by unemployed in the hands of one caseworker, (ii) the number of unemployed managed by a caseworker was reduced to the (political) benchmark of at most 150 (of which at most 75 are under age of 25 years) and (iii) priority was given to workers above the age of 50. One might think about inquiring whether these measures could help other countries as well.

5 Overlooked PEA and debate on benefits

5.1 PEA in the post-reform evaluation effort

An evaluation of the entire Hartz reform was foreseen by the law with results to be delivered by the end of 2006.[14] Overall the reform has enjoyed rather favorable assessment ex post (see e.g. Jacobi and Kluve, 2007; Fitzenberger, 2009, and most recently, Hertweck and Sigrist, 2012). Despite the fact that some of the modules, such as for instance employment-stimulating measures for older workers in the first package, did not completely meet initial expectations, the reform comprised a fair number of successes policies. Within Hartz I, particular merit in reducing unemployment has been attributed to introduction of training vouchers (Schneider and Uhlendorff, 2006). Hartz II has provided an especially strong impact through start-up subsidies (Baumgartner and Caliendo, 2008; Caliendo and Künn, 2011).

[12] See e.g. the new release 50/2013 of 2 April 2013 by Eurostat.

[13] The first evidence on the significant increase in the outflows following the Hartz reform comes from Hertweck and Sigrist (2012).

[14] "Vierteljahrshefte zur Wirtschaftsforschung", 2006, 75(3), and "Zeitschrift für ArbeitsmarktForschung", 2006, 39(3/4), have dedicated two special issues to embody the corresponding set of evaluation studies. These were mostly policy-advisory and concentrated predominantly on the effect of the first three packages of the reform because reliable data on the last one were not available yet.

A positive and significant net effect of Hartz I and II as collections of policies was similarly underlined by Fahr and Sunde (2009) and Klinger and Rothe (2012).

Unlike with Hartz I and II that have attracted a good deal of evaluation studies, except of already mentioned Fahr and Sunde (2009) and Klinger and Rothe (2012), there is no paper known to us that explicitly addresses the restructuring of the Federal Employment Agency (Hartz III). The reason is, most likely, in the nature of the package itself. It deals with macro-aspects of matching effectiveness, whereas the majority of the evaluation studies to date were the reduced-form econometric analyses of micro-data, which makes identification rather difficult. Finally, even Fahr and Sunde (2009) and Klinger and Rothe (2012) are silent about the equilibrium effects.[15] As a result the whole power of the reform of the agency was largely overlooked by the major segment of the post-reform evaluation literature.

There also exists a smaller segment of the literature that develops structural equilibrium models capable of pinning down the effect of the reformed agency. Krebs and Scheffel (2011) suggest an equilibrium matching model with ex ante homogeneous workers, consumption and savings decisions and markets for physical and human capital. Krause and Uhlig (2012) consider an equilibrium matching model with ex ante skill heterogeneity of workers, human capital dynamics and endogenous separations. Launov and Wälde (2013) develop an equilibrium matching model with ex ante skill heterogeneity of workers, explicit two-step benefit mechanism, known time limit on UI benefits and endogenous spell-dependence of unemployment duration. All three provide a direct link between the effectiveness of matching and benefit system design on the one hand and the equilibrium unemployment rate on the other hand, allowing straightforward causal interpretation of unemployment changes due to the reform. However this literature also leaves the reform of PEA unaddressed, concentrating all its effort on the reduction of benefit generosity under Hartz IV.

The analysis of the present paper clearly shows that improving PEA has a considerable potential and analysis of agencies effectiveness should not be easily overlooked.

5.2 The root of diverse results on unemployment benefits

The attention paid to the equilibrium effects of reduced generosity of unemployment benefits under Hartz IV has led to a good deal of heterogeneity in evaluation results. Of the observed 3.9 percentage point decline in the unemployment rate, Krause and Uhlig (2012) attribute 2.8 percentage points to Hartz IV. Krebs and Scheffel (2011) find that Hartz IV is responsible for 1.2 percentage point reduction, of which 1.1 percentage point is due to lower post-reform benefits. Launov and Wälde (2013), and the present paper, report 0.1 percentage point reduction at most.[16] Why do we find such a small effect relative to the first two studies? It turns out that the big part of the answer lies in the assumption about the severity of the

[15] Possibly the closest to recognizing the role of the reform of PEA were Krause and Uhlig (2012) who do have an equilibrium model with the aggregate matching function. Krause and Uhlig (2012) simulate the composite effect of all packages pre-dating the reform of the benefit system, but do not provide any discussion on the impact of PEA. Furthermore, their quantitative results hinge on the assumptions about the direct effect of UA reduction. We discuss this in detail in Section 5.2.

[16] Lastly, equidistant from Krebs and Scheffel (2011) and the estimates of the present paper is the result of Franz et al. (2012). Their CGE-microsimulation analysis implies the reduction of the unemployment rate by 0.6 percentage points.

benefit cut implied by the reform.

In Krebs and Scheffel (2011), the ex ante homogeneity of unemployed workers precludes having winners and losers of the reform, implying an already stronger aggregate reduction of UA benefits than in our analysis. Furthermore, they implement the switch to the ALG II system as a reduction of the replacement rate on previous wage earnings from 0.69 to 0.45. This turns out to be a substantial number. If we perform the simulation of such a benefit reduction within our own model, we predict that Hartz VI is responsible for unemployment rate going down by 1.3 to 1.5 percentage points.[17] This aligns with 1.1 percentage points reported by Krebs and Scheffel (2011) quite well.

Krause and Uhlig (2012) evaluate Hartz IV by removing *UA* benefits completely. Instead they let an unemployed individual receive a *welfare* benefit that amounts to 80 % of the lowest pre-reform UA benefit by assumption. This leads to even stronger cuts if compared to Krebs and Scheffel (2011). Table 2 in Krause and Uhlig (2012) shows that welfare benefits after the reform amount to 0.33 of the pre-reform UA benefit for the high-skilled workers and to 0.76 of the pre-reform UA benefit for the low-skilled workers. Again, if we take our own model to simulate the Hartz IV reform using the benefit cut of Krause and Uhlig (2012), we find that Hartz IV alone explains 2.0 to 2.2 percentage points reduction of the unemployment rate. These numbers come relatively close to the reported 2.8 percentage points, the latter also comprising the effect of reduced entitlement to UI.

Thus, the central question "which analysis to lend more credibility?" indeed simplifies to a question "how big the benefit cut induced by the Hartz IV reform actually is?". This is good news as three analyses predict the same effect, conditional on the same input. The models per se therefore coincide in their predictions which strongly underlines the policy relevance of work of this type. The central question is therefore: Did the reform reduce UA payments to the half? Was this reduction even stronger? Or maybe much weaker? We look for the answer to this question in the income data of benefit recipients before and after 2005. OECD (2007) suggests that the average effect of the reduction of UA payments has amounted to just 7 %. Goebel and Richter (2007) show that, for Germany as a whole, mean benefits of ALG II recipients in 2005 have become 0.94 to 0.95 of the mean benefits of UA recipients in 2004.[18] In addition Blos and Rudolph (2005) and Goebel and Richter (2007) emphasize that some of ALG II recipients even improved their income position as a result of the reform (1/2 and 1/3 of all recipients, respectively). These data stand in contrast with the strong cuts taken up by Krebs and Scheffel (2011) and Krause and Uhlig (2012).

Following this data-driven approach, we define the benefit reduction due to Hartz IV as mean ALG II payments after 2005 relative to mean UA payments before 2005. Although comparison of means does not deliver the exact treatment effect of Hartz IV on benefits as an outcome variable, looking at these data still provides the order of magnitude for the change in benefit payments. As expected in light of descriptive findings, these changes can hardly be called substantial. In tab. A.2 we show them for all the skill- and regional groups in our analysis. To draw a parallel to Krause and Uhlig (2012), if we view high- and medium-skilled workers as one group, benefit reduction due to Hartz IV in our data is approximately 0.93

[17] Entitlement in this exercise was kept at the pre-reform values to single out the effect of benefits.

[18] Goebel and Richter (2007) also have a detailed breakdown for East and West as well as for the deciles of income distribution; see their tab. 3 on page 757.

of the original UA benefit, instead of 0.33 in their calibration. For the low-skilled workers ALG II has even *exceeded* the former UA benefits, marking approximately 1.17 more than the original UA level, in place of 0.76 reduction of Krause and Uhlig (2012).

Summarizing, differences in the predictions of the effects of the Hartz IV reform almost entirely result from differences in the assumptions about severity of the benefit cut exercised by this reform. As modest numbers of an average benefit reduction under 10 %, along with existence of winners and losers, appear empirically more convincing than the assumption of extreme cuts, we claim that negligible effect of Hartz IV on the reduction of the unemployment rate is most likely its true effect.

To conclude this discussion, if we want to understand why Krause and Uhlig (2012) obtain such a big reduction in benefits the following explanation appears plausible. In their pre-reform steady state, Krause and Uhlig (2012) obtain the distribution of benefits as a function of the distribution of skills. Each skill level has an idiosyncratic random productivity which enters the production function. This skill-specific productivity influences the equilibrium wage and, via the statutory replacement rates, ultimately the UI and UA benefit levels. As productivities are drawn form the distribution with non-overlapping supports,[19] equilibrium wages of the high-skilled become more than twice as big as those of the low-skilled. This leads to the same discrepancy between UA benefits of different skills and to even higher discrepancy between UA and welfare benefits. As a result, via particular distributional assumptions for productivity one can get a fairly strong simulated effect of the reform.

6 Conclusions

In this paper we analyze two different policies aimed at reducing unemployment. One is the standard reduction of generous unemployment benefits. Another is the improvement of operating effectiveness of a public employment agency that arises as a result of internal reorganization. The first policy addresses search incentives of an unemployed worker without affecting the degree of information frictions in the market. The second, to the contrary, reduces the degree of information frictions. We evaluate both these policies using a unique setup of the recent comprehensive labour market reform in Germany: the Hartz reform of 2003-2005. Our evaluation is carried out in a structurally estimated equilibrium search model. The model directly maps the change in the benefit system, as defined by the legislation, and the change in operating effectiveness of the public employment agency, as estimated in the literature, into the response of the equilibrium unemployment rate.

We find that improved effectiveness of public employment agencies has substantially contributed to the reduction of the equilibrium unemployment rate, explaining more than 25 % of the difference between the pre-reform and post-reform steady states. The reduction of benefit generosity, which foresaw shortening of entitlement period to unemployment insurance and moderate cuts of unemployment assistance benefits, has brought in contrast almost no result. Its share in the difference between pre- and post-reform equilibrium unemployment barely exceeds 2 %.

[19] Productivity is uniformly distributed on [0.5,1.5] for low-skilled and [1.5,2.5] for high-skilled; see Krause and Uhlig (2012), page 70.

Our analysis makes two main contributions. First, we discover a great unemployment-reducing potential for typical welfare states. It lies in making public employment agencies more effective. There exists a rich literature that addresses different labour market institutions of a welfare state and analyzes how reforming these institutions can help us reduce unemployment. Unemployment compensation systems, trade unions, labour taxes or subsidies and employment protection are all among the most frequently analyzed institutions. Surprising as it is, in the long list of institutions one cannot find the public employment agency itself. With our findings that over one quarter of the post-reform decline in unemployment can be attributed to their reorganization, public employment agencies and their modernization must not be overlooked by policy makers and by academic researchers.

Second, we show that within a class of search and matching models three fairly different models of one and the same unemployment benefit reform can generate relatively close predictions, provided that all of them take a given benefit reduction as a common basis for simulation. Thus, correct assessment of the employment effect of the reform appears to be not so much the question of the choice of modelling device, but rather a question of picking the right discrepancy between the pre- and post-reform benefits. We choose to be guided by the data and the existing descriptive literature on the change in unemployment assistance as a part of the Hartz reform in Germany. These data tell us that what can otherwise be considered a typical benefit reduction, is barely capable of delivering any economically significant result. Given the amount of public debates that were surrounding the reduction of benefit generosity we also think that cuts big enough to substantively curtail unemployment lie very likely well outside the range of possible political compromise.

In the end we credit the Hartz reform in its entirety with a excellent job in combating unemployment. All its four packages, together with economic growth, explain the observed post-reform unemployment decline almost completely.

Appendix

Table A.1 reports parameters required to simulate the model and provides the complete characterization of the pre-reform steady state. Sources for this table are the GSOEP (www.gsoep.de) for wage and benefit data along with all group characteristics; the IAB (www.iab.de) for vacancy and unemployment data and Launov and Wälde (2013) for the sample taken from GSOEP and all the structural parameters. The skill distribution $\{\pi(k)\}_{k=1}^{K}$ in the economy relates to the sample taken from the entire population of working age individuals. The rest of the observed data, except of labour market tightness, stems from the flow sample of entrants into full-time employment and unemployment between 01.2001 and 12.2003.

All monetary values are in Euros of 2005. Reported UA benefits $\tilde{b}_{UA,k}$ are conditional on eligibility to UI benefits (an event happening with probability π_k^{UI}) and on passing the means test upon expiration of entitlement to UI (and event happening with probability π^{UA}). Expected benefit $b_{UA,k}$ used in the simulation is therefore defined as $b_{UA,k} \equiv \pi_k^{UI}\pi^{UA}\tilde{b}_{UA,k}$. The statutory replacement rate is set to 0.65 of the average net wage of previous employment, such that $\tilde{b}_{UA,k} \equiv 0.65 * w_k$. Entitlement length $\bar{s}$ is computed using the observed duration of the contribution period in the last employment spell and age-dependent rules before Hartz

IV.

Parameters $\{\lambda_k, \eta_{0,k}\}_{k=1}^K$ and $\{\alpha, \sigma, \pi^{UA}, \pi^{\chi}, \nu\}$ are structurally estimated. For methodological discussion of the prediction of parameters $\{A_k, \gamma_k\}_{k=1}^K$ and of the equilibrium solution for $\{w_k, u_k, \theta_k\}_{k=1}^K$ and κ see Launov and Wälde (2013).

		West			**East**		
		high	medium	low	high	medium	low
observed	$\pi(k)$	0.1989	0.4094	0.1688	0.0730	0.1202	0.0297
parameters	π_k^{UI}	0.3913	0.5068	0.3696	0.6757	0.7023	0.4412
policy	$\bar{s}_k$	15	11	11	12	12	13
parameters	$\tilde{b}_{UA,k}$	1109	727	588	998	737	548
	λ_k	0.0055	0.0080	0.0124	0.0139	0.0203	0.0282
estimated and	$\eta_{0,k}$	0.0189	0.0224	0.0204	0.0268	0.0360	0.0314
predicted parameters	A_k	2155	1473	1368	2130	1587	1276
	γ_k	15633	14136	13916	27563	22464	8193
	w_k	1705	1118	905	1535	1134	843
equilibrium	θ_k p):	0.46	0.27	0.16	0.11	0.08	0.19
values	θ_k c):	0.37	0.21	0.13	0.09	0.06	0.14
	u_k p):	4.6%	7.4%	15.9%	15.1%	19.1%	22.1%
	u_k c):	5.1%	8.1%	17.5%	16.6%	20.9%	24.1%
estimated	α	0.4203	π^{UA}	0.2398	ν	1.4438	
aggregate parameters	σ	0.7808	π^{χ}	0.9228			
	κ p):	0.0283					
aggregate	κ c):	0.0305		exogenous	ρ	2.4% p.a.	
equilibrium values	u p):	10.7%		parameters	β	0.5	
	u c):	11.7%					

Notes: Above, "p):" stands for predicted and "c):" stands for calibrated pre-reform steady state

Table A.1 *Characteristics of the pre-reform steady state*

Table A.2 reports changes to benefits and entitlement as a consequence of Hartz IV. All values in this table are computed as described on page 13.

	West			**East**		
	high	medium	low	high	medium	low
ALG II as a share of UA	0.95	0.95	1.15	0.70	0.95	1.3
Entitlement cut (months)	3	1	1	1	2	2

Table A.2 *Specification of the Hartz IV reform*

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