Labor Market Reform and the Cost of Business Cycles

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October 2013

Abstract

This paper uses a tractable search model with idiosyncratic labor market risk and risk-averse workers to analyze the effect of labor market reform on the welfare cost of business cycles and hence the potential gain from macroeconomic stabilization policy. The paper derives a closed-form solution for the welfare cost of business cycles as a function of the various parameters of interest (unemployment benefit generosity, matching efficiency) and uses the formula to provide a quantitative analysis of the effect of the German labor market reforms of 2003-2005, the so-called Hartz reforms, on the welfare cost of business cycles. The quantitative analysis suggests that the Hartz reforms reduced the welfare cost of business cycles in Germany by about 1/3.

Keywords: Labor Market Reform, Cost of Business Cycles

JEL Codes: E21, E24, D52, J24

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1. Introduction

In his highly influential contribution Lucas (1987, 2003) argued that the welfare costs of business cycles are small. In other words, the potential gains from macroeconomic stabilization are negligible and academic scholars as well as policy makers are well-advised to focus on long-run issues. Subsequent research, however, has shown that the cost of business cycles can be substantial once worker heterogeneity and idiosyncratic risk are taken into account. Further, the Great Recession has provided a fresh reminder of the devastating labor market consequences of severe economic downturns, and has acted as impetus to a large body of theoretical and empirical work on the macroeconomic effects of stabilization policy. Overall, policy makers and many academics alike seem to have adopted (once again) the view that business cycle fluctuations are very costly and that macroeconomic stabilization policy is the most effective instrument for reducing the cost of business cycles.[1]

In this paper, we argue that well-designed labor market reform is a highly effective tool for reducing the welfare cost of business cycles. In other words, labor market reform and macroeconomic stabilization policy are substitutes, and implementing the former reduces the need for the latter. Our analysis is based on a tractable macro model with job search, idiosyncratic labor market risk and incomplete insurance markets. We show theoretically that any labor market reform that enhances labor market flexibility has two beneficial effects. First, it reduces the non-cyclical component of the unemployment rate, an effect that has been the focus of previous macro research on labor market reform. Second, it reduces the response of the unemployment rate to macroeconomic shocks and thereby reduces the cost of business cycles (recessions), an effect that is the focus of the current paper. Put differently,

[1] The recent academic literature on the business cycle effects of macroeconomic stabilization policy is vast and we make no attempt to survey this literature. Akerlof and Yellen (2006) provide a summary of the standard arguments in support of counter-cyclical monetary policy, and Yellen (2013) provides an account of US monetary policy since the Great Recession and how it has been shaped by concerns for the labor market. The IMF World Economic Outlook October 2012 provides one of many examples how recent policy making has been strongly influenced by the view that counter-cyclical fiscal policy is an effective tool to reduce the cost of adverse macroeconomic shocks. Our paper is also related to the recent work on cyclical labor market policy, which we discuss below.

well-designed labor market reform is not only good in the long-run, but also helps reduce the cost of short-run aggregate fluctuations.

We provide a quantitative application of our theoretical argument by studying one of the most ambitious attempts in recent history to reform the labor market of an advanced economy, the German labor market reforms of 2003-2005. Faced with stubbornly high and persistent unemployment, the German government implemented in 2003-2005 a package of far-reaching labor market reforms, the so-called Hartz reforms.[2] Two essential ingredients of these reforms were i) a complete overhaul and restructuring of the Public Employment Agency (Hartz III) to improve matching efficiency and ii) a substantial reduction in the unemployment benefits for the long-term unemployed (Hartz IV) to increase search incentives. There is strong empirical evidence that, in line with the theoretical prediction, these two parts of the reform package led to a substantial increase in the non-cyclical component of the job finding rate of unemployed workers. This empirical evidence in conjunction with the scale of the German labor market reforms of 2003-2005 make them an ideal case study for the theory put forward in this paper.

In our quantitative application, we calibrate the model economy to German pre-reform data and then simulate the effects of the Hartz reforms using the available empirical evidence on the effect of these reforms on matching efficiency and search incentives of unemployed workers. Our analysis suggests that the resulting increase in labor market flexibility led to a significant reduction in the responsiveness of the German unemployment rate to adverse macroeconomic shocks and a corresponding reduction in the welfare cost of business cycles. According to our baseline model/calibration, the Hartz III reform reduced the welfare costs of business cycles by 24 percent and the Hartz IV reform by 8 percent. Thus, these two labor

[2]In the US, labor market policy has often been adjusted in response to business cycle conditions, the recent extension of unemployment benefit eligibility from 26 weeks to up to 99 weeks being a case in point. However, after WWII the US has not witnessed any permanent changes in labor market policy comparable to the Hartz reforms. Of course, most European countries introduced some type of labor market reform in the last 20 years, but they were either much more limited in scope than the Hartz reforms or the implementation was much more gradual.

market reforms taken together reduced the potential gains from macroeconomic stabilization policy by about 1/3.

We also consider the robustness of our quantitative results to different model specifications and calibration targets. The following parts are important for our quantitative analysis: i) effect of Hartz reform on job finding rate, ii) effect of Harz reforms on wages of new hires (no large decline in match quality due to reforms), iii) skill depreciation during unemployment, and iv) how to eliminate of business cycles.

Following Lucas (1987,2003) we do not use a particular model of monetary/fiscal policy. We also have a model of the labor market that focuses on the search decision of workers ("labor supply") a long the lines of McCall (1970) and Ljungqvist and Sargent (1998, 2008), but do not model job creation ("labor demand") using the matching function approach of Mortensen and Pissarides (1994) or the island approach of Lucas and Prescott (1974). Discussion of teh modelling choices ...

Literature

Cost of business cycles: Alvarez and Jermann (2004), Atkeson and Phelan (1994), Barlevy (2004), Beaudry and Pages (2001), Imrohoroglu (1989), Krusell and Smith (1999), Krusell, Mukoyama, Sahin, Smith (2009), Krebs (2003, 2007), Storesletten, Telmer and Yaron (2001)

Labor market institutions and macro shocks: Ljungqvist and Sargent (1998, 2008), Blanchard and Wolfers (2002).

Labor market instutions and macro shocks in Germany: Burda and Hundt (2011), Krause and Uhlig (2012), Krebs and Scheffel (2013), Jung and Kuhn (2013)

Optimal Unemployment Insurance: Acemoglu and Shimer (2000), Hansen and Imrohoroglu (1992), Hopenhayn and Nicolini (1997), Pavoni (2009), Shimer and Werning (2008).

Empirical Evaluation of Hartz reforms: See Krebs and Scheffel (2013) for survey

2. The German Labor Market 1970 - 2012

In this section, we briefly review the German labor market experience since the 1970s in section 2.1 and discuss the main elements of the labor market reforms implemented in 2003-2005, the so-called Hartz reforms, in section 2.2. A more detailed account of the Hartz reforms can be found in Jacobi and Kluve (2006). In section 2.3 we discuss the empirical evidence on the effect of the Hartz reforms on matching efficiency and job finding rates.

2.1. Macroeconomic Performance

Figure 1 shows the unemployment rate in Germany in the period 1970-2012. The graph suggests that the German unemployment rate has a trend-component and a cyclical component, and that both have been affected by the Hartz reforms implemented in 2003-2005. Specifically, the trend component has been rising since the 1970s until the mid 2000s, and then started a secular decline that continued until the end of 2012. Further, the response of the German unemployment rate to the Great Recession was relatively mild compared to the cyclical increases of the German unemployment rate in previous recessions that occured before the Hartz reforms.

FIGURE 1 HERE

Figure 2 shows the evolution of per capita output and real wages in the post-unification period 1992-2011. We see that per capita output grew modestly at an average annual rate of 1 percent. In this period, Germany went through three recessions, 1993, 2003-2004, and 2008-2009, and had two periods of strong economic expansion, 2004-2007 and starting in 2010, and one prolonged period of weak but positive GDP growth in 1994-2001. Real wages stagnated between 1992 and 2003, and then fell about 4 percent in the period 2004-2009.

FIGURE 2 HERE

The next two figures show the quarterly flow rates from employment to unemployment (the job destruction rate) and from unemployment to employment (the job finding rate) fro the period 1992-2012. The flow rates are constructed by applying the method of Elsby et al. (2008) to OECD data on unemployment and unemployment duration for Germany.

FIGURES 3 AND 4 HERE

2.2. Labor Market Reforms: Hartz I-IV

The dismal labor market performance and a tightening of the social security budget convinced the German government that a drastic policy reversal had to take place. As a consequence, the German government implemented in 2003-2005 a number of labor market reforms, the so-called Hartz reforms named after the chairman of the commission that worked out the reform package.[3] The far reaching reform package had three ambitious goals: i) improve the services of the employment agencies (increase the matching efficiency), ii) activate the unemployed (provide better incentives to search for jobs), and iii) foster new employment opportunities with low tax wedges and deregulate the labor market (increase labor demand). Overall, the Hartz reforms constitute one of the most ambitious attempts in recent history of restructuring the labor market of an advanced economy.

Hartz I and Hartz II took effect in Jan 1st, 2003. Their main objective was to reduce labor costs through wage subsidies and to create new employment opportunities. For example, these laws eliminated the social security tax for jobs paying up to 400 Euro per month (Mini-job) and reduced social security contributions for jobs paying up to 800 Euro per month (Midi-jobs) and for firms hiring older workers. Further, Hartz I introduced measures that were meant to improve the search effort of the unemployed, in particular benefit sanctions for non-compliance. In this sense, Hartz I was a predecessor to Hartz IV by making it more costly for unemployed workers not to search for new jobs or to reject job offers.[4]

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[3]To gather public support for the reforms, the government took advantage of a scandal involving the Federal Employment Agency, which had grossly mis-reported the success of job placement.

[4]They also deregulated the labor market. In particular, restrictions on temporary work agencies and fixed-term contracts were weakened and dismissal regulations were simplified and additional exceptions were introduced.

In Jan 1st 2004, Hartz III was enacted with the goal to increase the efficiency of the job placement service for the unemployed. To this end, the Federal Employment Agency was re-structured and a heavy emphasis was placed on quality control. Moreover, the German government adopted a more market-based approach by allowing the Federal Employment Agency to outsource services to private firms and by offering unemployed workers the option to choose private employment agencies. Finally, Hartz III improved the process of matching particular measures of active labor market policy to the needs of unemployed individuals.

The best-known part of the reform package, Hartz IV, was implemented in Jan 1st, 2005. It constituted a radical overhaul of the German unemployment benefit system. Before the reform, the system was characterized by very long period of Unemployment Benefit entitlement and an essentially unlimited, means-tested Unemployment Assistance and/or Social Assistance after the eligibility for Unemployment Benefits had expired. The Hartz IV reform merged Unemployment Assistance and Social Assistance into Unemployment Benefit II and reduced the benefits payments for most households previously receiving Unemployment Assistance/Social Assistance (i.e. for most of the long-term unemployed).[5]

The Hartz IV reform reduced entitlement duration and benefit levels for most households, but the extent of the reduction varies substantially across household groups. One way to aggregate this heterogeneity is to follow the OECD and to report the median net replacement rate for short-term unemployed households, defined as unemployment less than one year, and long-term unemployed households, defined as unemployment more than one year. Figure 5 shows the average net replacement rate for single households based on the OECD data (see Krebs and Scheffel, 2013, for more details on the construction of this variable). Clearly, Hartz IV had almost no effect on the net replacement rate of the short-term unemployed, but a very large effect on the net replacement rate of the long-term unemployed.

FIGURE 5 HERE

[5] In addition, the eligibility period for short-term unemployment benefits (Unemployment Benefit I) was reduced in February 2006, but this change was not officially a part of the Hartz-laws and had only a small effect on the average net replacement rate (see figure 6).

2.3. Effect of Hartz Reforms on Job Search and Matching Efficiency

To be written

FIGURE 6 HERE

3. Model

This section develops the model and provides a convenient characterization of equilibrium.

3.1 Workers

Time is discrete and open ended. There is a unit mass of infinitely-lived workers. The employment status of a worker in period t is denotes by s_t and can take on three values, $s_t \in \{e, su, lu\}$, where e stands for employed, su for short-term unemployed, and lu for long-term unemployed. Unemployed workers search for jobs and the job finding rate depends on search effort l and possibly the aggregate state S_t. We denote the job finding rate of the short-term unemployed by $\pi(e|su, S, l)$ and the job finding rate of the long-term unemployed by $\pi(e|lu, S, l)$. At the beginning of any unemployment spell, the household is short-term unemployed, and then becomes long-term unemployed with probability $\pi(lu|su)$. Employed households become unemployed with probability $\pi(su|e, S)$ (job destruction rate), which is independent of effort but depends on the aggregate state S. We assume that the aggregate state follows a Markov process with transition probabilities denoted by $\pi(S'|S)$. We denote the transition probabilities of the joint Markov process over individual and aggregate states by $\pi(s', S'|s, S, l)$.

We consider two types of labor market policy/institution and corresponding labor market reforms. The first type of policy/institution is defined by the structure of the Public Employment Agency affecting job matching efficiency. This policy affects the job finding rates $\pi(e|su, S, l)$ and $\pi(e|lu, S, l)$ directly and its effect is summarized by an efficiency parameter z. We suppress the dependence of these transition probabilities on the parameter z until we return to the discussion of labor market reform in section 4.3. The second type of policy/institution analyzed in this paper is unemployment insurance. The level and duration of unemployment benefit payments do not affect job finding rates directly, but have an indirect impact through their effect on search effort l. We next turn to a discussion of the unemployment insurance system.

Employed workers receive labor income $(1-\tau_{ht})r_{ht}h_t$, where r_{ht} is the wage per unit of human capital (the rental rate of human capital) and τ_{ht} is a linear tax on labor income (social security tax). Unemployed workers receive unemployment benefits $b(s_t)h_t$ with $s_t = su, lu$. For tractability reasons, we also assumed that unemployment benefit payments depend on the current human level of human capital, but in our robustness section we consider an extension in which current benefit payments of unemployed workers depend on the labor income (human capital) in the last period before job loss. At the beginning of life, worker have no financial wealth but they can save at the risk free rate r_t and borrow at the rate $r_t + \Delta_r$, where Δ_r is an exogenous cost of financial intermediation. Thus, workers' budget constraint reads

$$
\begin{aligned}
a_{t+1} &= \begin{cases} (1+(1-\tau_{kt})r_t)a_t + (1-\tau_{ht})r_{ht}h_t - c_t & if\ a_{t+1} \geq 0\ and\ s_t = e \\ (1+(1-\tau_{kt})r_t)a_t + b(s_t)h_t - c_t & if\ a_{t+1} \geq 0\ and\ s_t = su, lu \\ (1+r_t+\theta)a_t + (1-\tau_{ht})r_{ht}h_t - c_t & if\ a_{t+1} < 0\ and\ s_t = e \\ (1+r_t+\theta)a_t + b(s_t)h_t - c_t & if\ a_{t+1} < 0\ and\ s_t = su, lu \end{cases} \\
h_{t+1} &= (1+\epsilon(s_t, S_t, s_{t+1}))h_t \qquad (1)
\end{aligned}
$$

Note that the exogenous process of human capital (skills) defined in (1) defines in conjunction with the wage rate the labor income process.

Workers are risk-averse and have identical preferences that allow for a time-additive expected utility representation. The one-period utility function depends on consumption, search effort, and the employment status:. We confine attention to utility functions that are logarithmic over consumption: $u(c, l, s) = \ln c - d(l, s)$, where d is an increasing and strictly convex function in l. Expected life-time utility associated with a consumption-effort plan,

$\{c_t, l_t\}$ for a worker with initial employment status s_0 is given by

$$U(\{c_t, l_t\}) \;=\; E\left[\sum_{t=0}^{\infty} \beta_w^t \left(\ln c_t - d(l_t, s_t)\right) | s_0\right] \tag{2}$$

where β_w is the pure discount factor of workers. Note that the expectations in (2) is taken with respect to joint distribution over idiosyncratic and aggregate shocks that depends through the transition probabilities π on the effort choice $\{l_t\}$. For notational ease we suppress this dependence.

Workers choose a plan $\{c_t, l_t, a_t\}$ so as to maximize (2) subject to (1).

3.2 Firms

There is one good that can be consumed or invested. Production takes place under the aggregate production function $Y_t = A_t F\left(K_t, L_t\right)$, where Y_t is aggregate output in period t, A_t is the total factor productivity parameter, K_t the aggregate physical capital stock employed in production and L_t the aggregate stock of effective labor employed in production (the human capital stock of employed households). We assume $A_t = A(S_t)$ and that F is a standard neoclassical production function. In particular, it exhibits constant returns to scale.

There is a representative firm that has access to the production function F. The representative firm can rent physical capital and labor in competitive markets at rental rates r_{kt} and r_{ht}, where r_{ht} is the wage rate per unit of effective labor (human capital). In each period, the representative firm hire physical capital and effective labor so as to maximize profit

$$A_t F(K_t, L_t) - r_{kt} K_t - r_{ht} L_t \ . \tag{3}$$

3.3 Capitalist

There are a large number of identical, infinitely-lifed capitalists who have no human capital and begin life with initial capital k_0. The capitalists have the opportunity to save or borrow at the risk-free rate r_t and their budget constraint reads:

$$
\begin{aligned}
k_{t+1} &= (1 + (1 - \tau_{kt}) r_t) k_t - c_c \\
k_{t+1} &\geq -D \ , \ \ k_0 \ given
\end{aligned}
\tag{4}
$$

Lifetime utility associated with the consumption plan $\{c_t\}$ is given by

$$
U(\{c_{ct}\}) = \sum_{t=0}^{\infty} \beta_c^t \ln(c_{ct}) \tag{5}
$$

where β_c is the pure discount factor of the capitalist.

A capitalist chooses a plan $\{c_{ct}, k_t\}$ so as to maximize (5) subject to (4).

3.4 Equilibrium Definition

We assume that the government runs a balanced budget in each period. Thus, the government budget constraint requires that the revenues from capital and labor taxation have to finance the unemployment benefit payments:

$$
\tau_{kt} r_{kt} K_t + \tau_{ht} r_{ht} E_t[h_t | s_t = e] = E_t[b(s_t) h_t] \tag{6}
$$

where the notation E_t indicates that the expectation is taken conditional on S^t.

In equilibrium, choices of firms and households have to be consistent, that is, the capital market and the labor market have to clear:

$$
\begin{aligned}
K_t &= k_t \\
L_t &= H_{et}
\end{aligned}
\tag{7}
$$

where $H_{et} = E[h_t | s_t = e]$ is the aggregate stock of human capital of employed workers. Similarly, we use the notation $H_{su,t} = E[h_t | s_t = su]$ and $H_{lu,t} = E[h_t | s_t = lu]$ for the aggregate stock of human capital of the short-term unemployed and long-term unemployed, respectively. Note that the aggregate resource constraint reads

$$
C_{ct} + C_{wt} + K_{t+1} + H_{t+1} = (1 - \delta_k) K_t + (1 - \delta_h) H_t + A_t F(K_t, L_t) \tag{8}
$$

where $C_{wt} = E[c_t]$ and $H_t = H_{et} + H_{su,t} + H_{lu,t}$. A standard argument shows that the government budget constraint (6), the worker's budget constraint (1), and the market clearing condition (7) imply the resource constraint (8) under the assumption of competitive rental markets and constant returns to scale in production. In other words, in our model Walras law states that capital market clearing and labor market clearing (equation 7) implies goods market clearing (equation 8).

A (sequential) competitive equilibrium is defined in the standard manner:

Definition For given government policy $\{b_t, \tau_t\}$, a competitive equilibrium is a sequence of rental rates, $\{r_{kt}, r_{ht}\}$, a workers' plan, $\{c_t, l_t\}$, a plan or the representative capitalist, $\{C_{ct}, K_{ct}\}$, and a sequence of firm choices, $\{K_t, L_t\}$, so that

i) for given rental rates (r_{kt}, r_{ht}) the production choice (K_t, L_t) maximizes profit (3) in each period t.

ii) for given sequence of rental rates $\{r_{kt}, r_{ht}\}$ the individual plan $\{c_t, l_t\}$ maximizes expected lifetime utility (1) subject to (1) and the plan $\{c_{ct}, k_t\}$ maximizes (5) subject to (4).

iii) market clearing condition (7), respectively (8), holds in each period t

iv) the government budget constraint (6) holds.

A recursive equilibrium is a competitive equilibrium with recursive structure. In this paper, we focus on recursive equilibria with endogenous aggregate state $(K, \vec{H})$, where $\vec{H}$ stands for the vector of human capital stocks with components $H_s = E[h|s]\pi(s)$ for $s = e, su, lu$. Note that the aggregate human capital stock is given by $H = E[h] = \sum_s H_s$. We next turn to the construction of recursive equilibria with aggregate state $(K, \vec{H}, S)$.

3.5 Equilibrium Characterization

From the firm's profit maximization problem it follows that rental rates are a function of the current productivity shock, $A = A(S)$, and the current capital-to-labor ratio: $r_k =$

$r_k(K/L,S)$ and $r_h = r_h(K/L,S)$. Using the market clearing conditions $K = k$ and $L = H_e$, the government budget constraint reads for all aggregate states $(K,\vec{H})$:

$$\left[\tau_k(K,\vec{H},S)r_k(K/H_e,S)K + \tau_h(K,\vec{H},S)r_h(K/H_e,S)\right]H_e \;=\; b(su)H_{su} + b(lu)H_{lu}(lu) \quad (9)$$

Equation (9) imposes a restriction on the class of admissible tax policies $\tau_k(.)$ and $\tau_h(.)$.

Let G be the equilibrium law of motion for the aggregate state variable: $(K',\vec{H}') = G(K,\vec{H},S)$. The recursive formulation of workers' maximization problem reads

$$\begin{aligned} V_w(a,h,s,K,\vec{H},S) \;&=\; \max\nolimits_{c,l,a'}\left\{\ln c - d(l,s) + \beta\sum_{s',S'} V_w(a',h',s',K',\vec{H}',S')\pi(s',S'|s,l,S)\right\} \\ s.t.\;\;& (a',c) \in \Gamma(a,h,s,K,\vec{H},S) \\ s.\,t.\;\;& h' \;=\; (1+\epsilon(s,S,s'))h \qquad\qquad (10)\\ & (K',\vec{H}') \;=\; G(K,\vec{H},S) \end{aligned}$$

where Γ is the correspondence defined by the individual budget set (1) and the effort choice l is only relevant if $s = su, lu$. For capitalists the Bellman equation reads

$$\begin{aligned} V_c(k,K,\vec{H},S) \;&=\; \max\nolimits_{k'}\left\{\ln c_c + \beta_c\sum_{S'} V_c(k',K',\vec{H}',S')\pi(S'|S)\right\} \\ s.t.\;\;& k' \;=\; \Big(1+(1-\tau_k(K,\vec{H},S))(r_k(K/H_e,S)-\delta_k)\Big)k - c_c \\ & (K',\vec{H}') \;=\; G(K,\vec{H},S) \end{aligned}$$

In the Appendix we show that under certain conditions there is an equilibrium in which workers choose asset holdings $a_t = 0$ and consumption $c_t = \phi(s_t,K_t,\vec{H}_t,S_t)h_t$ for all histories (for all states), that is, no trade in financial assets and consumption equals income (after-tax earnings or unemployment benefits). Further, the value function of workers is given by

$$V_w(0,h,s,K,\vec{H},S) \;=\; v_w(s,S,K,\vec{H}) + \frac{1}{1-\beta}ln\,h \quad (11)$$

where v_w together with the optimal effort choice are the solution to the intensive-form Bellman equation

$$v_w(s,K,\vec{H},S) \;=\; \max\nolimits_l\left\{\ln\phi(s,K,\vec{H},S) - d(l,s) + \frac{\beta}{1-\beta}\sum_{s'}\ln(1+\epsilon(s,S,s'))\pi(s'|s,S,l)\right.$$

$$
\begin{aligned}
&+\beta \sum_{s',S'} v_w(s', S', K', \vec{H}')\pi(s', S'|s, S, l)\Big\} \qquad (12)\\
&(K', \vec{H}') \;=\; G(K, \vec{H}, S)
\end{aligned}
$$

Further, a standard argument shows that the capitalist' utility maximization problem has the solution

$$
\begin{aligned}
k' &= \beta(1 + (1 - \tau_k(K, \vec{H}, S))(r_k(K/H_e, S) - \delta_k))k \qquad (13)\\
c_c &= (1 - \beta)(1 + (1 - \tau_k(K, \vec{H}, S))r_k(K/H_e, S))k
\end{aligned}
$$

and the value function is given by

$$
\begin{aligned}
V_c(k, K, \vec{H}, S) &= \bar{v} + \frac{1}{1-\beta}\ln k \qquad (14)\\
&+ \frac{1}{1-\beta}\ln\Big(1 + (1 - \tau_k(K, \vec{H}, S))(r_k(K/H_e, S) - \delta_k)\Big)\\
&+ \frac{\beta}{(1-\beta)^2}\sum_{S'}\Big(1 + (1 - \tilde{\tau}_k(K, \vec{H}, S'))(\tilde{r}_k(K/H_e, S') - \delta_k)\Big)
\end{aligned}
$$

where $\bar{v}_c =$ and $\tilde{\tau}_k(K, \vec{H}, S') = \tau_k(G_k(K, \vec{H}, S'), G_h(K, \vec{H}, S'))$.

Equations (11)-(14) define a recursive equilibrium in conjunction with the market clearing conditions $k = K$ and $L = H_e$. Note that the equilibrium law of motion G can be found using the first equation in (13) together with the equilibrium law of motion for the human capital distribution, which yields:

$$
\begin{aligned}
K' &= \beta(1 + (1 - \tau_k(K, \vec{H}, S))(r_k(K/H_e, S) - \delta_k))K \qquad (15)\\
H'_{s'} &= \sum_{s,S}(1 + \epsilon(s, S, s'))\pi(s'|s, S, l(s, K, \vec{H}, S))H_s
\end{aligned}
$$

Proposition 1. Suppose condition A* holds. Then the solution to (11)-(15) is a recursive equilibrium.

Proof: Appendix.

4. Cost of Business Cycles

We now turn to the analysis of the interaction between labor market reform and the cost of business cycles. In section 4.1 we discuss how to eliminate business cycles in our framework and in section 4.2 we derive a useful formula for the cost of business cycles. Section 4.3 considers the effect of labor market reform, in particular permanent changes in unemployment benefits and permanent changes in job matching (search) efficiency.

In our baseline model, we confine attention to tax policies that ensure that the after-tax wage rate is constant and equal to a pre-determine level: $(1-\tau_h(K,\vec{H},S))r_h(K/H_e,S) = w$. This requirement pins down the labor income tax function $\tau_h(.)$ and the government budget constraint (9) then determines the capital income tax function $\tau_k(.)$. In this case, $\phi(.)$ is independent of $(K,\vec{H})$ and the intensive-form Bellman equation (12) and its solution v_w do not depend on $(K,\vec{H})$ as well. In this section we confine attention to the baseline model for notational ease.

4.1 Eliminating Business Cycles

We follow Lucas (1987, 2003) and analyze the welfare consequences of macroeconomic stabilization policy without having an explicit model of the interaction between stabilization policy and the business cycle. As in Lucas (1987, 2003) we consider a thought experiment in which stabilization policy completely eliminates business cycles, that is, we consider moving from an economy with S-dependent labor market risk π and ϵ to an economy with labor market risk $\hat{\pi}$ and $\hat{\epsilon}$, that is, independent of business cycle conditions S. The question that arises is how to find $\hat{\pi}$ and $\hat{\epsilon}$ given π and ϵ.

For economies without idiosyncratic risk Lucas (1987, 2003) postulates that the elimination of business cycles amounts to replacing all S-dependent random variables by their expected value. In this paper, we follow Krebs (2003) and Krusell and Smith (2002) and extend this principle to economies with idiosyncratic risk by taking the expected value conditional on each possible individual state s:

$$\begin{aligned} \hat{\pi}(s'|s,l) &= \sum_S \pi(s'|s,S,l)\tilde{\pi}(S|s) \\ \hat{\epsilon}(s,s') &= \sum_S \epsilon(s,S,s')\tilde{\pi}(S|s) \end{aligned} \tag{16}$$

with $\tilde{\pi}(S|s) = \frac{\tilde{\pi}(s,S)}{\tilde{\pi}(s)}$. We use two different assumptions for the weighting distribution $\tilde{\pi}$ corresponding to two different assumption regarding the effect of macroeconomic stabilization policy. In the first approach we assume

$$\tilde{\pi}(s,S) = \pi(s,S) \tag{17}$$

In the second approach, we assume that stabilization policy has an asymmetric effect on the business cycle in the sense that it removes recessions without affecting negatively the economy in all other states.:

$$\tilde{\pi}(s,S) = \begin{cases} \frac{\pi(s,S)}{\sum_{S\neq L}\pi(s,S)} & if\ S \neq L \\ 0 & if\ S = L \end{cases} \tag{18}$$

where L stands for the aggregate state with the lowest output growth rate (recession states). This asymmetry can arise, for example, if the fiscal multiplier is larger in recessions than in booms ( ). Further, Hairault, Lagot, and Osotimehim (2010) and Jung and Kuester (2011) have shown that in the search and matching model of Mortensen and Pissarides (1994) a mean-preserving reduction in the volatility of aggregate productivity shocks reduces the mean unemployment rate. Clearly, for our baseline model with two aggregate states the two methods define a lower bound and upper bound on the welfare cost of business cycles.

4.2 Cost of Business Cycles

Let Δ_w stand for the welfare cost of business cycles for workers. We define this welfare cost as the ex-ante welfare difference for workers, expressed in lifetime consumption units, between living in an economy with business cycles (recessions) and an economy without business cycles (recessions). Here we use ex-ante in the sense of not knowing the initial values of (s_0, S_0), but conditional on $(h_0, K_0, \vec{H}_0)$. Thus, if we denote variables in the economy without business cycles by a hat, then this welfare cost Δ_w is the solution to the equation

$$E\left[\sum_{t=0}^{\infty}\beta_w^t\left(\ln\left((1+\Delta_w)c_t\right)-d(l_t,s_t)\right)|h_0,K_0,\vec{H}_0\right] = E\left[\sum_{t=0}^{\infty}\beta_w^t\left(\ln\left(\hat{c}_t\right)-d(\hat{l}_t,s_t)\right)|h_0,K_0,\vec{H}_0\right] \tag{19}$$

where c_t is worker consumption in the economy with business cycles and $\hat{c}_t$ is worker consumption in the economy without business cycles. Our equilibrium characterization result (proposition 1) allows us to compute equilibrium consumption for given fundamentals and our method of eliminating business cycles (15) specifies the fundamentals for the economy without business cycles.

Using the value function (11) the welfare cost of business cycles can be written as

$$\ln(1+\Delta_w) = \sum_s \hat{v}_w(s)\hat{\pi}(s) - \sum_{s,S} v_w(s,S)\pi(s,S) \tag{20}$$

where $\hat{v}_w$ is the intensive-form value function in the economy without business cycles. Further, π and $\hat{\pi}$ are the stationary distributions of the economy with business cycles, respectively without business cycles. Of course, the equilibrium value function as well as the equilibrium distributions depend on equilibrium effort choices l, respectively $\hat{l}$, through their dependence on the transition probabilities $\pi(s',S'|s,S,l)$, respectively $\hat{\pi}(s'|s,l)$. Using formula (12) for the intensive-form value function we find that the cost of business cycles can be written as:

$$\begin{aligned}\ln(1+\Delta_w) &= \sum_s \ln\phi(s)\hat{\pi}(s) - \sum_s \ln\phi(s)\pi(s) \\ &\quad - \left[\sum_s d(\hat{l}(s),s)\hat{\pi}(s) - \sum_{s,S} d(l(s,S),s)\pi(s,S)\right] \\ &\quad + \frac{\beta}{1-\beta}\left[\sum_{s,s'}\ln(1+\hat{\epsilon}(s,s'))\hat{\pi}(s'|s)\hat{\pi}(s) - \sum_{s,s',S}\ln(1+\epsilon(s,s',S))\pi(s'|s,S)\pi(s,S)\right]\end{aligned} \tag{21}$$

4.3 Labor Market Reform

Define the lifetime utility loss of short-term, respectively long-term, unemployment as $\hat{L}_{su} = \hat{v}_w(e) - \hat{v}_w(su)$ and $\hat{L}_{lu} = \hat{v}_w(e) - \hat{v}_w(lu)$ for the economy without business cycles and

$L_{su}(S) = v_w(e,S) - v_w(su,S)$ and $L_{lu,S} = v_w(e,S) - v_w(lu,S)$ for the economy with business cycles. Using this definition and expression (20) we can write the cost of business cycles as

$$\begin{aligned} \ln(1+\Delta_w) &= \sum_S L_{su}(S)\pi(su|S)\pi(S) - \hat{L}_{su}\hat{\pi}(su) \\ &\quad + \sum_S L_{lu}(S)\pi(lu|S)\pi(S) - \hat{L}_{lu}\hat{\pi}(lu) \\ &\quad + \hat{v}_w(e) - \sum_S v_w(e,S)\pi(S) \end{aligned} \tag{22}$$

The first term in (22) represents the reduction in the aggregate cost of short-term unemployment due to the elimination of business cycles and the second term represents the corresponding reduction in the aggregate cost of long-term unemployment. The aggregate cost of unemployment (short-term or long-term) is the product of the cost of unemployment for an individual workers times the number of unemployed workers. The third term in (22) captures the effect of the elimination of business cycles on the welfare of employed workers.

Consider now the case in which $\epsilon = \epsilon(s)$, which implies that $\hat{\epsilon}(s) = \epsilon(s)$. Assume further that the aggregate shock process is i.i.d, $\pi(S'|S) = \pi(S')$, and that the elimination of business cycles does not change the equilibrium effort choice: $\hat{l}(s) = l(s)$. In this case, equation (20) becomes

$$\ln(1+\Delta_w) = \sum_s \left[\ln\phi(s) + \frac{\beta}{1-\beta}\ln(1+\epsilon(s))\right][\hat{\pi}(s;z,b) - \pi(s;z,b)] \tag{23}$$

where we made explicit the dependence of the type-distributions π and $\hat{\pi}$ on labor market policies z (matching efficiency parameter) and b (unemployment benefits).

For this case, equation (23) also simplifies substantially since now the lifetime utility losses of unemployment, L_{su} and L_{lu}, are independent of business cycle conditions. To gain further intuition, let us assume that there are two aggregate states, $S \in \{L, H\}$ (low and high growth), and that the elimination of business cycles removes the low-growth state without affecting the high-growth state (method 2). For $s = su, lu$ let $\Delta\pi(s;z,b) = \pi(s|L;z,b) - \pi(s|H;z,b)$ stand for the increase in the unemployment rate of the short-term unemployed, respectively long-term unemployed, during a recession. In this case, expression (23) becomes:

$$\tilde{\Delta}_w(z,b) = \pi(L)\left[L_{su}\Delta\pi(su;z,b) + L_{lu}\Delta\pi(lu;z,b)\right] \tag{24}$$

where

$$L_s \;=\; \ln w - b(s) + \frac{\beta}{1-\beta}\left[\ln(1+\epsilon(e)) - \ln(1+\epsilon(s))\right] \quad for\ s = su, lu$$

Labor market reform affects the cost of business cycles through its effect on $\Delta\pi$ and L_s. In the case of a re-structuring of the Employment Agency leading to an increase in matching efficiency z, labor market reform only affects $\Delta\pi$. In the Appendix, we show that an increase in z increases the equilibrium job finding rate $\pi(e|s,l;z,)$ for $s = su, lu$, and that this reduces the increase in the unemployment rate during recessions, $\Delta\pi$. A glance at formula (24) shows that this reduces the cost of business cycles and hence the potential gains from stabilization policy. Thus, we have the following result:

Proposition 2. The welfare cost of business cycles is given by (21), respectively (22). Suppose that $\epsilon = \epsilon(s')$, the aggregate shocks process is i.i.d. with $S \in \{L, H\}$. Then the welfare cost of business cycles is given by (24) and an increase in matching efficiency z reduces the cost of business cycles:

$$\frac{\partial \Delta_w}{\partial z} \;<\; 0$$

5. Model Specification and Calibration

In this section, we specify a baseline model and calibrate the model economy in order to match a number of facts of the German labor market before the Hartz reforms. In particular, the model economy matches some of the key features of the German unemployment insurance system before the reform. In addition, we require the model economy to be consistent with the empirical evidence on labor market risk and the unemployment benefit elasticity of individual job finding rates (search intensity). We also require the model economy to match the cyclical properties of the German job destruction and job finding rate (the flow into and out off unemployment). Finally, we impose the restriction that the values of a number of macro variables (unemployment rate, flows in and out of unemployment) in the stationary equilibrium of the calibrated model economy should match the corresponding long-run values for the German economy before the reform.

Our calibration strategy requires us to find the long-run values of a number of macro variables before the reform. We use two methods to find these long-run values. The first method computes from the data the average value in the period 2000-2004. The second method is to apply the HP-filter to the data in the period until 2005, and then to take the value of the long-run trend in year 2002. Both methods yield almost identical results and we therefore report only the results using the first method. However, it is conceivable that alternative methods could produce very different target values. We therefore return to the issue of finding long-run values from the data in our robustness analysis in section 7, where we report how our main results change if we choose target values that differ substantially from the ones chosen here.

5.1 Model Specification

The basic model period is one quarter. We use a Cobb-Douglas production function, $Y = AK^{\alpha}L^{1-\alpha}$, where A is a constant parameter (no aggregate productivity shocks). We assume a two-state aggregate shock process $S \in \{L, H\}$, where L stands for low growth and H for high growth. We further assume $\epsilon = \epsilon(s)$ and denote skill depreciation of the short-term unemployed and long-term unemployed by $\epsilon(su) = \delta_{h,su}$ and $\epsilon(lu) = \delta_{h,lu}$, respectively. For the baseline calibration, we assume $\delta_{h,su} = \delta_{h,lu}$. We use the standard convention and define long-term unemployment as any unemployment spell that lasts longer than 12 months. Thus, we choose the probability $\pi(lu|su)$ of transiting from su to lu equal to 0.25.

5.2 Search

For the job search technology, we follow Hopenhayn and Nicolini (1997), Lentz (2009), and Shimer and Werning (2008) and assume an exponential specification:

$$\begin{aligned} \pi(e|su, l) &= 1 - e^{-\lambda(su)l} \\ \pi(e|lu, l) &= 1 - e^{-\lambda(lu)l} . \end{aligned} \tag{25}$$

We choose the values of $\lambda(su)$ and $\lambda(lu)$ so that the corresponding job finding probabilities match the observed average transition rates in the period 2000-2004 for the short-term unemployed and long-term unemployed, respectively. The values for the quarterly transition probabilities are $\pi(e|lu) = .06$ and $\pi(e|su) = .24$ according to the data provided by the Federal Employment Agency (Bundesagentur fuer Arbeit), which yields $\lambda(su) = 0.724$ and $\lambda(lu) = 0.229$.

We assume that dis-utility of search is

$$d(l, s) \;=\; d_0\, l^{\gamma} - d_1(s) \tag{26}$$

For the employed workers, we set the disutility of work, $d_1(e)$, equal to the value assumed in the standard real business cycle model with log utility (Prescott and Hansen, 1995). It is well-known that with the above specification the parameters $\lambda(su)$, $\lambda(lu)$ and d_0 are not separately identified. We therefore choose a numerically convenient normalization of $d_0 = 1$. We choose $d_1(su)$ and $d_1(lu)$ so that the value of the disultility term d in equilibrium is the same for employed workers, short-term unemployed workers, and long-term unemployed workers. We choose the curvature parameter γ to match a given value of the elasticity of the job finding rate with respect to benefits payments for the short-term unemployed. This target elasticity is chosen as follows.

For the US, there are a number of empirical micro studies estimating the search elasticity directly. The best known studies are Moffitt (1985) and Meyer (1990) who estimate elasticity of around -0.9. Krueger and Meyer (2002) survey the literature and suggest an elasticity of around -1. Landais, Michaillat, and Saez (2010) calibrate theor model economy using an elasticity of -0.9. There is much less work on this issue for Germany, but Hunt (1995) finds estimates for Germany that are similar to the US results. Consistent with this finding are the results reported in Hofmann (2012) and Mueller and Steiner (2008), who find that imposing benefit sanctions on long-term unemployed for non-compliance has significant effects on the unemployment-to-employment transition in Germany. Addison, Centeno and Portugal (2008) use a structural search model and the European Community Household Panel (ECHP) to estimate the elasticity for several European countries, and they find values ranging from -1.14 to -1.66 for Germany. Almost all empirical studies deal with unemployed workers who are short-term unemployed according to our definition (less than one year of unemployment). We therefore use the empirical results to match a given elasticity for the long-term unemployed. In our baseline calibration, we choose -0.6 as a target, which is a conservative value given the available empirical evidence.

Our calibration implies an elasticity of unemployment duration with respect to unemployment benefits for the long-term unemployed of -1.13, which is almost twice as large as the corresponding elasticity for the short-term unemployed. We are not aware of any study that estimates this elasticity separately for the short-term and long-term unemployed. However, work by Chetty (2008) shows that the effect of unemployment benefits on unemployment duration is much stronger for low-wealth individuals, an effect he calls the liquidity effect based on the assumption that low-wealth individuals are liquidity constrained. In the data and in our model the long-term unemployed are the low-wealth individuals. Indeed, in Germany unemployment insurance for the long-term unemployed (Unemployment Benefits II) is means-tested with very low levels of permissable asset holdings. In line with our results, the estimates reported in Chetty (2008) suggest that the elasticity of the long-term unemployed (low-wealth unemployed) is at least twice as large as the search elasticity of the short-term unemployed.

We choose the job separation rate, $\pi(e|su)$, so that the implied unemployment rate is equal the average unemployment rate in the period 2000-2004, namely 9 percent. This yields a job separation rate of $\pi(e|su) = 0.0148$, which is in line with Jung and Kuhn (2013). Finally, we choose $\pi(su|lu)$ to match a given fraction of long-term unemployed in the unemployment pool. According to the OECD statistics, the share of long-term unemployment was 50 percent for the period 2000-2004, a value we match if $\pi(su|lu) = 0.190$.

5.3 Skill Loss During Unemployment

There is substantial empirical evidence that job loss leads to subsequent lower wages and earnings, and that these wage losses increase with the duration of unemployment. For the US, Addisson and Portugal (1989) use data drawn from the Displaced Worker Survey and find that an increase in the unemployment duration by 10% reduces wages between 0.8% and 1.4%. Using the same data, Neal (1995) finds that an additional week of unemployment reduces the wages by 0.37%, implying a monthly rate of wage loss of 1.5%. Further, using a structural approach Keane and Wolpin (1997) estimate high rates of skill depreciation during unemployment. For Germany, Schmieder, Wachter, and Bender (2012) use a large administrative data set to implement a regression discontinuity (RD) design and find that each month out of work reduces reemployment wages by 0.9 percent, pointing to very high costs of long-term unemployment. In this paper, we interpret the duration dependence of wage losses as arising from skill depreciation during unemployment. Guided by the findings of the empirical literature, we set the skill depreciation parameter to a quarterly depreciation rate of 2.5%.

5.4 Wage Risk

Our assumption of i.i.d. human capital shocks imply that wages follows a logarithmic random walk with normally distributed innovation term: $\eta \sim N(0, \sigma^2)$. For the US, the random walk component of individual labor income has been estimated by a number of empirical studies using data drawn from the PSID, and estimates of σ for the US are in the range between 0.1 and .15 for annual wage changes. For Germany, Krebs and Yao (2013) and Fuchs-Schuendeln, Krueger, and Sommer (2009) find a value of around 0.10. We therefore choose a quarterly value of $\sigma^2 = 0.0025$.

5.5 Unemployment Benefits

We choose the unemployment benefit parameters $b(su) = w$ so that consumption of the short-term unemployed only changes because of the loss of human capital (perfect consumption smoothing of transitory income shocks). We choose the unemployment benefit parameter $b(lu)$ to match the difference in the net replacement rate of the short-term unemployed and long-term unemployed (the change that occurs when moving from short-term unemployment to long-term unemployment).[6] The OECD reports the net replacement rate for short-term and long-term unemployed, where long-term unemployment is defined as unemployment duration longer than one year. The Hartz IV reform clearly had different effects on different sub-groups of the short-term and long-term unemployed. However, neither the model nor the OECD data are detailed enough to capture all aspects of this heterogeneity. We therefore focus on net replacement rates of single households with median earnings before the job loss. The OECD reports the net replacement rate for two subgroups of this group of households, namely single households without children and single households with two children. We calibrate the parameter $b(lu)$ so that the model matches the weighted average net replacement rate for these two groups, where the weight for the first group is set equal to the population weight of all households without children and the weight of the second group is set equal to the population weight of all households with children. For the period 2000-2004, this yields a net replacement rate of 0.63 for the short-term unemployed and 0.57 for the long-term unemployed.[7]

5.6 Production

We normalize the wage rate per unit of human capital to one: $w = 1$. We assume a Cobb-Douglas production function, $F(K, H^e) = AK^\alpha (H^e)^{1-\alpha}$, and set the capital share of output to $\alpha = 0.36$. We choose the technology parameter A, the capital depreciation rate δ_k, and the discount factor of the capitalist β_c so that the model matches and interest rate of 3 percent and the output growth rate and saving rate in Germany before the reform, namely one percent economic growth and a saving rate of 20 percent.

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[6] In the model, the net replacement rate is not b, but $b/((1-\tau)r_h)$, and we choose b so that the implied value of $b/((1-\tau)r_h)$ matches the corresponding net replacement rate.

[7] The results are similar, at least in terms of the effect of Hartz IV on net replacement rates, if we take couples instead of singles as long as we weigh the group without children and the group with two children the same way. The OECD does not report net replacement rates for households with one child. Hartz IV had a larger effect on the net replacement rate of households with one child than it had on the net replacement rate of households with two children, and our weighing scheme therefore understates the effect of Hartz IV on net replacement rates.

5.7 Cyclical Variation

We estimate job separation rates and job finding rates from OECD data according to Elsby et al (2008) for the period 1992-2005 and detrend the time series using a HP filter. See figures 3 and 4 for the resulting flow rates into and out off unemployment expressed as percentage deviation from the HP-trend. We identify the times the job separation rate is above trend with the low-growth scenario $S = L$. We then count the relative number of periods the state $S = L$ has occured and find that this event happened 43 percent of the times. We also find that the average duration of the low growth scenario $S = L$ is about 8 periods. We set the two free parameters of the 2×2 transition matrix $\pi(S'|S)$ to match these two targets, which yields $p(H|H) = 0.1250$ and $p(L|L) = 0.8750$. We set the value of the job separation rates $\pi(su|e, L)$ and $\pi(su|e, H)$ to match the mean and volatility (standard deviation) of the cyclical component of the empirical job separation rate. Correspondingly, we set the two values of the job finding rate, averaged over short-term and long-term unemployed, to match the mean and volatility of the corresponding empirical time series.

6. Results

To be written

References

Acemoglu, D., and R. Shimer (2000) "Productivity Gains from Unemployment Insurance," *European Economic Review* 44: 1145-1224.

Alvarez, F., and U. Jermann (2004) "Using Asset Prices to Measure the Cost of Business Cycles," *Journal of Political Economy* 112: 1223-1256.

Addison, J., and Portugal, P (1989), "Job Displacement, Relative Wage Changes, and Duration of Unemployment," *Journal of Labor Economics* 7: 281-302.

Addison, J., Centeno, M., Portugal, P. (2008) "Unemployment Benefits and Reservation Wages: Key Elasticities from a Stripped-Down Job-Search Model," IZA Discussion Paper.

Atkeson, A., and C. Phelan (1994) "Reconsidering the Cost of Business Cycles with Incomplete Markets," *NBER Macroeconomcis Annual*

Barlevy, G. (2004) "The Cost of Business Cycles under Endogenous Growth," *American Economic Review* 94: 964-960.

Beaudry, P., and C. Pages (2001) "The Cost of Business Cycles and the Stabilization value of Unemployment Insurance," *European Economic Review* 45: 1545-72

Blanchard, O., and J. Wolfers (2000) "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence," *Economic Journal* 100: 1-33.

Bundesagentur fuer Arbeit (2005) "Der Uebergang von der Arbeitslosen- und Sozialhilfe zur Grundsicherung fr Arbeitssuchende," Sonderbericht.

Bundesagentur fuer Arbeit (2011) "Der Arbeitsmarkt in Deutschland: Sockel- und Langzeitarbeitslosigkeit," Arbeitsmarktberichterstattung.

Burda, M. and J. Hunt (2011) "What Explains the German Labor Market Miracle in the Great Recession?" NBER Working Paper.

Chetty, R. (2008) "Moral Hazard vs Liquidity and Optimal Unemployment Insurance," *Journal of Political Economy* 116: 173-234.

Elsby, M., Hobijn, B., and A Sahin (2008) "Unemployment Dynamics in the OECD" *NBER Working Paper*

Fahr, R., and U. Sunde (2009) "Did the Hartz Reforms Speed Up the Matching Process? A Macro-Evaluation Using Empirical Matching Functions," *German Economic Review* 10, 284-316.

Fuchs-Schuendeln, N., Krueger, D., and M. Sommer (2009) "Inequality Trends for Germany in the Last Two Decades: A Tale of Two Countries," *Review of Economic Dynamics* 13: 103-132.

Hairault, J., Lagot, F., and S. Osotimehim (2010) "Matching Frictions, Unemployment Dynamics, and the Cost of Business Cycles," *Review of Economic Dynamics* 13; 759-779.

Hansen, G., and A. Imrohoroglu (1992) "The Role of Unemployment Insurance in an Economy with Liquidity Constraints and Moral Hazard," *Journal of Political Economy* 100: 118-142.

Hofmann, B. (2012) "Short- and Long-Term ex Post Effects of Unemployment Insurance Sanctions," *Journal of Economics and Statistics* 232: 31-60.

Hopenhayn, H., and J. Nicolini (1997) "Optimal Unemployment Insurance," *Journal of Political Economy* 105: 412-438.

Hertweck, M., and O. Sigrist (2012) "The Aggregate Effects of the Hartz Reforms in Germany," Working Paper

Hunt, J. (1995) "The Effect of Unemployment Compensation on Unemployment Duration in Germany," *Journal of Labor Economics* 13: 88-120.

Jacobi, L., and J. Kluve (2006) "Before and After the Hartz Reforms: The Performance of Active Labor Market Policy in Germany," IZA Discussion Paper.

Jung, P., and K. Kuester (2011) "The (Un)Importance of Unemployment Fluctuations for Welfare," *Journal of Economic Dynamics and Control* 35: 1744-1768.

Jung, P., and M. Kuhn (2013) "Labor Market Institutions and Worker Flows: Comparing Germany and the US?", *Economic Journal* forthcoming

Keane, M., and K. Wolpin "The Career Decision of Young Men," *Journal of Political Economy* 105: 473-522.

Krause, M., and H. Uhlig (2012) "Transitions in the German Labor Market: Structure and Crisis," *Journal of Monetary Economics* 59: 64-79.

Krebs, T. (2003) "Growth and Welfare Effects of Business Cycles with Economies with Idiosyncratic Human Capital Risk," *Review of Economic Dynamics* 6: 846-68.

Krebs, T. (2007) "Job Displacement Risk and the Cost of Business Cycles," *American Economic Review* 97: 664-686.

Krebs, T., and M. Scheffel (2013) "Macroeconomic Evaluation of Labor Market Reform in Germany," *IMF Economic Review* forthcoming.

Krusell, P., and A. Smith (1999) "On the Welfare Effects of Eliminating Business Cycles," *Review of Economic Dynamics* 2: 245-272.

Krusell, P., Mukoyama, T., Sahin, A., and A. Smith (2009) "Revisiting the Welfare Effects of Eliminating Business Cycles," *Review of Economic Dynamics*

Landais, C., Michaillat, P., and E. Saez (2010) "Optimal Unemployment Insurance over the Business Cycle," NBER Working Paper

Launov, A., and K. Waelde (2013) "Estimating Incentive and Welfare Effects of Non-Stationary Unemployment Benefits," *International Economic Review* forthcoming.

Lucas, R. (1987) *Models of Business Cycles*. London: Blackwell Publishing.

Lucas, R. (2003) "Macroeconomic Priorities," *American Economic Review* 93: 1-14.

Ljungqvist, L., and T. Sargent (1998) "The European Unemployment Dilemma," *Journal of Political Economy* 514-550.

Ljungqvist, L., and T. Sargent (2008) "Two Questions about European Unemployment, *Econometrica* 76:1-29.

Meyer, B. (1990) "Unemployment Insurance and Unemployment Spells," *Econometrica* 58: 757-782.

Meyer, B., and A. Kreuger (2002) "Labor Supply Effects of Social Insurance," *Handbook of Public Economcis*

Mortensen, D., and C. Pissarides (1994) "Job Creation and Job Destruction in the Theory of Unemployment," *Review of Economic Studies* 61: 397-415.

Mueller, K., and V. Steiner (2008) "Imposed Benefit Sanctions and the Unemployment-to-Employment Transition: The German Experience," *DIW Discussion Paper 792*.

Neal, D. (1995) "Industry-Specific Human Capital: Evidence from Displaced Workers," *Journal of Labor Economics*

Pavoni, N. (2009) "Optimal Unemployment Insurance with Human Capital Depreciation and Duration Dependence," *International Economic Review* 50: 323-362.

Pissarides, C. (1992) "Loss of Skill During Unemployment," *Quarterly Journal of Economics* 107: 1371-1391.

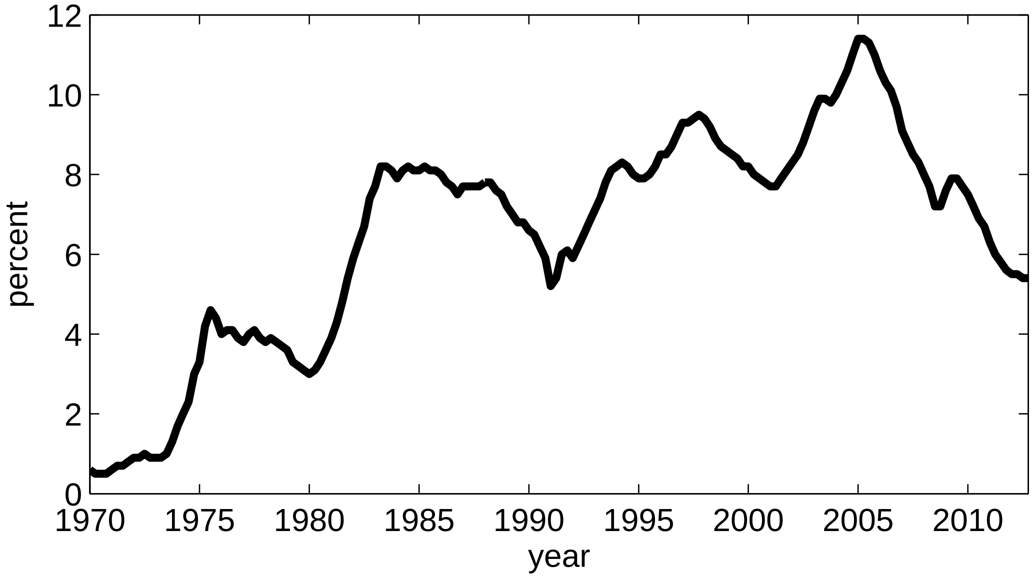
Storesletten, K., Telmer, C., and A. Yaron (2001) "The Welfare Cost of Business Cycles Revisited: Finite Lifes and Cyclical Variations in Idiosyncratic Risk," *European Economic Review* 45: 1311-39.

Shimer, R., and I. Werning (2008) "Liquidity and Insurance for Unemployed Workers," *American Economic Review* 98: 1922-1942.

Yellen, J. (2013) "Monetary Policy: Many Targets, Many Instruments. Where Do We Stand?" Speech given at the IMF Confererence "Rethinking Macro Policy II" on April 16, 2013.

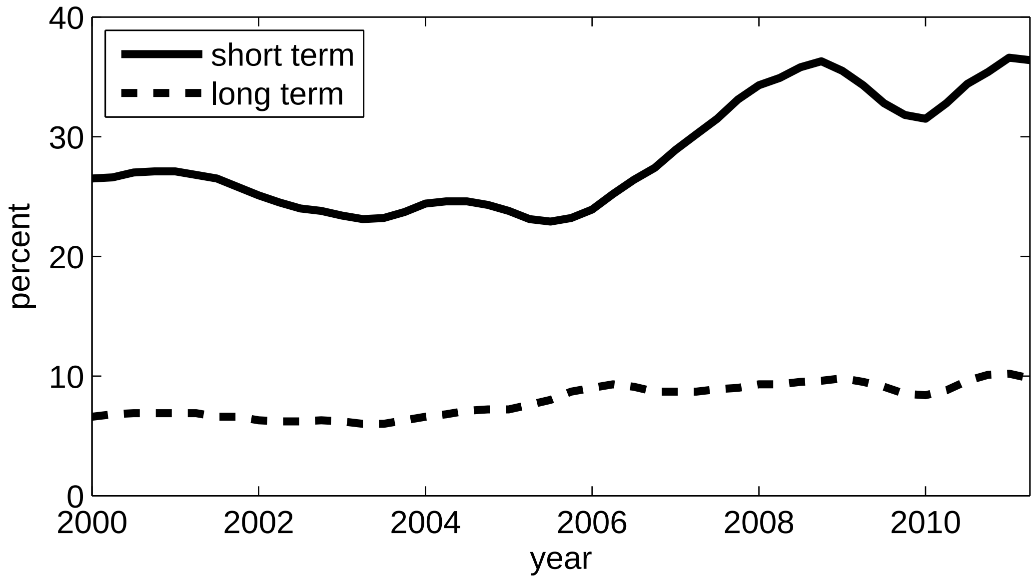
Yellen, J., and G. Akerlof (2006) "Stabilization Policy: A Reconsideration," *Economic Inquiry* 44: 1-22.

Figure 1: Quarterly Unemployment Rate, Germany 1970Q1-2012Q4



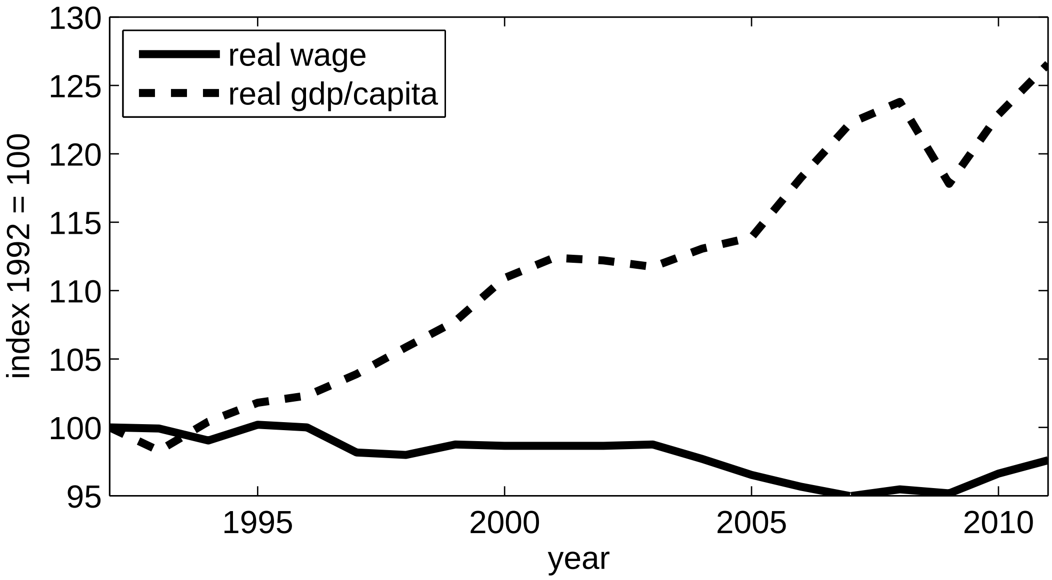
Source: OECD: 1970-1990, quarterly unemployment rate for West Germany; 1991-2012, quarterly harmonized unemployment rate for Germany.

Figure 3: Quarterly Job Finding Rates by Unemployment Duration, Germany 2000Q1-2011Q2



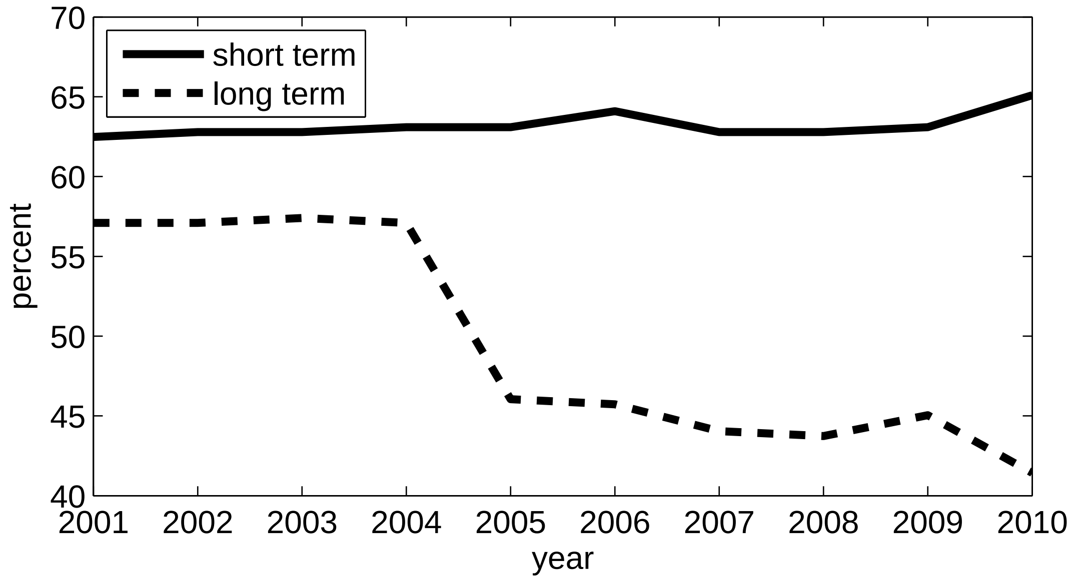
Source: Bundesagentur für Arbeit (2011).

Figure 4: Real Wage and Real GDP per Capita (1992 = 100), Germany 1992-2011



Source: Statistisches Bundesamt: annual real wage index (series: Reallohnindex) and annual real gdp per capita (series: Bruttoinlandsprodukt) normalized to 1992.

Figure 5: Average Net Replacement Rate, Germany 2001-2010



Source: OECD: (1) net replacement rates: OECD Tax-Benefit Modes, (2) population weights: OECD Family Database.