The Effect of Benefits on Unemployment when the Wage Bargaining Regime is Endogenous

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1. Introduction ............................................................................................................................................. 1
   1.1 Literature Review ......................................................................................................................... 2
   1.2 Reforming the German Labor Market .......................................................................................... 4
   1.3 The Policy Experiment ............................................................................................................... 6

2. The Basic Model ................................................................................................................................... 8
   2.1 Friction in the Labor Market ........................................................................................................ 9
   2.2 The Government’s Budget Constraint and Policy Instruments ................................................ 10
   2.3 The Value of Employment and Unemployment ....................................................................... 10
   2.4 The Goods Market and Monopolistic Competition .................................................................. 12
   2.5 The Firm’s Problem .................................................................................................................... 12
   2.6 The Bargaining Process and Firm-Level Equilibrium ............................................................... 15
      2.6.1 Individual Bargaining ..................................................................................................... 15
      2.6.2 Collective Bargaining .................................................................................................... 18
   2.7 Reservation Value of Unemployment ......................................................................................... 21

3. General Equilibrium .......................................................................................................................... 23
   3.1 The Free Entry Condition .......................................................................................................... 24
   3.2 The Unemployment Rate ........................................................................................................... 25
   3.3 Search and Efficiency ................................................................................................................. 26

4. Stable Bargaining Institution ............................................................................................................. 27
   4.1 The Choice of Bargaining Institution ....................................................................................... 28
   4.2 Nash Equilibrium with one Type of Bargaining Firm ............................................................. 29
   4.3 Nash Equilibrium with a Mix of Bargaining Types ................................................................. 31

5. Simultating the Effects of Unemployment Benefits .......................................................................... 32
   5.1 Calibration ................................................................................................................................. 33
   5.2 Quantitative Results .................................................................................................................... 35
      5.2.1 The Equilibrium Response ............................................................................................ 36
      5.2.2 The Importance of Product Market Competition ............................................................ 40
      5.2.3 The Free Entry Condition .............................................................................................. 41
      5.2.4 The Equilibrium Response of the Open Market .............................................................. 43
      5.2.5 Collective Bargaining Stability ....................................................................................... 45
   5.3 Robustness Checks ..................................................................................................................... 47

6. Conclusion ........................................................................................................................................... 48

References ................................................................................................................................................. 51

Appendix A: Tables ................................................................................................................................. 53

Appendix B: Figures ................................................................................................................................. 54
1. Introduction

Literature on unemployment insurance in a search and matching framework has mainly concentrated on the direct effects on agents’ adjustment and on unemployment. How this effect differs across bargaining institution, and potentially changes the bargaining institutions themselves has attracted less attention. In this paper, I examine these questions by analyzing the theoretical linkage between unemployment benefits and the setting of the bargaining process between firm and workers. Concentrating on the choice of two alternative bargaining institutions, individual and collective bargaining, I take advantage of a search and matching framework with endogenous union formation presented in the paper: “Product Market Regulation and Endogenous Union Formation” by Ebell and Haefke (2006). In this paper, Ebell and Haefke examine the link between product market regulation and union formation. They show that the effect of product market competition on unemployment depends crucially on the choice of bargaining regime. Here, I contribute to the theory of union formation by considering the importance of the benefit entitlements to the worker in the bargaining process. Building on the result of Ebell and Haefke (2006), I further explore the importance of the degree of product market competition when considering the effect of unemployment benefits on labour market outcomes.

As Germany is a country characterized by a high coverage of collective agreements (Calmfors, 2004), I calibrate the collective bargaining version of the model to match German long-run labour market data. Using the same baseline values obtained from the calibration, I compare the labour market equilibrium response of each bargaining regime by simulating both bargaining versions of the model. Taking amongst many factors also account of the long-run adjustment in competition and the government’s budget constraint, the model simulation provides more than a partial analysis of the labor market, illustrating the steady state equilibrium response in all key variables of the model. Further, focusing on the implication of a cut in benefit entitlements, I relate the results of the model to the recent labour market reforms in Germany that was taken as a measure to activate the unemployed (Wurzel, 2006).
1.1 Literature Review

The debate on unemployment insurance and labor market efficiency is mainly concentrated about the disincentive effect versus the quality of a job match.

The inefficiency occurs as high unemployment insurance changes the unemployed worker’s incentive by making them more selective to job offerings. Sargent and Ljungqvist (1998) blame the welfare state’s ability to cope with turbulent times as the cause of high and persistent unemployment rates: Highly skilled workers reject job transitions which involve accumulation of new skill due to too generous unemployment compensation. Especially after large negative shocks to the economy, the welfare state lacks the flexibility in the labor market to reconstruct the economy. Likewise, Pissarides (2000) discuss the implication of a higher non-market return to the individual in a standard search and matching framework: The workers claim a higher wage level as the cost of being unemployed decreases. Hence unemployment benefits prevent wages from fully absorbing productivity changes.

Contrary, Marimon and Zilibotti (1999) claim that the unemployment benefits works as a “search subsidy” (Burdett, 1979) improving the quality of a potential job match. It follows that the growth of productivity per worker is higher in an economy with unemployment insurance than without; as workers then get jobs that are more compatible with their skill-level. In accordance, Tatsiramos (2006) finds by examining data from eight European countries empirical evidence that suggests the matching effect of unemployment insurance: Countries with relative generous unemployment insurance shows higher employment stability due to the rise in average employment duration.

Taken together, the literature on unemployment insurance characterizes a trade-off between unemployment and the miss-match of workers’ skill and job. Both occur as a result of labor market frictions and uncertainty. Further in the analysis I will concentrate on the disincentive effect of unemployment benefits in a search and matching framework, and examine how labor market outcomes depend on the bargaining process between firm and workers.

In the matching-bargaining models of Pissarides and Mortensen firms’ vacancies and unemployed workers match according to a specified matching-function, reflecting the frictions in the labor market. After the job match is made, terms of trade are determined by a bargaining process that leads to a given sharing rule of the surplus (Hosios, 1990). The
existence of the bargaining process depends crucially on two main assumptions: First, there has to occur a surplus from the job match. And second, ex-ante wage commitment need to be ruled out, such that firm and workers can only agree on a surplus-sharing rule after the job match is made.

Moen (1997) presents a competitive equilibrium model with frictions in the labor market. By first stating that a job match is associated with a surplus due to the cost of search for both firms and workers, he introduces a setting for ex-ante wage determination: In contrast to the wage bargaining setting between firm and agents, firms announce a wage offer when stating the vacancy. And by offering higher wages, firms can potentially attract more applications. In this scenario firms are not likely to re-bargain their offer after the job match is made, as they are bounded by the given wage offer due to reputation effects and labor unions. But workers, given a high enough relative bargaining power, can gain from re-bargaining. Thus Moen (1997) suggests that wage determination depends on the relative bargaining power of the worker, where ex-post bargaining is likely to occur in labor markets where the workers’ relative bargaining power is relatively high. I assume further and in the calibration of the model that the relative bargaining power of workers in Germany is relatively high, thus making ex-post wage bargaining a realistic feature of the model.

Ebell and Haefke (2006) show that bargaining regime is crucial for the effect of product market competition on unemployment rates. By endogenizing the choice of bargaining institution in a standard search and matching framework they examine the stability of two alternative wage bargaining settings: Collective and individual bargaining. They illustrate that under collective bargaining the worker’s surplus is given by a profit share, in contrast to individual bargaining where the worker’s surplus reflects the marginal value of the worker to the firm, which is equalized to the marginal worker’s hiring costs in equilibrium. This has two main implications for the labor market: First, the employment level is relatively higher under individual bargaining, as firms can depress the wage level by overhiring due to the decreasing value of the worker to the firm in employment level. And second, the collective bargaining surplus to the worker is decreasing with product market

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1 Competitive equilibrium implies that all agents are characterized by price-taking behavior.

2 Moen (1997) claims that the worker can only improve his wage through re-bargaining given a relative bargaining power that exceeds the elasticity of the matching function with respect to unemployment.
competition, whereas the worker’s surplus under individual bargaining increases. In conclusion Ebell and Haefke (2006) determine a negative relation between the collective bargaining coverage rate and product market competition from the model. By calibrating the individual bargaining version of the model to US data, they simulate the model to both US- and EU- entry costs. Under EU-entry costs the collective bargaining institution is supported as a symmetric Nash equilibrium in the model. Thus Ebell and Haefke (2006) conclude that the relatively high degree of product market regulation may explain the relatively high unemployment rates in European labor markets.

To illustrate the importance of wage bargaining settings when considering the labor market response of a change in unemployment benefits, I will take advantage of the ex-post wage bargaining model used by Ebell and Haefke (2006). They specify a dynamic general equilibrium model which combines monopolistic competition in the goods market with unemployment arising from Mortensen-Pissarides-style matching frictions. What separates this model from the standard Mortensen-Pissarides search friction model is that the workers have the opportunity to collectively decide on the type of bargaining process in each firm, making union formation an endogenous factor of the model. To simplify, I separate as Ebell and Haefke (2006) between two alternative wage bargaining settings: Collective and individual bargaining. Under collective bargaining the coalition of workers negotiate with the firm together, in a process where they negotiate both over the wage and the number of workers. Whereas, under individual bargaining each worker is treated as a marginal worker and wages are negotiated between each worker and the firm individually.

1.2 Reforming the German Labor Market

The German government introduced in 2003 and 2005 several labor market reforms through the bill called Gesetz zu Reformen am Arbeitsmarkt (Bill for reforming the labor market) (Neugart, 2005). In previous years the labor market had performed poorly and inflexible: Data reveals a rising level of unemployment rates through the 1990’s, with unemployment rising when negative shocks hit the economy but falling only partially when

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3 I assume further and in the model description that all workers are characterized by the same identical preferences. Thus the choice of bargaining regime can be represented by the preference of one individual agent as the preferences of the remaining workers in the firm coincide.
the shocks subsided. Accompanying the rising trend in unemployment rates was an increasing share of long-run unemployment (Wurzel, 2006).

With the German economy showing symptoms of a too generous unemployment compensation, the government introduced in 2005 a replacement scheme with a considerable reduction in benefit’s entitlements to the unemployed.\(^4\) Taking advantage of the OECD international measurement on replacement rate (Martin, 1996), Figure 1 illustrates the negative shift in benefits entitlements. Showing both the gross- and net replacement rate of Germany, the year 2005 illustrates the considerable shift in benefit entitlements for unemployed workers compared to the income level of the working part of the economy.\(^5\)

As discussed in the literature a cut in unemployment insurance increases the cost of being unemployed, thus reducing the worker’s wage demand in the wage bargaining process. According to theory, the policy measure would result in less selective workers making the German labor market more flexible. Yet due to the different structure of the wage negotiation process, a reduction in wage demand does not imply the same labor market outcome for an individual and collective bargaining economy.

In chapter 2 I present the model of Ebell and Haefke (2006). The choice of bargaining institution appears as a crucial factor when considering the properties of the workers’ surplus: As the individually bargaining firm considers each worker on the margin, the worker surplus reflects the marginal value of the worker to the firm. In contrast, under collective bargaining firm and workers are assumed to negotiate both over wages and employment level. Due to the workers’ joint power in the negotiation process, the workers’ surplus reflects a share from total profits from production.

\(^4\) The welfare reform was bundled into four packages: The Hartz I to Hartz IV. They consisted of several adjustments in the labor market as the establishment of job centers and increased access to training centers for unemployed (Calmfors, 2004). One of the main contributions and most discussed aspect is the Hartz IV which merged the benefits for long-term unemployed and social assistance into Unemployment Benefit II, leaving both at a relative lower level than before (Neugart, 2005). The Hartz IV reform also reduced the duration before an unemployed worker exhaust the relatively higher unemployment insurance: Prior to the Hartz IV an unemployed worker would receive unemployment insurance from 12-32 months depending on private work history and age. After 2005, the worker’s period for receiving unemployment insurance was restricted to a maximum of 12 month or 18 month if the worker had passed the age of 55 (OECD, 2007).

\(^5\) The replacement rate is defined as the proportion of expected income from work which is replaced by unemployment and related welfare benefits, gross- and net replacement rate refer respectively to the compared income level before and after tax reduction (Martin, 1996).
Further, the worker surplus proves to be a decisive factor in the model when considering the optimal adjustment of the firm and the distribution of increased labor costs: First, as discussed by Ebell and Haefke (2006), the individual bargaining firm settles for a higher allocation of labor than the efficient outcome. The intuition follows from the worker surplus: As the workers’ value decrease in employment, individual bargaining firms choose to overhire to depress wages and thereby secure a larger share of the total surplus from production. In contrast, under collective bargaining both firm and workers have the same coinciding incentive to maximize profits. Thus the collective bargaining process results in an efficient adjustment of employment in firm-level equilibrium.

Second, the setting of the wage bargaining process is essential when considering how firms and workers share the cost of increased unemployment benefits. Under both bargaining regimes workers are at least guaranteed the income they enjoy as unemployed to secure a non-negative surplus from employment. Collective bargaining divides profits between workers and the firm according to relative bargaining powers. Thus the firm and the coalition of workers share the cost of increased wage demand as unemployment benefits increase. Under individual bargaining the worker’s surplus reflects the marginal value of the worker to the firm. Hence, the worker surplus is not directly affected by the increase in unemployment compensation.

1.3 The Policy Experiment

The main contribution of the analysis is a simulation of the ex-post wage bargaining model of Ebell and Haefke (2006). In Chapter 5 I carry out a policy experiment by simulating the steady state general equilibrium of the model for several degrees of unemployment compensation. The possible values of unemployment benefits are chosen exogenously, reflecting the government’s policy instrument in the model.

As Germany is a country where the majority of workers are covered by union wage contracts (Burda, et. al., 2008), I calibrate the collective bargaining version of the model to German long run data.\(^6\) I use the obtained parameter values from the calibration and solve

\(^6\) Burda, et. al (2008) reports from the German Structure of Earnings Survey 2001, a large linked employer-employee data file with detailed information on whether or not a worker is covered by a collective agreement, that in a sample of male
for both the collective and individual bargaining economy for all possible degrees of unemployment compensation. Further, I use the quantitative results from the model simulation to analyze and compare the equilibrium response of each bargaining regime from a lasting change in the level of unemployment benefits.\(^7\)

The simulation provides important insight into the dominating factors in each bargaining version of the model. In both bargaining economies a rise in unemployment compensation is met by higher labor costs and unemployment accompanied by a decrease in both after tax wage level and worker surplus. Even though both bargaining economies show the same qualitative adjustment from the policy experiment, the simulation suggests that the size of the response depends crucially on bargaining regime: The model illustrates a much stronger response in collective bargaining unemployment and after tax wages compared to the individual bargaining economy. The response of the worker surplus is, however, stronger under individual bargaining. This follows from the dominating adjustment of individual bargaining firms. As the individual bargaining firm can raise its own profit by depressing the wage level, the cost of increased wage demand is distributed through the overhiring effect from the firm to the workers in the model. This is the same factor that leads to the weaker increase in steady state unemployment as labor costs increase. On the other side the efficient adjustment of the collective bargaining firm and the even distribution of increased labor costs lead to the strong response in collective bargaining unemployment as wage demand increase.

As Ebell and Haefke (2006) pointed out that the degree of product market competition is a crucial factor when considering the worker’s surplus in the model, I simulate the equilibrium response from the policy experiment for several degrees of competition. When competition decreases firms leave the market and the remaining firms are left with more monopoly power in the product market and thus higher profit from production. Under

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\(^7\)As the level of benefit entitlements is one of the government’s policy instruments, it is not given that the cut in benefit entitlements is a lasting one. But as this analysis restricted to steady state, only a lasting change in unemployment benefits is relevant.
collective bargaining the worker surplus reflects the potential profits from production. Thus workers demand a surplus reflecting the monopoly power of the individual firm. That wage demand increases both when unemployment benefits rise and when the firms’ monopoly power increase has two main implications for the model: First, the model simulation suggests that the high level of unemployment in collective bargaining economies results from a combination of high monopoly power to the firm and unemployment benefits. And second, the model illustrates stronger sensitivity in collective bargaining wages from a change in unemployment compensation for low levels of competition.

The final contribution of the thesis follows the procedure of Ebell and Haefke (2006), and examine if a lasting change in unemployment benefits actually affects the setting of the bargaining process itself. Letting the choice of bargaining process for each firm be an endogenous factor of the model, I check numerically for both bargaining economies the necessary conditions for a symmetric Nash equilibrium. The result from the model is clear: Workers choose to form collective bargaining coalitions for all levels of unemployment benefits as they prefer the higher collective bargaining surplus.

The paper is organized as follows: Section 2 presents the basic model and outlines the implications on key factors in the economy with respect to a lasting change in the level of unemployment benefits. Section 3 follows with the determination of general equilibrium and introduce the free entry condition, thus making the degree of product market competition an endogenous variable in the long run version of the model. Further I discuss why the model of Ebell and Haefke (2006) does not necessarily lead to an efficient allocation of search intensity. Section 4 gives a short analysis of bargaining institution stability and how it relates to employment, worker’s surplus and wages. Section 5 explains the calibration of the model to German long run data and summarizes the main results of the policy experiment. Finally, section 6 concludes and summarizes important findings from the model and how they relate to the German labor market.

2. The Basic Model

In this chapter I present the basic framework of the model used by Ebell and Haefke (2006). I separate between steady state firm-level equilibrium of the two bargaining regimes,
where the alternative wage bargaining settings, collective bargaining and individual bargaining, are indexed by $k \in \{C, I\}$.

In the next chapter follows the description of general equilibrium where I impose steady state and introduce the long run free-entry condition: In the long-run the degree of product market competition is no longer given, but endogenously determined such that profit net of entry costs is driven down to zero. In chapter 4, I evaluate the necessary conditions for Nash equilibriums with respect to the choice of bargaining regime. Thus connecting the outcome of bargaining institution $k$ in the single firm with the rest of the economy.

### 2.1 Friction in the Labor Market

The labor market is assumed to be uncoordinated, time consuming and costly for both firms and workers, yet it is characterized by a well-behaved search and matching framework where the number of jobs formed depends on ratio of vacancies to unemployment (Pissarides, 2000). Each agent $n$ in the model can either be employed or unemployed. The aggregate unemployed individuals $U$ and the aggregate vacancies $V$ are matched according to a constant return to scale matching function: $m(U, V) = sU^nV^{1-n}$, where $n$ is the elasticity of the matching function and $s$ is a scaling parameter. Hence, vacant jobs become filled at the rate $q(\theta) = \frac{m(U, V)}{V} = s\theta^{-n}$ and unemployed workers find work at the rate $f(\theta) = \frac{m(U, V)}{U} = s\theta^{1-n}$, where $\theta = \frac{V}{U}$ the ratio of vacancies to searching workers, is defined as the labour market tightness. As the labour market tightness will vary with respect to bargaining regimes, I separate the possible outcomes of $\theta$ with the subscript $\mu$ as a measure of the collective coverage rate in the economy. If all firms in the economy engage in collective bargaining, then $\mu = 1$, and if all firms engage individual bargaining, then $\mu = 0$.

A match can be separated for two possible reasons: Either the firm exits the market with probability $\delta$ or the match is destroyed with probability $\chi$. This leads to the expression for total separation rate as $\chi = \bar{\chi} + \delta - \bar{\chi}\delta$. As firms will continue to enter the economy until profit net of entry costs equals zero, the property that the firms can not expect to live forever is crucial when considering the costs of entry to the firm. In the case that the firm never ceased to exist, the importance of the cost of entry would be greatly understated as it could be distributed over the total life span of the firm. (Ebell and Haefke, 2006)
2.2 The Government’s Budget Constraint and Policy Instruments

The employed worker receives an income each period given by the wage $w_k$, while the unemployed worker receives some compensation $h$, which is the policy determined variable in the model. Following Ebell and Haefke’s model I introduce two types of income taxes to finance the unemployment benefit: The single worker has to pay an income tax $t_i$ each period and all firms have to pay a payroll tax for each hired worker given by $t_p$. As the government has no access to capital markets, the government’s tax income has to finance the equilibrium expenditure of unemployment benefit each single period. Thus the government’s budget constraint is given by:

$$ (t_i + t_p)w(1 - u) = bu $$

(1)

To simplify, the unemployment benefits are financed by equal magnitude of the two taxes rates, thus it follows that $t_i = t_p$ throughout the model. This leaves two potential policy instruments for the government given by the tax rates and unemployment benefits. But given the finance constraint, the instruments are not independent and the government can only decide on one of the policy instruments (Pissarides, 2000). As the target of the analysis is the implication of changes in unemployment benefits, $h$ will be the exogenously determined policy variable, and the necessary changes in tax rates are taken into account by equation (1) throughout the model.

2.3 The Value of Employment and Unemployment

All individuals are assumed to be identical, risk neutral and there exists no disutility from the effort they invest in job search and work (Williamson, 1999).\(^8\) Hence, if $V^F_k$ and $V^U$ are the values of employment and unemployment to the agent respectively, then the agent’s maximization problem in steady state can be summarized by the Bellman equations:

Value of employment:
Value of unemployment:

\[ V_k^U(\theta_\mu) = b + \frac{1}{1 + r} \{ f(\theta_\mu)[(1 - \mu)V_k^E(\theta_\mu) + \mu V_c^E] + (1 - f(\theta_\mu))V_k^U(\theta_\mu) \} \]

The wage \( w_k \) is determined endogenously from the bargaining process \( k \). Thus the income from working one period is given by the net wage \( w_k(1 - t_k) \). The value of employment, given by equation (3), is determined by the net wage and the discounted expected value of the following period. It differs from the income as workers suffer the risk of unemployment in the future. As workers can either continue to work or suffer a separation with probability \( \chi \), the expected value of the next period is given by the value of each possible outcome weighted by their probabilities (Williamson, 1999).

The value of unemployment \( V_k^U(\theta_\mu) \) is the same for all unemployed workers as it only depends on the total mix of bargaining institution in the economy and not on the bargaining institutions the individual worker engaged in during previous employment. Each unemployed agent enjoy unemployment benefits \( h \) and the next periods expected value is characterized by the probability of moving into employment \( f(\theta_\mu) \), either in a firm with collective bargaining or in a firm with individual bargaining where the probability for each outcome is determined by the total mix of bargaining institutions given respectively by \( \mu \) and \( 1 - \mu \).

The worker surplus \( V_k^W \) is defined as the difference in the value of employment and unemployment and can be derived from equation (2) and (3):

\[ V_k^W(\theta_\mu) = V_k^E(\theta_\mu) - V_k^U(\theta_\mu) = \frac{w_k(1 - t_k)(1 + r) - rV_k^U}{r + \chi} \]

Thus the surplus from employment depends positively on the bargaining wage and negatively on the worker’s outside option and the income tax.
2.4 The Goods Market and Monopolistic Competition

All individuals $n$ in the economy are assumed to have identical Dixit-Stiglitz preferences over a continuum of differential goods $i$. Each agent maximizes their own utility given their budget constraint, leading to the maximization problem:

$$\max \left( \int_{0}^{1} c_{i,n} \frac{P_{i}}{P} di \right)^{\frac{1}{\sigma - 1}}$$

(5)

given the budget constraint:

$$I_{n} = \int_{0}^{1} c_{i,n} \frac{P_{i}}{P} di$$

(6)

Where $c_{i,n}$ denotes the consumption of good $i$ by individual $n$, $I_{n}$ is the real income of household $n$, $P_{i}$ is the price of good $i$, $P = \int P_{i}^{1-\sigma} di \left[ \frac{1}{\sigma - 1} \right]$ is the aggregate price level and $\sigma$ is the elasticity of substitution across goods. Solving the individual’s maximization problem leads to the monopolistic demand function for good $i$ (Ebell and Haefke, 2006):

$$Y_{i}^{D} = \left( \frac{P_{i}}{P} \right)^{-\sigma} I$$

(7)

where $I = \int I_{n} dn$ is the total real income from all agents. From equation (7) it follows that the demand for good $i$ is increasing in the income level and falling in the relative price. $-\sigma$ is the price elasticity of the demand function. Thus it reflects the degree of product market competition in the economy. The higher the value of $\sigma$, the more competition and the lower is the market power of the single firm. Thus when $\sigma \to \infty$, the goods market approaches perfect competition, and the demand for good $i$ is approximately unaffected by a relative change in price.

2.5 The Firm’s Problem

All firms maximize profit each period taking account of the monopolistic demand function with price elasticity $-\sigma$. To simplify I assume that labor is the only input in the production process, where there occurs no disruption from the natural exchange of workers when a match is separated and the worker is replaced by a new agent (Stole and Zwiebel, 1996). The same property follows for exchanged firms: The new firms that enter the economy each period and replace the firms that left continue production without disruption at the same steady state level.
Hours per worker is fixed, and consistent with stylized facts, I assume that firms adjust employment only by the number of workers hired, i.e. on the extensive margin (Ebell, 2006). Thus it’s crucial to assume multi-worker firms: As production depends on the price elasticity under monopolistic competition, which is an endogenous variable of the model, so does the size of the firm. It follows that with the number of hours being fixed, the firm needs to adjust the number of workers to produce optimal (Ebell and Haefke, 2006).

Under both bargaining regimes the real wage and hired workers are the control variables to be determined in firm-level equilibrium. Even though firms’ decision and outcome differ with the bargaining process, the basic optimization problem is the same: In both scenarios firms want to maximize profits, it is the degree of decision variables left alone to the firm that separates the adjustment under the two bargaining regimes. Under individual bargaining the firm can choose the firm’s employment level freely, whereas under collective bargaining both real wage and firm-level employment are outcomes of the bargaining process. It follows that the firm’s outside option when the bargaining process shuts down is one of the key factors that separates the two bargaining regimes: Under individual bargaining the firm produces with one less worker, whereas under collective bargaining the firm is dissolved.

The value of firm \( i \), \( V_k^i(h_i) \), equals the discounted stream of present and future maximized profits, fulfilling the Bellman Equation:

\[
V_k^i(h_i) = \max \left\{ \frac{P(Y_i)}{P} Y_i - (1 + t_p) w_k(h_i) h_i - \phi_v v_i + \frac{1 - \delta}{1 + r} V_k^i(h'_i) \right\} \tag{8}
\]

Subject to:

The demand function for good \( i \) derived from equation (7):

\[
\frac{P_i^k(Y_i)}{P} = \left( \frac{Y_i}{I} \right)^{-\frac{1}{\sigma}} \tag{9}
\]

The production function:

\[ Y_i = A h_i \tag{10} \]

The transition function:

\[ h'_i = (1 - \tilde{\chi}) h_i + q(\theta, v) v_i \tag{11} \]

The wage curve:

\[ w_k = w_k(h_i) \tag{12} \]
Where $\phi_V$ denotes the cost of stating one vacancy, $h_i$ is the number of workers hired by firm $i$, where the subscript $t$ refers to the number of workers hired in the following period, $A$ is a technology measure in the production process and $Y_i$ is the total production by firm $i$ which equals the total demand in equilibrium. Each period the firm has to pay the payroll tax for all hired workers to the government of the amount $t_p w_k(h_i)h_i$ giving the total wage cost of $(1 + t_p) w_k(h_i)h_i$. The value of the firm the following period is discounted at the rate $\frac{1-\delta}{1+r}$ where the firm takes account of the probability that it may exit the market, and the return from an alternative use of recourses $(1 + r)$. The wage curve $w_k(h_i)$ depicts the outcome of the bargaining process between workers and firm $i$, and thus how the wage depends on the number of workers hired.

It is notable that firms lack the opportunity to decide directly on the optimal number of workers $h_i$ to hire each period. Instead taking the transition equation into account firms decide indirect on the optimal number of workers to hire the following period $h'_{i}$ by choosing the number of vacancies to open in the present period given by $v_i = \frac{\bar{\chi}_i h_i}{q(\theta_{i})}$ in steady state, from equation (11). As $\frac{1}{q(\theta_{i})}$ is the mean duration of a vacant job, the total cost of hiring one more worker equals $\frac{\phi_V}{q(\theta_{i})}$.

As both types of firm face the same basic maximization problem, the first order condition giving the optimal adjustment for firm $i$ takes the same form for both bargaining regimes:

$$\frac{\phi_V}{q(\theta_{i})} = \frac{(1-\delta) \partial V_k^I(h_i)}{1 + r}$$

Thus the optimal adjustment for firm $i$ is obtained when the cost of hiring one more worker (given by the cost of opening enough vacancies the previous period) equals the discounted marginal surplus of the employment. The marginal surplus for firm $i$ can be derived using the envelope condition on equation (8) with respect to the state variable $h_i$, given equation (9)-(12):

$$\frac{\partial V_k^I(h_i)}{\partial h_i} = \frac{\sigma - 1}{\sigma} A \frac{P(Y_i)}{P} - (1 + t_p) \left[ w_k(h_i) + h_i \frac{\partial w_k(h_i)}{\partial h_i} \right] + \frac{(1-\delta)(1-\bar{\chi})}{1 + r} \frac{\partial V_k^I(h_i)}{\partial h_i}$$
From equation (14) the marginal surplus equals the marginal product, potential change in total wage cost and the marginal expected surplus to the firm from the possibility that the worker continues into the next period leading to saved search costs. Inserting the first order condition from equation (13) leads to the following Euler condition:

$$\frac{\phi_{V}}{q(\theta_{\mu})} = \frac{1 - \delta}{1 + \rho} \left\{ \frac{\sigma - 1}{\sigma} - \frac{\mathbf{P}(h_{i})}{\mathbf{P}} - (1 + t_{p}) \left[ w_{k}(h_{i}) + h_{i} \frac{\partial w_{k}(h_{i})}{\partial h_{i}} \right] + \left( 1 - \chi \right) \frac{\phi_{V}}{q(\theta_{\mu})} \right\} \tag{15}$$

Hence, under both bargaining regimes the optimal adjustment for firm \(j\) is obtained when the cost of hiring one more worker equals the discounted marginal surplus of the employment the following period, given by the right hand side of equation (15).

### 2.6 The Bargaining Process and Firm-Level Equilibrium

Next, I determine firm-level equilibrium for both types of bargaining firms. I describe separately the individual and collective bargaining process for a given mix of bargaining institution \(\mu\). Further, I focus on how bargaining wages and worker surplus depend on the value of unemployment.

#### 2.6.1 Individual Bargaining

Under individual bargaining firm \(i\) treats each worker as a marginal worker and negotiate the wage with each worker pair wise (Stole and Zwiebel, 1996), thus the only outcome and decision variable of the bargaining process is the individual bargaining wage \(w_{I}(h_{i})\). The number of workers hired in firm \(i\) follows from the number of vacancies the firm chose to open in the previous period, which the individual bargaining firm chooses freely. Upon making this decision the firm takes account of the wage curve \(w_{I}(h_{i})\) that follows endogenously from the individuals bargaining process:

$$\max_{i} \quad \beta \ln V_{w}^{i} + (1 - \beta) \ln \frac{\partial V_{w}^{i}(h_{i})}{\partial h_{i}} \tag{16}$$

The relative bargaining powers are reflected in the given parameter \(\beta\), where \(\beta\) is the bargaining power of the individual worker and \((1 - \beta)\) is the bargaining power of firm \(i\). The bargaining process takes form as a standard generalized Nash bargaining problem, where each worker wants to achieve the highest possible surplus from employment \(V_{w}^{I}(\theta_{i})\), while
the firm wants to maximize the marginal surplus from hiring the additional worker.\(^9\) The steady state surplus to firm \(i\) follows from the long-run solution of equation (14):

\[
\frac{\partial V^I_i(h_i)}{\partial h_i} = \frac{1 + r}{r + \chi} \left[ \frac{\sigma - 1}{\sigma} \frac{A}{P} P(Y_i) - (1 + t_p) \left( w_I(h_i) + h_i \frac{\partial w_I(h_i)}{\partial h_i} \right) \right]
\] (17)

Inserting the surplus for the individual worker and for firm \(i\) from equation (4) and (17) into the Nash product (16) and maximizing, leads to the first-order differential equation of the wage curve:

\[
w_I(h_i) = (1 - \beta) \left[ \frac{rV^U(\theta_\mu)}{(1 - t_i)(1 + r)} \right] + \beta \left[ \frac{\sigma - 1}{\sigma} \frac{A}{1 + t_p} \frac{P(Y_i)}{P} - h_i \frac{\partial w_I(h_i)}{\partial h_i} \right]
\] (18)

Where the solution is easily confirmed to be:\(^10\)

\[
w_I(h_i) = (1 - \beta) \left[ \frac{rV^U(\theta_\mu)}{(1 - t_i)(1 + r)} \right] + \beta \left[ \frac{\sigma - 1}{\sigma} \frac{A}{1 + t_p} \frac{P(Y_i)}{P} \right]
\] (19)

Equation (19) depicts how the individual bargaining wage depends on the number of workers hired in firm \(i\). The change in the wage level from a marginal increase in employment is given by the negative expression:

\[
\frac{\partial w(h_i)}{\partial h_i} = -\frac{\beta \sigma - 1}{\sigma \sigma - \beta (1 + t_p)} I \left( \frac{A h_i}{I} \right)^{-\frac{1 + \sigma}{\sigma}} < 0
\] (20)

Hence, the more workers hired in firm \(i\) the lower is the agreed upon wage level from the individual bargaining process. This follows from the worker’s value to the firm: Under individual bargaining the worker’s value to the firm is the marginal product, which decreases with the number of employed workers (Ebell and Ritschl, 2007). When the worker’s value to the firm decreases the firm is less willing to settle for higher wages in the bargaining process, as the potential gain of hiring the individual worker is reduced. By inserting the

---

\(^9\) By setting \(k = C\) or \(k = I\), I refer respectively to the economy where all firms either engage in collective bargaining (\(\mu = 1\)) or the economy where all firms engage in individual bargaining (\(\mu = 0\)).

\(^{10}\) I follow the same procedure used by Ebell and Ritschl (2007) to solve the first-order differential equation given by equation (18). The solution depends crucially on the assumption that \(\lim_{h_i \to 0} h_i w_I = 0\) Thus I assume that firm-level bargaining wages do not explode as employment \(h_i\) approaches zero (Ebell and Ritschl, 2007).
wage curve from equation (20) into the Euler condition of the firm, we obtain the optimal adjustment of firm $i$ in steady state, given the individual bargaining wage:

$$\frac{\phi_i}{\phi_i} + \frac{r + \chi}{1 - \delta} + (1 + t_P)wT(h_i) = \frac{\sigma}{\sigma - \beta} \frac{\sigma - 1}{\sigma} \frac{P(Y_i)}{P}$$  \hspace{1cm} (21)

It follows from equation (21), that the firm’s optimal adjustment under individual bargaining is inefficient. With an efficient adjustment of the firm with respect to labor; I mean one where the private surplus and social surplus from increased employment coincide given that there exists no other labor market imperfections.\textsuperscript{11} The left hand side gives the marginal cost of hiring one more worker, which would under an efficient allocation of labor equal the marginal product of employment given here by $\frac{\sigma - 1}{\sigma} \frac{P(Y_i)}{P}$. But as the firm takes account of the wage curve and the externality that an increase in the number of workers depresses the wage level through the individual bargaining process, the firm chooses to hire more workers than the efficient outcome to save on the total cost of employment. Even though the firm reduces total profit from production, the firm’s profit share increases at the expense of the individual worker as saved hiring costs surpass the reduced profits to the firm from increased employment. Thus by taking account of the wage curve and the property that wages are depressed by higher employment, the firm settles for a higher allocation of labor in production than under the efficient outcome.

As the firm’s incentive to overhire is pushed by a potentially increased share of the profit from production, this overhiring effect is reduced with the degree of product market competition. If the degree of competition increases, the profit from production is reduced as the firm’s market power diminish, and so follows the incentive to overhire. This is easily confirmed by equation (21): As $\sigma \to \infty$, the right hand side is reduced to $\frac{P(Y_i)}{P}$, which is the marginal product under free competition.

Firm-level equilibrium under individual bargaining is given by the intersection of the wage curve from the bargaining process and the labor demand curve from the firm’s optimal adjustment. Combining the two curves from equation (19) and equation (21) we achieve an

\textsuperscript{11} As the model of Ebell and Haefke (2006) includes several labor market imperfections, an efficient adjustment of the firm with respect to labor does not necessarily imply that the social and private return from production coincide.
implicit expression for the long run equilibrium employment in firm $i$ under individual bargaining:

$$
\frac{\sigma - 1}{\sigma - \beta} A \frac{P(Y_i)}{P} = \frac{1}{1 - \beta q(\theta_{\mu})} \frac{\phi_V r + \chi}{1 - \delta} + \frac{r V_U^U(\theta_{\mu}) (1 + t_p)}{(1 + r) (1 - t_i)}
$$

(22)

Using the property that the $h_i = \left( \frac{P(Y_i)}{P} \right)^{-\sigma}$, the explicit employment level is given by:

$$
h_i = A^{\sigma - 1} I \left\{ \frac{\sigma - \beta}{\sigma - 1} \left[ \frac{1}{1 - \beta q(\theta_{\mu})} \frac{\phi_V r + \chi}{1 - \delta} + \frac{r V_U^U(\theta_{\mu}) (1 + t_p)}{(1 + r) (1 - t_i)} \right] \right\}^{-\sigma}
$$

(23)

And finally, by inserting firm-level equilibrium employment from equation (22) into the wage curve, we obtain the individual bargaining wage in equilibrium:

$$
W_I(h_i) = \frac{r V_U^U(\theta_{\mu})}{(1 - t_i) (1 + r)} + \frac{1}{1 + t_p} \frac{\beta}{1 - \beta q(\theta_{\mu})} \frac{\phi_V r + \chi}{1 - \delta}
$$

(24)

It’s clear from equation (24) that the individuals net bargaining wage increases in the reservation value of unemployment $\frac{r V_U^U(\theta_{\mu})}{(1 + r)}$, i.e. the minimum compensation that an unemployed individual require to give up search. Yet the surplus of the worker is not directly affected by the value of unemployment as it does not change the marginal value of the worker to the firm. We see this easily by inserting the individual bargaining wage from equation (24) into the expression of the worker’s surplus:

$$
V_I^W(\theta_{\mu}) = \frac{1 - t_i}{1 + t_p} \frac{\beta}{1 - \beta q(\theta_{\mu})} \frac{1 + r}{1 - \delta}
$$

(25)

### 2.6.2 Collective Bargaining

Under collective bargaining the coalition of workers negotiate together with the firm both over the number of workers to hire and the wage for all employed workers; hence the single firm can no longer decide by itself on the optimal number of vacancies to open each period. If the firm and employed workers happen to disagree, the firm is dissolved. Thus the

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12 Still the individual bargaining wage can be affected indirectly through changes in tax rates and the labor market tightness.
collective bargaining process for firm $i$ can be represented by the standard generalized Nash bargaining problem:

$$\max \quad \beta \ln(h_iV_i^W) + (1 - \beta) \ln V_i^Z(h_i)$$  \hspace{1cm} (26)

Here $\beta$ reflects the bargaining power of the coalition of workers and $1 - \beta$ reflects the bargaining power of the firm. The workers surplus is given by equation (4) and the value of firm $i$ is given by equation (8). In steady state the value of firm $i$ is given by:

$$V_C^i(h_i) = \frac{1 + \tau}{r + \delta} \left[ \frac{P(Y_i)}{P} Y_i - (1 + t_p)w_C h_i - \phi V \frac{\tilde{\chi}}{q(\theta)} h_i \right]$$  \hspace{1cm} (27)

Solving the bargaining problem with respect to the number of employed workers and the wage we obtain the following first order conditions:

$$w_C = \frac{(1 - \beta)(\sigma - 1) P(Y_i)}{\sigma} \frac{A}{P} (1 + t_p) + \beta \frac{P(Y_i)}{P} A (1 + t_p) - \phi V \frac{\tilde{\chi}}{q(\theta)} \frac{1}{(1 + t_p)}$$  \hspace{1cm} (28)

$$w_C = \beta \frac{P(Y_i)}{P} A (1 + t_p) - \beta \phi V \frac{\tilde{\chi}}{q(\theta)} \frac{1}{(1 + t_p)} + (1 - \beta) \frac{r V^U(\theta)}{(1 - t_i)(1 + r)}$$  \hspace{1cm} (29)

Combining equation (28) and (29) we can easily solve for employment in firm-level equilibrium, given implicitly by:

$$\frac{\sigma - 1}{\sigma} \frac{P(Y_i)}{A} \frac{1}{P} = \phi V \frac{\tilde{\chi}}{q(\theta)} + \frac{r V^U(\theta)}{r(t_i)(1 + r)}$$  \hspace{1cm} (30)

From equation (30) it follows that the collective bargaining outcome is efficient: The firm adjusts production such that the marginal revenue equals the marginal cost of hiring one more worker.

The explicit steady state employment level is given by:

$$h_i = A^{\sigma-1} \left\{ \frac{\sigma}{\sigma - 1} \left[ \phi V \frac{\tilde{\chi}}{q(\theta)} + \frac{(1 + t_p) r V^U(\theta)}{(1 - t_i)(1 + r)} \right] \right\}^{-\sigma}$$  \hspace{1cm} (31)

By inserting into equation (28), we obtain the collective bargaining wage:

$$w_C(\theta) = \left( 1 + \frac{\beta}{\sigma - 1} \right) \frac{r V^U(\theta)}{(1 - t_i)(1 + r)} + \frac{\beta}{\sigma - 1} \frac{\phi V}{(1 + t_p) q(\theta)} \frac{\tilde{\chi}}{q(\theta)}$$  \hspace{1cm} (32)
There exists no overhiring effect under collective bargaining, as the firm lacks the wage externality to increase its own surplus by hiring more workers. The surplus to both the firm and workers are given by a profit share, reflecting the workers joint power to shut down production in the case of failed negotiations. The profit share is determined by the collective bargaining wage given by equation (32). As the surplus for both parties are monotonically increasing in the total profit from the production of good $\tilde{f}$, it follows that both workers and the firm have the same coinciding incentive to maximize total profit from production. Hence, the collective bargaining process leads to an efficient adjustment of the firm.

From equation (32), the collective bargaining wage is also increasing in the reservation value of employment. Thus both under individual and collective bargaining, a higher value of unemployment imply increased wage demand in the bargaining process. But the worker surplus from collective bargaining differs from that of individual bargaining, as it clearly depends on the value of unemployment:

$$V_W^C(\theta, \mu) = \frac{\beta}{\sigma - 1} \left[ r V(\theta, \mu) + \frac{(1 - t_i) \phi V}{(1 + t_i)} \frac{\hat{X}}{q(\theta, \mu)} (1 + r) \right]$$  \hspace{1cm} (33)

The difference follows from the properties of the two bargaining wages: Under individual bargaining the worker surplus reflects the marginal value of the worker to the firm, which workers are rewarded for through the bargaining wage according to the relative bargaining powers. When the value of unemployment increases, the value of the worker to the firm is not affected. Thus individual bargaining workers experience an increase in bargaining wage proportional to the increase in the value of unemployment, keeping the worker’s surplus fixed. Still the increase in wage demand reduces the total profit from production and thus the surplus to the individual bargaining firm.

Under collective bargaining the equilibrium wage reflects a profit share from the total surplus of production, this profit share assures that the ratio of the individual worker’s surplus to the firm’s average surplus equals the ratio $\frac{\beta}{1 - \beta} \frac{1 - t_i}{1 + t_i} \frac{r + \tilde{r}}{r + \tilde{r} + \chi}$, thus reflecting the relative bargaining powers of the coalition of workers and the firm. It follows that an increase in the reservation value of unemployment increases the collective bargaining wage through two main channels: First, the wage would increase to offset the reduced surplus to the worker, keeping the ratio of the individual worker’s surplus to the firm’s average surplus constant. And second, the optimal employment level and production would fall as the firm faces
higher employment costs.\textsuperscript{13} It follows that the average income to the firm increases given the lower employment level from the firm’s optimal adjustment.\textsuperscript{14} Thus bargaining wage increases even further to share the extra average income between the firm and the individual worker. In conclusion the total effect of the reservation value of unemployment on the worker’s surplus under collective bargaining is positive. And as the effect is increasing in the profit share of the worker, it will increase in the relative bargaining power of the coalition of workers and decrease in the degree of product market competition.

Given the optimal adjustment of the collective bargaining firm, increased wage costs will reduce total profits from production. Under collective bargaining the firm and the coalition of workers share the cost of increased unemployment benefits as each side of the bargaining process are assigned a certain share of the total surplus from production.

\subsection{2.7 Reservation Value of Unemployment}

The reservation value of unemployment is defined as the minimum compensation that an unemployed worker requires to give up search (Pissarides, 2000), and is obtained by inserting the value of employment from equation (1) into the value of unemployment from equation (2):

\begin{equation}
\frac{r}{1 + r} V^U(\theta_\mu) = \frac{r + \chi}{r + \chi + f(\theta_\mu)} b + \frac{f(\theta_\mu)}{r + \chi + f(\theta_\mu)} [(1 - \mu) w_f(\theta_\mu)(1 - t_i) + \mu w_C(\theta_\mu)(1 - t_i)]
\end{equation}

Thus the reservation value can also be interpreted as the average expected return on the worker’s human capital during search (Pissarides, 2000). The closed solution is found by inserting the equilibrium wages from the firm-level equilibrium of each bargaining regime from equation (24) and (32) into equation (34):

\textsuperscript{13} This is confirmed by equation (31), where the optimal employment level decreases in the reservation value of unemployment.

\textsuperscript{14} The average income to the firm is given by $\frac{P(Y)}{P} A$. As equation (30) can be rewritten to $\frac{P(Y)}{P} A = \frac{\phi V^U(\theta_\mu)}{\sigma - 1} \left[ \frac{\tilde{s} \phi (\theta_\mu)}{q(\theta_\mu)} + \frac{(1 + t_i) r V^U(\theta_\mu)}{(1 - t_i)(1 + r)} \right]$, an increase in the value of unemployment will through the firm’s optimal adjustment lead to a higher average income to the firm.
Hence, if $\mu = 0$ and all firms engage in individual bargaining the reservation value of unemployment equals:

$$\frac{r}{1 + r} V_U(\theta_{\mu}) = \frac{(\sigma - 1)(r + \chi)}{(\sigma - 1)(r + \chi) - f(\theta_{\mu})} b + \frac{(\sigma - 1) f(\theta_{\mu})}{(\sigma - 1)(r + \chi) - f(\theta_{\mu})} \beta \left\{ (1 - \mu) \left[ \frac{1 - t_l}{1 + t_p} \frac{\beta}{1 - \delta} \phi_V - \frac{r + \chi}{1 - \delta} \right] + \mu \left[ \frac{\beta}{\sigma - 1} \left( \frac{1 - t_l}{1 + t_p} \phi_V \hat{\chi} \right) \right] \right\}$$

Or if $\mu = 1$, such that all firms engage in collective bargaining, the reservation value of unemployment is given by:

$$\frac{r}{1 + r} V_U(\theta_{\mu}) = b + \frac{(1 - t_l)}{(1 + t_p) (1 - \beta)} \frac{\beta}{1 - \delta} \phi_V$$

As the necessary and sufficient condition for a job acceptance $w_k > h$ is fulfilled for each bargaining wage, the reservation value is assured to be greater or equal to the level of unemployment benefits in both bargaining scenarios. The reservation wage also depends positive on future potential earnings in both bargaining economies as it reflects the average expected return from search. Thus higher steady state unemployment decreases the reservation wage as it reduces the workers probability of future jobs, whereas a higher steady state surplus from employment increases the reservation wage due to higher potential earnings both today and in the future.

A lasting increase in unemployment benefits gives the unemployed worker more income to enjoy the corresponding period, and would at first sight seem to increase the reservation value of unemployment. But an increase in wage demand reduces the optimal production of both types bargaining firms, and thus there occurs an indirect effect through the response in equilibrium unemployment. As future potential earnings are reduced from increased tax rates and as both the probability of finding a job and the level of competition is affected by steady state employment, the total effect on the reservation value of unemployment is ambiguous as it clearly depends on the dominating factor. In chapter 5 I proceed by simulating the general equilibrium of the model for several values of the policy parameter $h$, thus accounting for all possible effects from a lasting change in the degree of unemployment compensation.
3. General Equilibrium

To analyze the total effect from a lasting change in the level of unemployment benefits, it’s crucial to determine the total change in all endogenous variables of the model for the given parameters \((\beta, \sigma, \phi, \chi, \delta, r, A, b)\) and the general equilibrium conditions. By first focusing on the outcome of each bargaining institution separately, taking the mix of bargaining institutions as given, I will later determine how a given \(\mu\) can be supported by the equilibrium outcomes of the model.

For each possible level of the policy parameter \(h\), equilibrium wages and employment levels satisfy the firm-level equilibrium conditions given by equations (23) and (24) for individual bargaining firms and equations (31) and (32) for collective bargaining firms. For a given mix of bargaining institutions \(\mu\) the equilibrium labor market tightness \(\theta_t\) is pinned down by imposing the aggregate resource constraint:

\[
I = (1 - \mu) \left[ \frac{P_f(h^I_t)}{P} Ah^I_t(\theta_t) \right] + \mu \left[ \frac{P^C(h^C_{\mu})}{P} Ah^C_{\mu}(\theta_{\mu}) \right]
\]  

Equation (37) states that in general equilibrium the total income from production has to equal the total income in the economy. By substituting in firm-level equilibrium employment for each bargaining regime from equation (22) and (30), the final equilibrium condition for \(\theta_t\) is given by:

\[
A^{1-\sigma} = (1 - \mu) \left\{ \frac{\sigma - \beta}{\sigma - 1} \left[ \frac{1}{1 - \beta q(\theta_t)} \frac{r + \chi}{1 - \delta} + \frac{rV^U}{(1 + r)} \frac{(1 + \bar{t}_p)}{(1 - \bar{t}_i)} \right] \right\}^{1-\sigma} \\
+ \mu \left\{ \frac{\sigma}{\sigma - 1} \left[ \frac{\phi}{q(\theta_{\mu})} + \frac{(1 + \bar{t}_p)}{(1 - \bar{t}_i)} \frac{rV^U}{(1 + r)} \right] \right\}^{1-\sigma}
\]

(38)

Setting \(\mu = 0\) and inserting the reservation value of unemployment, we finally obtain the general equilibrium condition for an economy where all firms engage in individual bargaining:

\[
A = \frac{\sigma - \beta}{\sigma - 1} \left[ \frac{1 + \bar{t}_p b}{1 - \bar{t}_i} + \beta \frac{\phi}{1 - \beta} \frac{\phi}{1 - \delta} \theta_t + \frac{1}{1 - \beta} q(\theta_t) \right]
\]

(39)
The general equilibrium condition pins down \( \theta_f \) as a function of the exogenously chosen policy parameter \( b \). Equation (39) is monotonically increasing in the labor market tightness. Thus to secure the existence of an equilibrium solution it is necessary to limit the possible values of unemployment benefits:

\[
\frac{\sigma - 1}{\sigma - \beta} \frac{1 - t_i}{1 + t_p} A > b
\]  (40)

Likewise, by setting \( \mu = 1 \) and inserting the reservation value of unemployment, we obtain the general equilibrium condition for an economy where all firms engage in collective bargaining:

\[
A = \frac{\sigma(r + \chi)}{(\sigma - 1)(r + \chi) - \beta \theta_C q(\theta_C)} \left[ \frac{(1 + t_p)b + \phi_v}{(1 - t_i)q(\theta_C)} \right]
\]  (41)

In this scenario the existence of equilibrium is guaranteed if:

\[
\frac{\sigma - 1}{\sigma} \frac{1 - t_i}{1 + t_p} A > b
\]  (42)

Restriction (40) and (42) reflect the necessary condition that the individual worker can’t receive more as unemployed than he would contribute to the economy by working in a firm. As \( b \) approaches its upper limit, unemployed agents exhaust the employed workers through higher taxation and in the end the economy shuts down.

### 3.1 The Free Entry Condition

Following the model of Ebell and Haefke (2006), where the outcome of bargaining institutions depends crucially on the degree of product market competition, I also endogenize the level of competition in the long run economy to account for the possible effects that unemployment benefits might have on the degree of competition in the two bargaining regimes. Thus in the long run economy firms are assumed to exploit all profit opportunities from entering the market, driving profit net of entry costs down to zero. For every value of \( h \) the degree of competition \( \sigma \) is no longer given, but is endogenously determined by the free entry-condition:

\[
\phi_E(\sigma) + \frac{\phi_v}{q(\theta_f)} h_1(\sigma) = V^J_k(\sigma)
\]  (43)
The condition states that the total cost of entering the market has to equal the steady state equilibrium value of the firm for each type of bargaining institution $k \in \{C, I\}$. The cost is divided into total barrier cost of entry $\phi_0$ and the cost of hiring enough workers to cover the steady state employment level. As the firm’s value decreases and the cost of entry increases in the degree of competition, there exists a unique long run equilibrium solution for $\sigma$ for each possible value of $b$, where profit net of entry costs equals zero.

### 3.2 The Unemployment Rate

By determining the labor market tightness for a given $\mu$, the equilibrium unemployment rate is obtained by imposing the steady state condition: The flow of individuals into employment has to equal the flow out of employment to maintain a constant rate of unemployment (Pissarides, 2000):

\[ f(\theta_\mu)u = (1 - u)\chi \]  

(44)

Thus equation (44) can be rewritten as the Bevridge curve, which determines the steady state unemployment rate in term of the transition rates $f(\theta_\mu)$ and $\chi$:

\[ u = \frac{\chi}{\chi + f(\theta_\mu)} \]  

(45)

For every possible value of $b$ the general equilibrium conditions now determine a unique unemployment rate. And noticeable, is that for a given $\chi$ unemployment only depends negative on the labor market tightness $\theta_\mu$, which equals the ratio of vacancies to unemployed searching workers.

The rest of equilibrium variables are found as follows: The number of workers in the economy $N$ is for convenience normalized to 1. Thus, for a given mix of bargaining institutions the condition that the number of employed workers has to equal the sum of filled job from the two bargaining regimes simplifies to: $\mu h^C_\ell(\theta_\mu) + (1 - \mu)h^I_\ell(\theta_\mu) = 1 - u$. Given $h^C_\ell$ and $h^I_\ell$ we can further solve for aggregate output and equilibrium prices. The only variable left to determine is the mix of bargaining institution $\mu$. In Chapter 4, I connect the outcome of employment, bargaining wages and worker surplus to the choice of bargaining regime, thus making $\mu$ an endogenous variable in the model.
3.3 Search and Efficiency

An efficient allocation of search intensity is one where the social and private return from search coincide (Moen, 1997). In an uncoordinated labor market with frictions, the probability of finding or filling a job does not only depend on the search intensity of the individual agent, but also the search intensity of the other agents in the market: During search an agent’s search intensity will affect the opposite party positive, but the same type negative (Moen, 1997). This is easily confirmed by the matching function of the Mortensen-Pissarides search friction model which reflects the technology that brings together unemployed workers and vacant jobs. For example: If a firm chooses to increase the search intensity by stating more vacancies, it follows from the matching function that the probability for a worker to find a job increases, whereas the probability for a firm to fill a vacancy will decrease. To achieve an efficient allocation of search, the private gain to both firm and workers should reflect these search externalities. Hence, in a labor market with friction, an efficient search allocation is the one that integrates the search externalities in the wage bargaining process between firm and worker.

When the wage setting occur prior to search, as in the ex-ante wage bargaining model of Moen (1997), firms set wages in competition with other firms profitably as a measure to attract employees. Thus firms can influence the search behavior of workers, and wages reflect the search externalities in the labor market. Under ex-post wage bargaining, however, there is no such mechanism as firm and worker settle the wage after the match is made. Wages are still endogenous, but the matching technology is now outside the model of the bargaining process (Hosios, 1990). Under ex-post wage bargaining, wages only reflect the relative negotiation power of the worker and the surplus from the match. Thus search externalities are not integrated in the ex-post wage bargaining process and wages do not contribute any signaling or reflect the allocation of search. Hosios (1990) and Pissarides (2000) suggest a solution to the efficiency problem of ex-post wage bargaining by connecting the social gain of the match and the private return from participating in the matching process: If the elasticity of the matching function equals the relative bargaining
power of the worker, then search externalities are integrated in the bargaining process, leading to an efficient allocation of search intensity.\(^{15}\)

Still, the condition of Hosios (1990) and Pissarides (2000) is only fulfilled by a coincidence of the parameter values in the model. In contrast, in Moen’s (1997) ex-ante wage bargaining model it is the intentional structure of the labor market itself that secure search efficiency.

Why does the efficiency condition not necessarily apply to the ex-post wage bargaining model of Ebell and Haefke (2006)? The efficiency condition of Hosios (1990) and Pissarides (2000) refers to an economy where all other market failures than search externalities are ruled out. This assures that the social surplus from the match coincide with the private surplus that is shared according to the bargaining process. Since the model of Ebell and Haefke (2006) includes several market imperfections, as the monopolistic behavior of the firm and distorting taxes on income to finance the expenditure of unemployment compensation to the government, the efficiency condition of Hosios (1990) and Pissarides (2000) will not connect the social gain and the private return from participating in the matching process. Thus we conclude that the ex-post wage bargaining process in the model of Ebell and Haefke (2006) does not necessarily lead to an efficient allocation of search intensity.

4. Stable Bargaining Institution

Until now the outcomes of the model have been derived for a given mix of bargaining institutions \(\mu\). In this section I connect the outcome of employment, worker’s surplus and wages to the choice of bargaining regime, making \(\mu\) an endogenous variable of the model.

Solving the model numerically, the necessary requirements for a symmetric Nash equilibrium will help us settle the choice of each bargaining regime taking account of all effects from a lasting change in unemployment benefits. I outline here the necessary

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\(^{15}\) The models of Hosios (1990) and Pissarides (2000) include different features, but both have the crucial assumption that the matching process is characterized by a constant return to scale matching function.
condition for a symmetric Nash equilibrium. I will further take advantage of these criteria in the model simulation when analyzing how a shift in unemployment compensation affects the mix of bargaining institution, either when considering an economy where all firms engage in individual bargaining or an economy where all firms engage in collective bargaining.

Ebell and Haefke (2006) outline necessary conditions for Nash equilibrium by first considering the relative gain or loss in worker surplus from deviating to the alternative bargaining process. Here, I explain briefly a set of necessary conditions for symmetric Nash equilibrium, where the individual worker will first take account of potential layoffs and then consider the relative gain or loss from switching to the alternative bargaining institution (Ebell and Haefke 2008). However, I assume that the workers who suffer from layoffs are random and not revealed prior to the switch of bargaining regime.

4.1 The Choice of Bargaining Institution

As firms can increase their own surplus by overhiring under individual bargaining, initially new firms will choose the individual bargaining process when entering the market to guarantee a higher surplus from production (Ebell and Haefke, 2008). But as workers in each firm have the opportunity to merge the individual settling of wages to a collective settling of both wage and firm-level employment, workers may decide if profitable to switch to collective wage bargaining. This makes the choice of bargaining institution a free and collective choice of the workers in the model. I assume further that all workers in a given firm have to agree unanimously on which bargaining institution to choose. Due to the assumption of identical agents in the economy, there occurs no situation of mixed opinions on the optimal bargaining process as all agents have the same coinciding preferences (Ebell and Haefke, 2006). Thus I only consider the preferences of the individual worker when settling the necessary requirements for a stable bargaining institution in the economy.

Further, I only consider the necessary requirements for Nash equilibrium of bargaining institution $k$ compared to the alternative bargaining institution $j$, where $k \neq j$ are two distinct bargaining institutions. In chapter 5 I apply this general setting to the model simulation of both the collective and individual bargaining economy.

I assume that all firms in the model are atomistic with respect to the economy, so that any individual decision of an arbitrary firm will have no impact on the aggregate labor market tightness $\theta_i$ (Ebell and Haefke, 2006). Hence, when evaluating the choice of
bargaining process, workers determine the outcome of both individual and collective wage bargaining for the same labor market tightness with the mix of bargaining institutions corresponding to that of the potential Nash equilibrium in the economy.

4.2 Nash Equilibrium with one Type of Bargaining Firm

To determine the necessary conditions for an economy where all firms either engage in individual- or collective bargaining, we need to settle the necessary conditions for a symmetric Nash equilibrium. A bargaining institution \( k \) is a symmetric Nash equilibrium if it is not optimal for the worker in an arbitrary firm to deviate to bargaining process \( j \), given that all other firms engage in bargaining process \( k \) (Ebell and Haefke, 2006). As all workers are assumed to be identical, we only determine the necessary conditions that one agent find it optimal not to deviate from bargaining process \( k \) given a labor market tightness \( \theta_k \), reflecting that all the other agents adopt the same bargaining process \( k \).

Intuitively the worker prefers the bargaining institution which gives the highest surplus from work. But as a switch of bargaining regime may involve layoffs, the individual worker will first consider the potential change in firm-level employment as a second key variable before making his decision.

If the switch from bargaining regime \( k \) to bargaining regime \( j \) does not involve layoffs, the individual worker will only consider the relative change in worker’s surplus, as he is indifferent to the utility of the potential extra workers. Thus, for a given long-run equilibrium where \( h_i^j(\theta_k) \geq h_i^k(\theta_k) \) for firm \( i \), bargaining institution \( k \) is a symmetric Nash equilibrium only if:

\[ V_k^W(\theta_k) \geq V_i^W(\theta_k) \]

(46)

From Chapter 2 the value of unemployment depends only on the total mix of bargaining institutions and not on the workers previous choice of bargaining regime. Given that the reservation wage is based on the same labor market tightness \( \theta_k \), the worker surplus is monotonically increasing in bargaining wage. Thus instead of comparing the relative surplus from employment, we can compare the relative wage from the bargaining process:

\[ w_k(\theta_k) \geq w_j(\theta_k) \]

(47)
It follows that equation (47) coincide with the necessary restriction for symmetric Nash equilibrium of bargaining institution \( k \) depicted in equation (46), given that
\[ h_i^j(\theta_k) \geq h_i^k(\theta_k). \]

Alternatively, if the switch of bargaining regime involves layoffs, workers will take account of the probability of becoming unemployed. As agents are assumed to be risk neutral, the individual worker will only deviate from the initial bargaining institution \( k \): if the expected surplus from employment is greater in the alternative bargaining process \( j \). Formally, for a given long-run equilibrium where \( h_i^j(\theta_k) < h_i^k(\theta_k) \) for firm \( i \), bargaining institution \( k \) is only a symmetric Nash equilibrium if:
\[ h_i^k(\theta_k)V_k^W(\theta_k) \geq h_i^j(\theta_k)V_j^W(\theta_k) \]  
(48)

In Chapter 5 I focus separately on the conditions for a symmetric Nash equilibrium in the collective and individual bargaining economy by applying the general conditions stated here for bargaining process \( k \): I always consider the employment criteria first, and then depending on the relative employment level I proceed to consider the wage criteria given by equation (47), or the expected utility criteria given by equation (48). There are several general equilibriums to consider as I for each bargaining economy check numerically for all possible degrees of unemployment compensation. Given the same labor market tightness, two different levels of unemployment benefits can show a different optimal choice of bargaining process. Only for the level where the individual worker chooses to stick to the original bargaining economy can we conclude that the bargaining process is a symmetric Nash equilibrium for that level of unemployment benefits. It is also possible that there exist two symmetric Nash equilibriums, one in each bargaining economy, for one level of unemployment benefits. Then the individual bargaining economy with \( \mu = 0 \) is the general equilibrium outcome of the model as firms initially choose the individual bargaining process.
4.3 Nash Equilibrium with a Mix of Bargaining Types

Next I focus on the conditions for a Nash equilibrium with a mix of bargaining types in the economy. I let $z$ denote the coverage rate of bargaining institution $k$. Thus for $z$ to be a Nash equilibrium, the share of firms $z$ that engage in bargaining process $k$ must find it sub-optimal to deviate to bargaining process $j$, whereas the share of firms $1-z$ that engage in bargaining process $j$ must find it sub-optimal to deviate to bargaining institution $k$ (Ebell and Haefke, 2008). I divide the conditions into two different cases (Ebell and Haefke, 2008):

**First case:** The worker surplus from bargaining process $k$ equals the worker surplus from bargaining process $j$. In this case no worker will find it optimal to deviate to the alternative bargaining process given the adjustment of all other bargaining firms. Thus a sufficient condition for Nash equilibrium of the mix of bargaining institution $z$ is:

$$w_k(\theta_z) = w_j(\theta_z)$$ (49)

Even though the two bargaining wages differ, it is fully possible that the two wage levels are equal for a given general equilibrium. However, they do not reflect the same properties from the bargaining process. Under collective bargaining the wage reflects a profit share, whereas under individual bargaining the wage reflects the marginal value of the worker to the firm. If these values happen to coincide for a given $\theta_z$, then we observe this in the model by equal bargaining wages.

**Second case:** The worker surplus is higher under bargaining institution $k$, but switching from bargaining institution $j$ to $k$ involve job losses given the labor market tightness $\theta_z$. In addition, the expected utility from bargaining process $j$ is at least as high as the expected utility from bargaining process $k$. Thus even though bargaining institution $k$ leads to the higher surplus for the individual worker, the workers that engage in bargaining process $j$ will not find it optimal to deviate. Formally:

$$w_k(\theta_z) > w_j(\theta_z)$$

$$h^j(\theta_z) > h^k(\theta_z)$$ (50)

$$h^j(\theta_z)V^W_j(\theta_z) \geq h^k(\theta_z)V^W_k(\theta_z)$$
The second case shows how workers do not only consider the relative wage level as the determining factor of bargaining choice as workers do not know the real outcome and which workers who suffers from potential layoffs before after the switch of bargaining process. Even though the worker’s wage could actually increase, workers abstain from switching bargaining regime as the expected utility is negative.

In the quantitative section of the next chapter, I analyze how the choice of bargaining regime depends of the level of unemployment benefits by changing the exogenously given policy parameter \( h \). I mainly focus on the possibility of a symmetric Nash equilibrium either supporting the individual or collective bargaining economy. By simulating the two boarder cases of the model, I check numerically the necessary requirements for a symmetric Nash equilibrium. Given that neither the collective nor the individual bargaining economy is supported as a symmetric Nash equilibrium in the model, the conditions for Nash equilibrium of bargaining economies with a mix of bargaining types illustrates the possibility for alternative bargaining economies.

5. Simulating the Effects of Unemployment Benefits

In this chapter I proceed by carrying out the policy experiment: I simulate the model described in Chapter 2 for several levels of the exogenously chosen policy parameter \( b \). I begin by explaining how the model is calibrated to match German long run data using the collective bargaining version of the model. In the quantitative section, I determine the individual bargaining version using the obtained parameters from the calibration. Next, I summarize the quantitative results from the model simulation and examine the equilibrium response of the policy experiment in both bargaining economies. The simulation provides important insight on the linkage between unemployment benefits and the wage bargaining process between firm and workers. Taking account of the government's budget constraint and the monopolistic behavior of the firm, the simulation provides more than a partial analysis of the labor market by illustrating the steady state equilibrium response in the key variables of the model.
5.1 Calibration

The model is calibrated using the collective bargaining version of the model to reflect the high coverage of collective agreements in Germany. In the calibration and simulation of the model, I take advantage of the software package Matlab. The periods of the model is set to one month. To calibrate the model we need some baseline values, these are set to match suggestions in past literature on search and matching framework and to match stylized labor market data from Germany. All parameters are reported in Table 1.

To simplify I normalize as Ebell and Haefke (2006) the level of technology $A$ to unity. Petrongolo and Pissarides (2000) report that earlier studies which converged on a Cobb-Douglas matching function satisfying constant return to scale reported a coefficient on unemployment in the range 0.5-0.7. Abowd and Allain (1996) estimated from private French industry the employee’s average bargaining power to be about 0.4. Likewise Yashiv (2001) suggests from estimation using aggregate Israeli labor market data that the worker’s bargaining power is around 0.4. For lack on better information on German relative bargaining power I set $\beta = \eta = 0.5$ to match the suggestion from the literature and fulfill Moen’s criteria for making ex-post wage bargaining a realistic feature of the model (see section 1.1). As the elasticity of the matching function equals the relative bargaining power of the worker, the model also fulfills Pissarides (2000) and Hosios (1990) condition on search efficiency. But as explained in section 3.3: In an economy with other labor market imperfections the condition does not necessarily lead to efficiency.

As one of the main targets of the analysis is to capture the implications of the shift in benefit entitlements, I use long-run data for Germany reported up until the year 2005. The long run unemployment rate and labor market tightness are chosen to match data reported by the Deutsche Bundesbank during the period 1991-2004: I set the long run unemployment rate $u = 9.9 \%$, and the labor market tightness based on monthly data of total vacancies and total unemployed workers equal to $\theta_C = \frac{V}{U} = 0.10$. The interest rate measure is also based on data from the Deutsche Bundesbank and is set to 0.0033 to reflect the approximate 4 % annual interest rate level during the 1990s. The monthly probability of firm exit $\delta$ is set to 0.5 %, thus to match the average five-year survival probability by small firms that entered German manufacturing industries between 1979 and 1982 reported by Wagner (1994). In a stationary environment, the inverse of $f(\theta_u)$ (the probability that a worker find a job within a
given period) is also the mean duration of unemployment (Petrongolo and Pissarides, 2000). As the model is restricted to steady state, I set $\frac{1}{f(\theta_n)} = 8.75$ to match the average mean duration of unemployment in Germany measured in months from the period 1998-2004 (Bundesagentur für Arbeit, 2007), which implies a job finding rate of 0.114. Thus the scaling parameter of the matching function follows from the definition: $s = f(\theta_C)/\theta_C^{1-n}$. The exogenous total separation rate is obtained from the Bevridge curve, which relates $\chi$ to the long run unemployment rate and unemployment duration. And finally, by setting $\chi = 0.0126$ from equation (45), the probability that a match is destroyed $\dot{\chi} = 0.0076$ follows from the expression of the total separation rate $\chi = \ddot{\chi} + \delta - \dot{\chi} \delta$.

From the definition of the worker’s value of unemployment given by equation (3), $h$ is defined as the real return an unemployed worker enjoys during search. As $h$ in praxis may include other real return than the unemployment benefits from any unpaid leisure activities such as home production, it occurs a problem by estimating the real value of $h$ from the data. In addition, prior to 2005, there existed two types of unemployment benefits in Germany dependent on both the characteristic of the individual and the unemployment duration: Unemployment insurance (U1) which was paid out for a limited period and depended positively on the individual’s pervious work-history and age. When the individual’s U1 benefits runs out, he may be entitled to receive unemployment assistance (UA) benefits, which though has a lower replacement rate than the U1 benefits is not time-limited (Wolff, 2003). As the depicted model only has one variable determining the level of unemployment benefits given by $h$ (as all individual are assumed to be identical in the model) and we are only concerned with the potential relative change in the level of benefits entitlement, I choose a net replacement rate target to calibrate the unemployment benefit level in the long run version of the model. The net replacement rate is set to 64 % to match the reported level by OECD during the period 2001-2004. Further, the payroll tax and income tax are set to equal magnitude, i.e. $t_i = t_p$, and chosen such that the total unemployment benefit expenditure is financed each period according to equation (1). The two tax rates are not representative for the more complex tax-system in Germany which includes several other types of taxes. This is a weakness of the model when calibrating it to German data. Still, in the model simulation the two tax rates provide important insight on how firms and workers are affected when the cost of unemployment compensation increases.
The cost of stating a vacancy and the degree of competition are finally pinned down by imposing the long run general equilibrium condition and the long run free entry condition from the collective bargaining version of the model, given respectively by equation (41) and (43). Thus the total barrier cost of entry is yet to be determined: I follow the procedure of Ebell and Haefke (2006) and divide $\phi_E$ into a regulatory delay $d$ and entry fees $f$ as a share of aggregate monthly income $I$:

$$\phi_E = (d + f)I$$

(Djankov, et. al. (2002) reports the cost in order to obtain all licenses and permits required for entry as a fraction of GDP in 1999 to be 15.7%. In addition I use an index derived by Fonseca, et. al. (2001) based on a study by Logotech on business start-up costs in OECD countries in 1997 to determine the regulatory delay: 16 The index measure weights the number of days on average that a new company need to complete the necessary number of procedures before start-up, for Germany it is estimated to be 55.2 working days (Ebell and Haefke, 2006).

5.2 Quantitative Results

In this section I summarize the main results from the model simulation. I solve for both the collective and individual bargaining version using the obtained parameter values from the calibration reported in Table 1. The possible values of $b$ are chosen exogenously, representing the government's policy instrument in the model. To provide a bare minimum of survival for unemployed workers $h$ is restricted to be non-negative. The upper limit is determined by restriction (40) and (42), thus securing the existence of a general equilibrium solution in the model (see section 3).

16 Fonseca, et. al. (2001) reports for Germany 10 number of procedures required and 16 weeks given by 80 working days as the average time to set up a company. Thus the index that combines the number of days and procedures ((days + procedures)/(average procedures /day))/2) is measured to 55.2 days as reported by Ebell and Haefke (2006).
I begin by comparing the labor market outcome of each bargaining regime for a given degree of product market competition. Next, I simulate the model for several degrees of competition and explore the importance of the firm’s monopoly power when considering the effects of a lasting change in unemployment benefits. I follow up, by introducing the free entry condition in the open market and thereby pin down the degree of long-run competition for every level of unemployment benefits. Thus I focus on the potential indirect effects of the adjustment in product market competition compared to the direct effects from the initial change in unemployment benefits. Finally, in the last sub-section, I examine which bargaining institution that emerges endogenously for every possible level of unemployment benefits, and then check numerically if the different properties of the bargaining processes potentially change the bargaining process itself.

5.2.1 The Equilibrium Response

The steady state equilibrium response for all possible levels of unemployment benefits are reported in Figure 2. The degree of product market competition is kept constant and equal to 11.95, the level calibrated from the collective bargaining version of the model. Real wage after tax refers to \( w_k(1 - t_i) \) in the model description and real wage cost per worker to firm \( i \) is given by \( (1 + t_w)w_k \). The two curves in Figure 2 refer to the alternative bargaining economies, where all firms either engage in collective or individual bargaining. Focusing on Germany, the collective bargaining curve illustrates the steady state outcome from the model of a lasting change in unemployment benefits, whereas the individual bargaining curve shows the alternative outcome if all firms were to engage in individual bargaining given the parameter values reported in Table 1.

According to Figure 2, both bargaining versions illustrate the same qualitative response in labor market outcome from a lasting change in unemployment benefits: As unemployment benefits increase, unemployment and tax-rates rise accompanied by a fall in both bargaining after-tax real wage and worker surplus. For both bargaining economies real profits to the firm decrease, whereas labor costs increase with the degree of unemployment compensation.
As expected from theory, an increase in unemployment benefits increases the workers wage demand in the bargaining process by making the agents more selective. Based on the model this implies higher labor costs to both type of bargaining firms, who adjust by decreasing production and employment. It is important to separate how this decision is made in each type of bargaining firm: Under collective bargaining this is a joint decision of the firm and the coalition of workers. They decide in the bargaining process to reduce firm-level employment, as wage demand increases, in order to maximize total profits from production. Under individual bargaining the reduction in firm-level employment is only a decision made by the firm. Upon making this decision the firm takes account of the bargaining wage which follows from the individual bargaining process. In contrast to collective bargaining, individual bargaining firms only maximize the value of the firm’s profit share.

Given a constant degree of product market competition the number of firms in the economy is considered fixed. Thus the adjustments in equilibrium employment only arise from the individual adjustment of the firms. It follows that the higher labor costs from increased unemployment compensation are reflected in the increasing unemployment rates in both bargaining versions of the model.

As an increase in steady state unemployment decreases both today’s and future potential earnings for all workers, the natural response in the model is a reduction in the reservation value of unemployment. This follows from the interpretation that the reservation wage reflects the average expected return on the worker’s human capital during search. But as the reservation wage also reflects the minimum compensation an unemployed worker requires to give up search, it is also reasonable to expect a rise in the reservation wage as unemployment benefits increase. The model simulation illustrates that the effect of increased steady state unemployment dominates the effect of extra income to unemployed workers in both bargaining economies as the reservation wage is decreasing with the degree of unemployment compensation. Thus unemployment benefits lead to reduced wage pressure through higher unemployment which counteracts the initial increase in wage demand in the bargaining process. The employment mechanism is further strengthened through the government’s budget constraint: As agents move from employment to unemployment, tax rates have to increase to finance the higher expenditure of unemployment compensation, thus leaving the remaining workers with a lower after-tax income and an even higher cost of labor to the firm.
The model simulation illustrates that the initial increase in wage demand raises employment cost for both types of bargaining firms. Still, the rise in unemployment combined with the needed increase in tax rates leads to a decreasing level of real wage for both bargaining economies. However, the labor market response is driven by the firms profit maximization and the workers wage demand in the bargaining process. Thus the model suggests that the size of the response depends crucially on the firm’s optimal adjustment and workers’ relative bargaining strength.

Figure 2 illustrate the decisive impact of bargaining institution when considering the quantitative reaction in labor market outcomes. The collective bargaining economy shows a strong response in both real wage and unemployment rates compared to the individual bargaining economy. And noticeable, is the almost constant collective bargaining surplus, whereas the reservation value of unemployment mirrors the strong reaction in unemployment. With individual bargaining the equilibrium response in all variables is relatively small. Still, Figure 2 illustrates a small reduction in both individual bargaining worker surplus and real profits as unemployment benefits increase compared to the almost flat collective bargaining response.

Looking at unemployment rates, the over hiring effect of individual bargaining firms is clearly evident: In contrast to collective bargaining, individual bargaining firms have the freedom to depress wages by hiring more workers, leading to a considerable lower long run unemployment rate in the individual bargaining version of the model for all possible levels of unemployment benefits. As discussed by Ebell and Haefke (2006), collective bargaining being the symmetric Nash equilibrium under high EU regulation, may explain the high observed unemployment rates in Europe. Likewise, we observe from the simulation of the German labor market a potential gain in the steady state unemployment rate from individual bargaining. This efficiency gain depends however crucially on the level of unemployment benefits: Given the initial value of unemployment benefits where \( h = 0.57 \) the unemployment rate can potentially improve from 9.9 % under collective bargaining to 4.4 % under individual bargaining. But as the level of unemployment benefits reach the significantly lower level of 0.3, the potential gain decreases from an unemployment rate of 5.2 % under collective bargaining to 3.3 % under individual bargaining.
The distributional effect of overhiring under individual bargaining and the joint power of the workers’ in the collective bargaining process, are also illustrated in Figure 2. Even though both production and firms’ profits in the individual bargaining economy surpass the outcome of collective bargaining, the simulated worker surplus is considerably lower for all levels of unemployment benefits.

From an employed worker's perspective the collective bargaining surplus is clearly to be preferred as it reflects the potential profits from the product market. Yet the efficient adjustment of the collective bargaining firm as unemployment benefits increase leads to the high level of unemployment observed in Figure 2. As unemployment benefits increase, the reduction of optimal employment level and profits follows. While in the individual bargaining economy, the firms’ freedom to choose firm-level employment in the bargaining process gives firms the advantage to increase their own share of the surplus by hiring more workers. In this way firms earn the higher profits and the workers’ surplus decrease with the degree of unemployment compensation. On the other hand, from collective bargaining workers are offered even more due to the increase in average profits, thus reducing the optimal employment level even further. The trade off under collective bargaining is clear: As unemployment benefits increase, the collective bargaining process keeps the worker's surplus approximately constant reflecting the worker's profit share from production. But given the firm's optimal adjustment, the relatively higher worker surplus combined with high unemployment benefits leads to the social cost of high unemployment.

Finally, unemployment is the key variable that explains the sharp fall in collective bargaining wage as unemployment benefits increase. First, the sharp increase in unemployment combined with the government’s budget constraint leads to an increase in tax rates given the higher cost of unemployment compensation. This reduces the after tax income to the working part of the economy. Second, the strong response in steady state unemployment due to higher labor costs is mirrored in the reservation wage, as steady state unemployment decreases the probability of future potential earnings. From the model the coalition of workers bargains for the joint surplus only. The wage level is an endogenous variable of the model and is only adjusted to keep the average worker's surplus reflecting the average profit share determined by the bargaining process. Thus the reduction in collective bargaining real wage is needed to maintain an approximately constant surplus from employment as the reservation wage decreases.
5.2.2 The Importance of Product Market Competition

Not only is the degree of product market competition essential for the choice of bargaining regime (Ebell, and Haefke, 2006), it is also an essential factor when considering the effect of a lasting change in unemployment benefits. As discussed in the model description, the surplus from collective bargaining mirrors the degree of product market competition: The workers' collective bargaining surplus is determined by a profit share. In this way the bargaining process offer high real wages at low levels of competition that decreases in the degree of product market competition. Whereas under individual bargaining, the incentive to overhire reflects the potential profits from the goods market, thus depending positive on the firms’ monopoly power. As the outcome of each bargaining regime depends crucially on the level of product market competition, it raises the question of how the equilibrium response of a change in benefit entitlements depends on $\sigma$. By simulating the general equilibrium response for several degrees of product market competition of a lasting change in unemployment benefits, I simulate respectively the equilibrium response of collective and individual bargaining in Figure 3 and 4, for every combination of $h$ and $\sigma$.

There are several aspects to be noticed from the illustration: Firstly, the strikingly flat response under individual bargaining compared to the efficient collective bargaining equilibrium outcome. As competition decreases, firms exit the market leaving the remaining firms with more monopoly power and thus relatively higher profits from production. It follows that in the collective bargaining economy, unemployment increases and workers demand a higher surplus to maintain a constant profit share. In the individual bargaining economy firms decide to overhire to secure a larger share of the increasing surplus. Thus individual bargaining firms hire more workers as the other firms leave the market, in the end keeping both employment and wages almost unaffected.

Secondly, the distributional impact of bargaining regime is even more evident when we illustrate the effect of product market competition. Under collective bargaining the degree of competition has a strong and negative effect on worker surplus, while a change in unemployment benefits leaves the surplus from employment approximately constant. It’s clear from Figure 3 that under collective bargaining firm and workers share the cost of higher unemployment benefits, in the same way they also share the gain from increased
monopoly power to the firm. From the individual bargaining simulation the worker surplus is almost unaffected by the degree of competition, but is clearly decreasing in unemployment benefits. Thus individual bargaining firms secure the increased profits from monopoly power through overhiring. Likewise, the individual bargaining firm earns the higher profits when wage demand increases; this leads to a decreasing worker surplus with the degree of unemployment compensation.

Thirdly, the sharp rise in unemployment under collective bargaining occurs as an outcome of both high unemployment benefits and monopoly power to the firm. Figure 3 thus suggests that it’s neither the regulated market nor high unemployment benefits as a single factor alone that cause the high level of unemployment in the collective bargaining version of the model. It follows that the degree of product market competition is essential when considering the implications of a cut in benefit entitlements. Likewise, the model illustrates that the potential gain of deregulation crucially depends on the level of unemployment benefits.

In Germany the degree of product market competition as calibrated in the model is relatively low, so the equilibrium response illustrated in Figure 2 suggests that a cut in benefit entitlements may be an effective cure against high unemployment rates. But to draw the same conclusion for the long-run economy, we need first to account for the possible adjustment in the degree of product market competition due to the free entry condition and the stability of bargaining institution choice.

### 5.2.3 The Free Entry Condition

In long-run equilibrium the degree of product market competition is determined by the free entry condition: Firms will enter the market until profit net of entry costs equals zero, thus removing the incentive for more firms to join the market. As profit decreases and total barrier cost increases in the degree of competition, there exists only one long run equilibrium solution of $\sigma$ for each possible level of $\lambda$. Thus the potential change in product market competition depends indirectly on the lasting change in unemployment benefits through the equilibrium outcomes of firms entry cost and profits: When profit surpasses entry costs, firms will enter the market leading to an increase in product market competition. Alternatively, when a shift in unemployment benefits leads to negative net profits, firms will
with time be pushed out of the market, thus increasing the long-run monopoly power of the individual firm.

The barrier cost of entry in the model reflects the time and investment needed by the individual firm to establish itself in the market. Following the procedure of Ebell and Haefke (2006), the cost is divided into a regulatory delay and fees which are determined as a share of aggregate monthly income. Hence, a decrease in unemployment does not only lead to a higher level of long run production and profit in the model, but it also increases the cost of entry to the firm.

Figure 5 and 6 illustrate the equilibrium response of profits and entry costs from a lasting change in unemployment benefits. The first row of Figure 5 refers to the initial case where \( \sigma = 11.95 \), suggesting the potential adjustment in the long run degree of competition. In the collective bargaining economy, the free entry condition is fulfilled for the initial level of unemployment benefits from the calibration where \( h = 0.57 \). The second row illustrates the absolute value of profit net of entry costs in general equilibrium for several degrees of product market competition. We see that profit net of entry costs is positive for low levels of competition in both bargaining economies. As the degree of competition increases, profit net of entry costs falls. When profit net of entry costs equals zero, then an increase in competition leads to negative values, which in the Figure 5 is illustrated by a rise in the absolute value of profit net of entry costs. Thus Figure 5 determines the long-run degree of competition where profit net of entry costs equals zero. Figure 6 illustrates separately real profits and entry costs to the firm in both bargaining economies as a function of both \( h \) and \( \sigma \).

As individual bargaining firms can increase profit by overhiring, the degree of competition is considerably higher than the degree calibrated from the collective bargaining economy. This is confirmed by Figure 5: Bargaining firms will enter the market as long as profit net of entry cost is positive, leading to a higher degree of long-run competition.

From the collective bargaining economy the sharp fall in unemployment as \( h \) decreases is followed by a rise in entry costs. Figure 6 illustrates how entry costs in the collective bargaining economy mirror the level of unemployment depicted in Figure 3. As the adjustment of the collective bargaining firm is always efficient and both workers and firm share the cost of increased unemployment compensation, Figure 6 illustrates an almost
flat response in profits over the level of unemployment benefits. Thus collective bargaining firms experience a higher rise in entry cost than profits as $h$ falls for a given value $\sigma$, leading to the decreasing degree of product market competition as observed in Figure 5.

The paradox of the model simulation is noticeable: The efficient response of the collective bargaining firm as unemployment benefits fall is the same factor that causes the inefficiency of increased monopoly power in the product market. Likewise, the overhiring effect from individual bargaining firms causes the higher degree of competition and thus reduces the inefficiency in the individual bargaining economy.

### 5.2.4 The Equilibrium Response of the Open Market

Figure 7 illustrates the general equilibrium response of a lasting change in unemployment benefits when the model simulation accounts for the adjustment in product market competition. We still observe the same qualitative equilibrium response from a change in unemployment benefits as observed in Figure 2. But now the equilibrium response in unemployment also reflects the adjustment of product market competition as firms may enter or leave the market.

In the collective bargaining economy a cut in unemployment benefits reduces the degree of product market competition.\(^{17}\) Thus firms are pushed out of the market as $h$ falls. The remaining firms experience lower labor costs combined with more monopoly power; naturally they adjust by increasing steady state production. It is clear from Figure 7 that the increased production from lower labor costs dominates the decreased production from lower product market competition, as steady state unemployment in Figure 7 falls when unemployment compensation is reduced. In the individual bargaining economy the positive shift in competition is constant for all levels of unemployment benefits. Hence, the decrease in wage demand implies that unemployment falls, reflecting the adjustment of production within the individual firm.

\(^{17}\) Given the initial value of $h=0.57$ calibrated for the German long-run economy, the collective bargaining economy has the same labor market outcome in Figure 7 as illustrated in Figure 2. Thus I only consider the implication of a cut in unemployment compensation, as the two figures converge for high levels of unemployment benefits when considering the outcome of the collective bargaining economy.
Figure 7 illustrates a change in the size of equilibrium response in the collective bargaining economy due to the adjustment of product market competition. As a decrease in unemployment benefits now is followed by an increase in the firm’s monopoly power, the profit maximizing firm and workers experience an even higher return as unemployment benefits falls. Thus Figure 7 illustrates a stronger response in firm’s profits and the worker’s surplus compared to the equilibrium response depicted in Figure 2. The equilibrium response in unemployment is, however, weaker due to the decreasing degree of product market competition: As unemployment benefits falls, the increased equilibrium production from the individual firm due to lower labor costs is slowed down as the degree of product market competition decreases.

Under individual bargaining, the labor market experience the same shift in the degree of product market competition for all levels of unemployment benefits. From Figure 4 a shift in competition is met by a flat response in labor market outcome to the worker. As explained in the previous section, the overhiring effect under individual bargaining decreases in product market competition and thus counteracts the increased production from firms entering the market. In conclusion, the shift in labor market outcome from opening the market is relatively small in the individual bargaining economy compared to the shift in product market competition.

Due to the relatively weaker response in collective bargaining unemployment compared to the closed market, the adjustment in product market competition enhances the gain from the individual bargaining alternative for low levels of unemployment compensation. The negative shift in the individual bargaining outcome secures a larger gain for all levels of unemployment benefits. Given the initial value of unemployment benefits from the calibration where $h = 0.57$, the unemployment rate can now improve from 9.9% under collective bargaining to 4.3% under individual bargaining. For the significantly lower level of unemployment compensation where $h = 0.3$, the potential gain decreases to 5.7% under collective bargaining compared to 3.3% under individual bargaining. Thus Figure 7 illustrates a larger gain in unemployment from individual bargaining when the model simulation account for the indirect effect of product market competition.

To summarize: The same qualitative reaction in labor market outcomes from a lasting change in unemployment benefits can still be observed when we adjust for the degree of
product market competition as in the equilibrium response illustrated in Figure 2. Under both bargaining regimes a cut in unemployment benefits leads to a higher after-tax wage level combined with a fall in unemployment rates.

Also when we take account of product market competition, the potential change in labor market outcome is still considerably stronger under collective bargaining due to the workers' joint power in the negotiation process and the efficient adjustment of the firm. Figure 7 illustrates the trade-off concerning the choice bargaining regime: Under individual bargaining employment appears stable, but with the cost of a relatively small surplus to the worker. Whereas under collective bargaining the worker maintains a higher surplus reflecting the profit share and the firm’s monopoly power in the product market. But due to the firm's optimal adjustment, high levels of unemployment benefits result in high unemployment.

### 5.2.5 Collective Bargaining Stability

Initially the model was calibrated to reflect the high coverage of collective agreements in Germany. For minor changes in the level of unemployment benefits the collective bargaining curve may be a good approximation of the reaction to a policy change in unemployment benefits. But to draw any conclusion to the German labor market from a considerable reduction in benefit entitlements, we first need to consider the stability of each bargaining regime and the potential indirect effect of a change in bargaining institution.

By endogenizing the choice of bargaining institution, I proceed to check numerically how the model simulation fulfills the necessary requirements for Nash equilibriums as stated in Chapter 4. Figure 8 illustrates the three criteria the individual worker will take account of when considering the choice of optimal bargaining regime. The collective bargaining models refer to the long-run economy where all firms engage in collective bargaining, thus all curves are simulated with the labor market tightness $\theta_r$. Likewise, the individual bargaining models refer to the long-run version of the model where all firms engage in individual bargaining, making the labor market tightness equal to $\theta_f$. Each figure shows the outcome the individual worker achieves if the firm sticks to the dominating bargaining process of the economy. It also illustrates the outcome if the individual firm were to deviate to the alternative bargaining regime. Thus Figure 8 makes it possible to evaluate the potential gain or loss to the individual worker if the firm deviates to the alternative bargaining process, by
either considering the relative wage, the expected utility or the relative employment of the firm.

By first focusing on the employment criteria, we can determine whether the worker will consider the relative wage level or the relative change in expected utility as the crucial factor determining the optimal bargaining institution. When all firms engage in individual bargaining a deviation to collective bargaining leads to an increase in the number of employed workers in the deviating firm, if \( h \) is less or equal to 0.44. If \( h \) exceeds 0.44, the collective bargaining firm will hire fewer workers than under individual bargaining. Thus the individual worker will consider the wage criteria if \( h \leq 0.44 \), and then switch to consider expected utility of importance. As both criteria show that a deviation to collective bargaining leads to higher expected utility, the individual worker will choose to deviate for all levels of unemployment benefits. If \( b \leq 0.44 \), the deviation will secure every worker in the firm higher utility through increased real wage. When \( b \) exceeds 0.44, the risk neutral worker is only secured an increase in expected utility. The actual outcome to the individual worker depends on the worker’s luck in the transition from individual to collective bargaining in the firm. In the case where a worker loses his job, he would actually be better off sticking to individual bargaining. But as this information is only revealed after the firm deviates, the risk neutral worker still chooses collective bargaining as the expected gain in utility is positive. Thus we can conclude from the Figure 8 that individual bargaining is not a symmetric Nash equilibrium in the model.

Alternatively, when all firms engage in collective bargaining a deviation to an individual bargaining firm leads to a rise in the number of employees for all levels of unemployment benefits. Thus the individual worker only considers the wage criteria of importance in the collective bargaining version of the model. From Figure 8, workers will earn a higher wage by sticking to the collective bargaining firm until unemployment benefits converges to its upper limit, only then will a change of bargaining process in the individual firm secure the higher income.

In conclusion, it’s clear from Figure 8 that the effect of increased employment from individual bargaining firms is dominated by the relatively higher worker's surplus under collective bargaining. In the individual bargaining version of the model, employment is high even if one firm chooses to deviate, thus the worker will prefer the higher surplus secured from the collective bargaining process. In the collective bargaining economy, however, the
increase in firm employment under individual bargaining makes the worker only consider the relative wage. And as both types of firm base the bargaining process on the same equilibrium labor market tightness, collective bargaining firms maintain a higher wage due to the sharing rule of the surplus. Only when unemployment benefits converge to the upper limit and exhaust the collective bargaining economy, will the individual worker consider individual bargaining.

5.3 Robustness Checks

To check the robustness of my results, I proceed by varying the key targets in the calibration. The results are reported in Figure 9 - 16. Each figure illustrates the alternative equilibrium response of the open market given the new calibration target. Thus all figures should be compared to Figure 7 in the previous analysis. The first column in the table reported to each figure, refers to the new long-run equilibrium solution from the alternative calibration of the model. Further, the table reports the equilibrium outcomes of both bargaining economies when $h$ is reduced to 0.3.

I find only a slight change of results when I vary the annual interest rate, the mean duration of unemployment and the labor market tightness. For the annual interest rate and the mean duration of unemployment I set the values in the calibration to two alternative calibration targets. Varying the interest rate target shows minor effects in the model results, while varying the mean duration of unemployment has an almost negligible impact. Replacing the labor market tightness with the median value from the data leads also to a negligible change in labor market outcomes.

However, the results are more sensitive to changes in calibration targets of entry costs and the probability of firm exit. In Figure 14 I reduce the regulatory delay $cl$ and entry fees $f$ respectively to 0.118 and 41.4, which is 75% of their values from the original calibration. This results in an increase in the degree of product market competition in the individual bargaining economy and a convergence of equilibrium outcomes in the two bargaining economies. Further, changing the firms exit rate in Figure 15 and 16 leads to a noticeable reaction in individual bargaining outcome: Decreasing $\delta$ to 0.004 leads to a convergence of outcomes in the individual bargaining economy to the outcomes in the
collective bargaining economy. Whereas increasing $\lambda$ to 0.006 separates the equilibrium outcomes of the individual bargaining economy and decreases the level of unemployment in the individual bargaining economy to the low level of 0.4% when $b = 0.57$. The reason is that the firm exit rate determines the rate which firm discounts profits and entry costs (see section 2.1). Thus increasing the exit rate increases the discounted value of entry costs to the firm and makes it less profitable for firms to enter the market. This leads to the relatively weaker response in competition due to the free entry condition in Figure 16. Likewise, Figure 15 illustrates that decreasing firms exit rate leads to a stronger response in product market competition, especially for the individual bargaining economy. This only confirms the result of section 5.2.2: The equilibrium response of a change in unemployment benefits depends crucially on the degree of product market competition. Thus I conclude that the calibration and model results are sensitive to factors that influence the adjustment of product market competition.

6. Conclusion

Even though the policy experiment is mainly illustrative, the model simulation provides important insight into the linkage between unemployment benefits and the choice of bargaining regime. The policy experiment has three main findings: First, it illustrates the importance of bargaining economy when considering the size of equilibrium response. In the collective bargaining economy an increase in unemployment compensation is met by a strikingly stronger response in steady state unemployment and after tax wages compared to the individual bargaining economy. This follows from the collective bargaining process, which secures an efficient adjustment of the firm and an even distribution of the cost of increased wage demand between firm and workers. Under individual bargaining the firm has the freedom to overhire. This keeps employment relatively high even when wage demand increases, but at the cost of a considerably reduced surplus to individual bargaining workers for all degrees of unemployment compensation. Second, the degree of product market competition is an essential contributor to the high level of unemployment in the collective bargaining economy. As the worker surplus reflects the firm’s monopoly power in the product market, low levels of competition leads to a stronger reaction in collective bargaining wage and unemployment as wage demand increase. And third, even though the individual bargaining economy shows a weaker response in steady state unemployment for
high levels of unemployment benefits, the workers in the model choose to form bargaining coalitions for all levels of unemployment compensation. As the choice of bargaining institution is only a choice of the working part of the economy, collective bargaining is preferred as it secures a higher surplus from employment.

How does the result of the policy experiment relate to the recent replacement scheme in Germany, taken as a measure to active the unemployed? The replacement scheme in Germany involved a reduction in benefits entitlements to unemployed workers, which in the model of Ebell and Haefke (2006) corresponds to a reduction in the degree of unemployment compensation. As the collective bargaining economy is the preferred choice for all levels of unemployment benefits in the policy experiment, the model suggests that German workers will also continue to form bargaining coalitions after the cut in unemployment benefits. This has two main implications for the German labor market: First, the model indicates that long-run level of unemployment will fall combined with and increase in the real after-tax wage level. And second, the model suggests that the relative gain from a deregulation in the product market will decrease: As unemployment falls with the degree of unemployment compensation in the collective bargaining economy, so falls the social gain of lower steady state unemployment in the individual bargaining economy.

In the collective bargaining economy the model simulation suggests that the reduction in benefits entitlements leads to a considerable reduction in unemployment accompanied by an increase in bargaining wage. This follows from the combination of the firm’s optimal adjustment and the joint power of the workers in the bargaining process. However, the German labor market is characterized by a high coverage of collective agreements which covers whole sectors or industries. Existing research suggest that this type of bargaining system is not known to promote relative wage flexibility, which raises the question if the German labor market really is responsive to policy measures as the one described here (Calmfors, 2004). An alternative setting for the collective bargaining process is the so called right-to-manage collective bargaining where the firm and the coalition of workers only consider wages in the bargaining process. As the right-to-mange bargaining setting lets the firm freely choose the number of workers to hire, it gives the firm the opportunity to overhire also under collective bargaining. As illustrated by the model simulation the overhiring effect under individual bargaining leads to a considerably weaker response in labor market outcome from a cut in benefit entitlements. Thus right-to-manage removes one
of the factors leading to the strong response in labor market outcome under collective bargaining, which may improve the model by making it more compatible to the German bargaining system.

In conclusion, there are many factors that have to be taken into account before it is possible to determine the real effectiveness of unemployment benefits as a policy instrument. In my contribution to this evaluation the degree of product market competition is shown to be a decisive factor for the size of labor market response. Likewise, by considering alternative bargaining settings, one could improve the policy experiment by making the search and matching model more representative for the German labor market.
References


Neugart, M (2005): Why German Labour Market Reform has begun, Institute of Economic Affairs, Blackwell Publishing, Oxford

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## Appendix A: Tables

### Table 1: Calibration to German Data / Baseline Values

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<tr>
<th>Parameter</th>
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Appendix B: Figures

Figure 1: The Shift in German Benefit’s Entitlements

The replacement rates are based on the OECD summary measures (Martin, 1996). The gross replacement rate is the average of the gross unemployment benefit replacement rates for two earnings levels, three family situations and three durations of unemployment. The net replacement rate is an overall average of the net unemployment benefit replacement rates for two earnings levels and four family situations over 60 months of unemployment (OECD, 2007).
Figure 2: The Equilibrium Response

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Figure 3: Equilibrium Response under Collective Bargaining
Figure 4: Equilibrium Response under Individual Bargaining
Figure 5: The Free Entry Condition and the Long-Run Degree of Product Market Competition
Figure 6: Firm’s Profit and Entry Costs

Collective Bargaining: Real Profits

Collective Bargaining: Entry Costs

Individual Bargaining: Real Profits

Individual Bargaining: Entry Costs
Figure 7: The Equilibrium Response of the Open Market

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Figure 8: Determining Bargaining Institution Stability

Endogenous bargaining institution: Criteria for symmetric Nash equilibrium
Figure 9: Robustness to Choice of Annual Interest Rate,

Annual Interest Rate = 3.5%

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Figure 10: Robustness to Choice of Annual Interest Rate,

Annual interest rate = 4.5 %

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Figure 11: Robustness to Choice of Mean Duration of Unemployment,

\[ \frac{1}{f(\theta_{\mu})} = 7.5 \]

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Figure 12: Robustness to Choice of Mean Duration of Unemployment,

\[ \frac{1}{f(\theta_u)} = 10 \]

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Figure 13: Robustness to Choice of Labor Market Tightness, $\theta_C = 0.075$, the median value

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<td>0.930</td>
<td>0.926</td>
</tr>
<tr>
<td>Real Profit</td>
<td>0.038</td>
<td>0.046</td>
<td>0.043</td>
<td>0.049</td>
</tr>
<tr>
<td>Reservation Wage</td>
<td>0.853</td>
<td>0.898</td>
<td>0.885</td>
<td>0.901</td>
</tr>
<tr>
<td>Real Wage Cost per Worker</td>
<td>0.954</td>
<td>0.943</td>
<td>0.948</td>
<td>0.937</td>
</tr>
<tr>
<td>Worker's surplus</td>
<td>0.039</td>
<td>0.019</td>
<td>0.044</td>
<td>0.026</td>
</tr>
<tr>
<td>Competition</td>
<td>11.95</td>
<td>13.84</td>
<td>11.04</td>
<td>13.86</td>
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</table>
Figure 14: Robustness to Choice of Entry Costs,

\[ f = 0.118 \text{ and } \lambda = 41.4 \]

<table>
<thead>
<tr>
<th>Bargaining Process:</th>
<th>Collective</th>
<th>Individual</th>
<th>Collective</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment Benefits</td>
<td>0.564</td>
<td>0.564</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Unemployment</td>
<td>9.8%</td>
<td>7.7%</td>
<td>6.4%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Tax Rates</td>
<td>0.034</td>
<td>0.026</td>
<td>0.011</td>
<td>0.010</td>
</tr>
<tr>
<td>Real Wage after Tax</td>
<td>0.885</td>
<td>0.892</td>
<td>0.911</td>
<td>0.909</td>
</tr>
<tr>
<td>Real Profit</td>
<td>0.037</td>
<td>0.042</td>
<td>0.046</td>
<td>0.048</td>
</tr>
<tr>
<td>Reservation Wage</td>
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<td>0.860</td>
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<td>0.946</td>
<td>0.939</td>
<td>0.931</td>
<td>0.927</td>
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<tr>
<td>Worker's Surplus</td>
<td>0.039</td>
<td>0.031</td>
<td>0.048</td>
<td>0.044</td>
</tr>
<tr>
<td>Competition</td>
<td>12.04</td>
<td>18.35</td>
<td>10.11</td>
<td>18.37</td>
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</table>
Figure 15: Robustness to Choice of Firm Exit Rate,

\[ \hat{\delta} = 0.004 \]
Figure 16: Robustness to Choice of Firm Exit Rate, \( \tilde{\delta} = 0.006 \)

<table>
<thead>
<tr>
<th>Bargaining Process:</th>
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<th>Individual</th>
<th>Collective</th>
<th>Individual</th>
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</thead>
<tbody>
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<td>0.4%</td>
<td>5.2%</td>
<td>0.3%</td>
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<tr>
<td>Tax Rates</td>
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<td>0.001</td>
<td>0.009</td>
<td>0.000</td>
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<tr>
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<td>0.955</td>
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<tr>
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<td>0.043</td>
<td>0.040</td>
<td>0.043</td>
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<tr>
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<td>0.956</td>
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<tr>
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<td>0.042</td>
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<tr>
<td>Competition</td>
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<td>12.40</td>
<td>11.82</td>
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