Are Product and Labour Market Reforms Mutually Reinforcing?
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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.
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Abstract

This paper analyses the relationship between product market competition and labour market institutions in a general equilibrium context. It concludes that an increase in product market competition, enhanced flexibility of labour supply, social security reform and a reduction in union bargaining power are mutually reinforcing (in terms of their employment impact) in some, but not all cases. This stresses the need for an extremely careful design of such reforms.

JEL codes: E24, E52, J50.

Key words: labour market regulation, wage bargaining.

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1 Introduction

Analysing the macroeconomic impact of product and labour market reforms is complicated by the possibility that some of these factors may interact. Indeed, OECD (2004) finds that it is difficult to establish robust associations between indicators of wage bargaining on the one hand and real wages and employment rates on the other and suggests this may be explained by interaction effects. Belot and Van Ours (2004) also stress that institutions may interact, but conclude that it is difficult to make clear predictions from theory. Blanchard and Giavazzi (2003) provide theoretical support for a positive interaction between union bargaining power and product market competition. They argue that product market deregulation decreases total rents, which will weaken opposition to labour market deregulation. This illustrates that obtaining a better insight into how reforms may interact is of crucial importance to policymakers.

The current paper takes the model by Blanchard and Giavazzi (2003) as a starting point. I make a number of different modeling choices and also extend their model by adding several other types of institutions. This is reflected in the inclusion of measures for the generosity of social assistance and labour market flexibility in the model, in addition to measures for union bargaining power and product market competition. These extensions enable me to analyse whether the positive interaction identified by Blanchard and Giavazzi (2003) extends to other types of deregulation.

The main results are as follows. First, different types of reform are mutually reinforcing in some, though not all cases. In particular, more flexible labour market arrangements enhance the employment impact of other reforms. Enhanced product market competition and a weakening of union bargaining power tend to strengthen each other in terms of their impact on employment, except in the case of centralised wage bargaining. Whether a reduction in social benefits reinforces other reforms depends on whether benefits are based on individual or average wages.

Second, equilibrium employment is lower and the employment impact of labour market reform is higher when social benefits depend on average rather than individual wages. Assuming bargaining at the firm level, unions fail to take into account the impact of wage settlements on the national average wage rate and thus on the level of social benefits in case benefits depend on the average wage rate. This gives rise to more ‘responsible’ wage claims but also to a higher responsiveness of labour supply to wages. On balance, lower
equilibrium employment is the result as wage claims are still too high and labour supply is more responsive to that. Along the same lines, changes in the replacement rate or in union bargaining power have a larger effect on the employment rate when social benefits are linked to average rather than individual wages. Intuitively, decentralised negotiations neglect the impact of their own wage settlements on social benefits, which magnifies the impact of reforms on labour supply.

Third, the employment impact of product market reform and social benefit reform is larger under decentralised bargaining than under centralised bargaining. The reason is that participants in centralised bargaining take into account that social benefits (the outside option) are not costless and also that money wages affect output prices and employment. As a result, several of the interaction terms that reinforce the impact of reforms in case of decentralised bargaining are not present under centralised bargaining.

The remainder of this paper is organised as follows. Section 2 presents the model and derives the equilibrium conditions. Section 3 discusses the impact of product and labour market regulation on the macroeconomic equilibrium and analyses the interaction between different types of reform. Section 4 concludes.

2 The model

The economy contains a number of firms producing a single differentiated good, under monopolistic competition in the goods market, and a number of households (workers/consumers).

2.1 Market structure and preferences

Each firm is a monopolist in the production of a single good. The firm uses only one input: labour. Labour is homogeneous. The production function exhibits constant returns to scale

\[ Y_i = \alpha N_i, \]

where \( N_i \) is employment in firm \( i \), \( Y_i \) is output of good \( i \), and \( \alpha \) is labour productivity (assumed to be equal across firms).

Demand for good \( i \) is given by

\[ Y_i = (Y/m)(P_i/P)^{-\sigma}, \]

\[ \text{(2)} \]
where $Y$ is total demand, $P = \left(\frac{1}{m} \sum_{i=1}^{m} P_i^{1-\sigma}\right)^{1/(1-\sigma)}$ is the general price level and $\sigma$ is the price-elasticity of demand for good $i$.

Profits of firm $i$ are

$$\Pi_i = P_i Y_i - W_i N_i.$$  (3)

There are $L$ households, indexed $j$, with preferences defined over consumption and labour effort

$$U_j = \left(m^{-1/\sigma} \sum_{i=1}^{m} C_{ij}^{\sigma/(\sigma-1)}\right)^{\sigma/(\sigma-1)} - \kappa N_j^{1+1/\delta}, \quad (4)$$

where $U$ is the period utility of a household $j$, $C_{ij}$ is consumption of good $i$ by household $j$, $N_j$ is the amount of labour supplied by household $j$, $m$ is the number of products (fixed in the short run, endogenously determined in the long run), $\sigma = \sigma g(m)$, $\sigma$ is a constant, $g'(\cdot) > 0$, $\delta$ is the wage-elasticity of labour supply and $\kappa$ captures the disutility from work effort.\(^1\)

The household budget constraint is given by

$$\sum_{i=1}^{m} P_i C_{ij} = W_j N_j + WR(1 - N_j) - T_j, \quad (5)$$

where $P_i$ is the price of good $i$, $W_j$ is the wage rate for household $j$, $W$ is the average national wage rate ($W = (1/L) \sum_j W_j$), $T_j$ is the amount of (lump-sum) taxes paid by household $j$, and $R$ is the replacement rate, i.e. the ratio of the unemployment benefit and the wage rate, so that $WR$ equals the level of the unemployment benefit. It seems natural to think of the replacement rate (rather than the absolute level of social benefits) as reflecting social preferences for income equality, so that maintaining the replacement rate at a certain level over time can be thought of as ‘no policy change’. The idea that the replacement rate rather than the benefit level is exogenous is confirmed by Layard et al (1991, page 107). Income is spend in the same period, i.e. there is no intertemporal saving or borrowing.

Unemployment benefits are financed via lump-sum taxation of households. The government budget constraint is $\sum_{j=1}^{L} T_j = \sum_{j=1}^{L} WR(1 - N_j)$.

Under symmetry, households will consume all products in equal proportions, so that $C_{ij} = C_j/m$ and $V_j = C_j - \kappa N_j^{1+1/\delta}$. An increase in the number of goods does not affect household utility directly (but it does via reducing

\(^1\) Appendix A shows that $\delta$ can be interpreted as the labour-supply elasticity.
the monopoly power of firms). Combining equations (4) and (5) and using symmetry, the utility of household $j$ can be rewritten as

$$V_j = \frac{W}{P} R - \frac{T_j}{P} + \left[ \frac{W_j}{P} - \frac{W}{P} R - \kappa N_j^\frac{1}{2} \right] N_j.$$  

(6)

### 2.2 Wage bargaining

Bargaining takes place at the firm level. Each period, every firm bargains with $L/m$ workers. There is bargaining over wages only, i.e. firm $i$ and its workers (represented by a labour union) jointly choose wages to maximise the (log) geometric average of their surpluses from employment

$$\beta \log\{[W_i - WR - P\kappa N_i^\frac{1}{2}] N_i\} + (1 - \beta) \log\{(P_i\alpha - W_i) N_i\},$$  

(7)

where the weight $\beta$ is the relative bargaining power of labour unions. Firms and workers take the general price level and the aggregate level of output and unemployment as given. Firms retain the so-called ‘right-to-manage’, i.e. they set employment after wages have been negotiated. This ‘right to manage’ model seems to be more realistic than efficient bargaining as simultaneous bargaining on wages and employment has only been observed in case of severe corporate problems and mass layoffs. See Layard, Nickell and Jackmann (1991), page 87, and Teulings and Hartog (1998), p. 144. Thus, firms choose output prices (and implicitly output and employment) after nominal wages are set, i.e. they maximise profits (3), subject to production function (1) and goods demand (2).

Wage bargaining involves maximising the joint surplus (7) subject to production function (1) and goods demand (2). Together, this yields the

\[ 3 \text{ Unlike Blanchard and Giavazzi (2003), the current paper clearly distinguishes between the disutility of work effort (which enters via the utility function) and the pecuniary income from being unemployed (which enters via the budget constraint). This distinction enables me to analyse exogenous (policy) changes in the replacement rate and to derive a reduced-form solution for the level of employment in section 3.} \]

\[ 3 \text{ A further advantage of focussing on wage bargaining, rather than efficient bargaining is that there is no need to assume that the attractiveness of work varies with the level of aggregate employment, as Blanchard and Giavazzi (2003) do. Under efficient bargaining, the first-order conditions can only be solved when the value function } V_j \text{ is linear in individual employment } N_j. \text{ Deriving a reduced-form solution for employment then implies the need to impose that the attractiveness of work varies with the level of aggregate employment.} \]
following first-order conditions:

\[
\frac{P_i}{P} = (1 + \mu) \frac{(W_i/\alpha)}{P},
\]

(8)

\[
\frac{1 - \beta}{\alpha P_i - W_i} = \frac{\beta}{W_i - WR - P\kappa N_i^{1/3}},
\]

(9)

where \( \mu = 1/(\sigma - 1) \).

The first equation states that relative output prices are equal to a mark-up over real unit labour costs. This condition determines the size of the joint surplus from employment. The second equation states that the distribution of the joint surplus over workers and firms is proportional to their relative bargaining power.

3 Labour and product market institutions

Next, the reduced-form solution for key economic variables can be derived, in order to analyse the macroeconomic impact of labour and product market institutions (represented by \( \mu, \beta, R, \delta \)). Market-oriented reforms and increased worldwide competition are likely to reduce \( \mu, \beta \) and \( R \) and increase \( \delta \). More specifically, government efforts to reduce barriers to market entry for firms put downward pressure on the markup \( \mu \). Union bargaining power \( \beta \) in the advanced economies is likely to decline as a result of growing international mobility of firms and the emergence of large labour-abundant economies in Asia. Attempts to control the costs of the welfare state are likely to involve a reduction in the replacement rate \( R \). The promotion of more flexible labour arrangements (part-time jobs, temporary employment agencies) and better childcare facilities will likely result in a higher labour supply elasticity \( \delta \).

3.1 Short run

In the short run, the number of firms is taken as given. Combining equations (8)-(9) and imposing symmetry among firms and among households yields the reduced-form solutions for short-run real wages and the level of employment

\[\text{\footnote{Naturally, these parameters are also influenced by other factors. Interpreting changes in these parameters as reflecting structural reforms thus involves a ceteris paribus assumption with respect to these other factors.}}\]
\[
\frac{W}{P} = \frac{\alpha}{1+\mu}, \quad (10)
\]
\[
N = \left\{ \frac{\alpha}{\kappa} \left[ \frac{1}{1+\mu} \left[ \frac{1}{1-\beta} - R \right] - \frac{\beta}{1-\beta} \right] \right\}^\delta, \quad (11)
\]

In the absence of product and labour market distortions \((\mu = R = 0)\), it would follow that \(\frac{W}{P} = \alpha\) and \(N = (\frac{\alpha}{\kappa})^\delta\), i.e. equilibrium values are entirely determined by labour productivity, the disutility of labour effort and the elasticity of labour supply. Since in this case there is no rent to be distributed, the value of \(\beta\) is irrelevant. This is no longer so in the more general case.

Labour market institutions (reflected in \(\beta, \delta, R\)) do not affect the short-run real wage rate. The right to adjust employment after wage negotiations are completed allows firms to ensure that output prices are equal to a mark-up \(\mu\) over unit labour costs, i.e. \(P_i = (1+\mu)W_i/\alpha\). Imposing the general equilibrium condition \(P_i = P\) (given that firms are symmetric) yields equation (10). Put differently, changes in \(\beta, \delta\) or \(R\) affect the labour supply schedule, but firms choose labour demand such that in equilibrium this will only affect the employment rate, not the real wage. A change in product market institutions (reflected in \(\mu\)) will affect the real wage. The intuition is that a higher level of product market competition (as reflected in a lower mark-up) benefits the real wage by putting downward pressure on goods prices.

An increase in the replacement rate \((R)\) reduces the level of employment, as it reduces the net marginal gain from having a job for workers. My finding that the replacement rate has only a small or no effect on real wages but a substantial effect on employment is in line with the empirical evidence reported in Layard et al (1991, p. 211). If social expenditures are higher relative to income \((R\) higher), the unions’ willingness to pursue a policy of wage moderation declines, i.e. nominal wage claims are higher.\(^5\) In equilibrium, real wages are unaffected, but employment is lower. Similarly, an increase in union power \((\beta)\) induces a decline in employment, as higher union power will result in higher (nominal) wage settlements, which will lead firms to choose

\(^5\)Mares (2004) shows that the rational strategy of trade unions is to deliver wage restraint in exchange for the expansion of social policy commitments if a sizeable part of transfers affect union members and if the net benefit of social policy transfers to union members exceeds the tax burden necessary to finance these commitments. However, these conditions are not fulfilled here.
higher output prices and lower output (and hence employment). A lower mark-up ($\mu$) leads to higher employment. The lower degree of monopoly power implies that firms supply more output, thus demanding more labour input. The impact of the wage-elasticity of labour supply ($\delta$) on employment is ambiguous in general, but note that a high elasticity of labour supply reinforces the impact of changes in labour and product market institutions on employment. Intuitively, in a more flexible labour market (more precisely: if labour supply is more sensitive to real wages) reforms will have a larger effect on the volume rather than the price of labour.

More generally, it is easy to show that different types of reforms are mutually re-inforcing in terms of their short-run effect on employment. See appendix B1. The intuition for a positive interaction between $R$ and $\beta$ is fairly straightforward. When the social security system is more generous (high $R$), higher nominal wages are needed to generate the same net income gain from work. This consideration will have a larger impact on equilibrium outcomes when unions are more powerful (high $\beta$). The intuition for a positive interaction between $\mu$ on the one hand and $R$ and $\beta$ on the other is that the mark-up acts as a multiplier between nominal wage settlements and output prices, so that limited product market competition (high $\mu$) re-inforces the employment impact of a high $\beta$ and/or $R$. These findings confirm the idea that institutional reforms interact. It also follows directly from the results in appendix B1 that the impact of a particular institutional reform depends on initial conditions (here: the initial values of $\beta$, $R$, $\mu$, $\delta$), as also suggested by Belot and Van Ours (2004).

### 3.2 Long run

When implementing structural reforms, positive short-run effects (‘quick wins’) may help to build political support, but this is useless if these positive effects disappear (or are even reversed) in the long run.

In the long run, entry and exit of firms is determined by the equilibrium condition that firm rents are equal to entry costs $c$:

$$\frac{\Pi_i}{P} = \alpha(\frac{\mu}{1+\mu})N_i = cN_i.$$ 

After substituting the implied long-run condition $\mu = c/(\alpha - c)$ into the equations (10)-(11), the following long-run general equilibrium solutions for
the real wage and the level of employment are obtained:

\[
\frac{W}{P} = \alpha - c, \tag{12}
\]

\[
N = \left\{ \frac{1}{\kappa} \left[ \alpha(1 - R) - c\left(\frac{1}{1 - \beta} - R\right) \right] \right\}^\delta. \tag{13}
\]

Again, in the absence of product and labour market distortions \((c = R = 0)\), it follows that \(\frac{W}{P} = \alpha\) and \(N = \left(\frac{2}{\kappa}\right)^\delta\).

More in general, the long-run real wage is increasing in the degree of product market competition (i.e. decreasing in the costs of entering the product market \(c\)). Similarly, the long-run level of employment (or, equivalently in this model, the participation rate) is decreasing in the replacement rate \((R)\), the bargaining power of workers \((\beta)\) and the level of entry costs \((c)\).\(^6\) Thus, the short-run and long-run effects of structural reform all go in the same direction.

It is easy to show (analogously to appendix B1) that different reforms are mutually reinforcing in their long-run impact on employment, so that all results are qualitatively the same as for the short run.

### 3.3 Social benefits based on individual wages

It has been assumed so far that the unemployment benefits depend on the average wage rate \(W\). Alternatively, one can assume that the unemployment benefit is related to the individual wage rate (or the firm-level average) \(W_i\).\(^7\)

Replacing the household budget constraint (5) by \(\sum P_iC_{ij} = W_jN_j + W_jR(1 - N_j) - T_j\) has no implications for the firms’ choice of output and prices, but affects wage bargaining. More specifically, it leads to the following

---

\(^6\)This follows from using \(\frac{W}{P} > 0\) (\(\Rightarrow \alpha > c\)), \(\beta > 0\) (\(\Rightarrow \frac{1}{1 - \beta} > 1\)) and \(R < 1\).

\(^7\)In reality, social benefits may be a function of individually earned salaries in the first period of unemployment and then change to an (often lower) percentage of the national average wage rate. See Beissinger and Egger (2004) for a more detailed discussion of the incidence of both types of benefits. The discussion here will be restricted to the two special cases.
reduced-form solutions for short run real wages and employment\textsuperscript{8}

\[ \frac{W}{P} = \frac{\alpha}{1 + \mu}, \]

\[ N = \left\{ \frac{\alpha(1 - R)}{\kappa(1 - \beta)} \left[ \frac{1}{1 + \mu} - \beta \right] \right\} ^{\delta}. \]

The solution for the real wage rate is the same as in the baseline case. The equality of real wages under both regimes is due to the fact that the condition for the real wage follows from profit maximisation, i.e. firms will set output prices equal to a mark-up $\mu$ over unit labour costs, thus ensuring the validity of equation (14).

The solution for employment is different from the baseline case. As before, employment is decreasing in $R$, $\mu$ and $\beta$. However, it is easy to see that equilibrium employment is higher when social benefits depend on individual wages as in equation (15), rather than average wages as in equation (11). There are two effects working in opposite directions. First, given symmetry between firms, any increase in individual (i.e. firm-level) wages will be reflected in an increase in the national wage rate. However, if social benefits depend on average wages (as in the baseline case) participants in decentralised negotiations will disregard the impact of a higher wage ($W_i$) on the outside option ($WR$), which will lead to more modest wage claims.

Second, since the level of the outside option is taken as given in the baseline case, labour supply responds to the wage increase $W_i$ whereas it responds to the increase in the net gains from work $W_i(1 - R)$ if benefits are based on individual wages. Thus, social benefits depending on individual wages leads to higher nominal wage claims, but also to a more moderate response of employment to wages. The second effect dominates, so that employment is higher for all admissible parameter values if social benefits are based on individual wages.\textsuperscript{9}

\textsuperscript{8} This is the solution for the short run. The long-run solution is $\frac{W}{P} = \alpha - c; N = \left\{ \left( \frac{\alpha}{\kappa} \right) \frac{1 - R}{1 - \beta} \left( \frac{\alpha - c}{\alpha} - \beta \right) \right\} ^{\delta}$. The qualitative statements that follow apply to both the short run and the long run.

\textsuperscript{9} Beissinger and Egger (2004) also find that benefits being tied to individual wages leads to higher wage claims than if benefits are tied to average wages. The current paper shows that the resulting equilibrium level of employment is still lower in case of benefits tied to average wages, as the ‘wage claim effect’ is dominated by the ‘labour supply effect’ (i.e. the impact of social security arrangements on the slope of the labour supply curve).
The interaction between different types of reform is qualitatively the same as in the baseline case, except for social benefit reform. As before, labour market flexibility (as reflected in a high labour supply elasticity $\delta$) is reinforcing the employment impact of other reforms. Moreover, the impact of strong union power (high $\beta$) and weak product market competition (high $\mu$) on the level of employment is mutually reinforcing. However, the level of the replacement rate is no longer relevant for the employment impact of other types of reform. Nor does the employment effect of a change in the replacement rate depend on union power or product market competition. See appendix B2. Thus, the interaction between different types of reform depends on the precise institutional setting. This indicates that the devil may be in (what may appear to be) the details when designing product and labour market reforms.

Having derived the employment impact of social benefit reform under different assumptions, it is now straightforward to show that an increase in the replacement rate is more detrimental to employment if social benefits depend on national average wages. See appendix B3. Intuitively, an increase in $R$ depresses equilibrium employment by pushing up nominal wage claims and the impact on employment is larger in case decentralised negotiators neglect the impact of their own wage settlements on social benefits, as will happen when benefits depend on average wages.

### 3.4 Centralised bargaining

So far we have assumed wage bargaining takes place at the level of the firm. Centralised wage bargaining is different in at least two aspects. First, participants in centralised bargaining take into account that social benefits need to be financed by taxing workers. Thus, effectively there is no outside option from the perspective of a centralised labour union. Second, negotiators at the central level understand how money wages affect the general price level and employment. The reduced-form solutions for short run real wages and
Equilibrium employment in case of centralised wage bargaining is higher than in both decentralised cases discussed before, as would be expected given that the scope for coordination failures is smaller in this case.

In contrast to previous cases, the replacement rate $R$ is irrelevant for equilibrium employment. Employment is decreasing in the degree of product market competition $\mu$, as before, but increasing in union power $\beta$. The explanation for the latter is that unions now take into account that they cannot affect the equilibrium real wage, so they endeavour to maximise employment.

Under centralised bargaining it is still the case that initial conditions are relevant for the impact of structural reforms on equilibrium employment, in the sense that the marginal impact of a change in $\mu$ or $\beta$ depends on the initial values of both $\mu$ and $\beta$.

In terms of interactions, the elasticity of labour supply $\delta$ is still of importance for the employment impact of changes in product market competition or union power. However, there are no interactions between $\mu$, $\beta$ and $R$ in this case. Thus, this is another example where reforms are not necessarily mutually re-inforcing.

4 Conclusion

This paper focussed on the possible interaction between different types of reforms. Blanchard and Giavazzi (2003) provide theoretical support for a positive interaction between union bargaining power and product market competition. The current paper extends their model by distinguishing between different labour market institutions. This is reflected in the inclusion of the replacement rate (the level of social benefits as a percentage of the wage rate) and the elasticity of labour supply in the model, in addition to

\[ \frac{W}{P} = \frac{\alpha}{1 + \mu}, \quad (16) \]
\[ N = \left\{ \left( \frac{\alpha}{\kappa} \right) \frac{1}{1 + \mu} \left( \frac{1}{1 - \beta} \right) \right\}^{\delta}. \quad (17) \]

\(^{10}\) This is the solution for the short run. The long-run solution is $\frac{W}{P} = \alpha - c; N = \left\{ \frac{1}{\kappa} (\alpha - c) \right\}^{1/(1 - \beta)} \delta$. The qualitative statements that follow apply to both the short and the long run.
measures for union bargaining power and product market competition. These extensions enable me to analyse whether the positive interaction identified by Blanchard and Giavazzi (2003) between union bargaining power and product market competition extends to other types of deregulation.

The main results are as follows. First, different types of reform seem to be mutually reinforcing in many, though not all cases. In particular, more flexible labour market arrangements enhance the employment impact of other reforms. Moreover, enhanced product market competition and a weakening of union bargaining power tend to strengthen each other in terms of their impact on employment. However, whether a reduction in the level of social benefits reinforces other reforms depends on the precise institutional setting. This demonstrates that product and labour market reforms need not be mutually reinforcing in all cases.

Second, the employment impact of labour market reform is higher when social benefits depend on average rate rather than individual wages, as the ‘wage claim effect’ stressed by Beissinger and Egger (2004) is dominated by the impact of social security arrangements on the slope of the labour supply curve.

Third, the employment impact of product market reform and social benefit reform is larger under decentralised bargaining than under centralised bargaining. The reason is that participants in centralised bargaining take into account that social benefits (the outside option) are not costless and also that money wages affect output prices and employment. As a result, several of the interaction terms that reinforce the impact of reforms in case of decentralised bargaining are not present under centralised bargaining.

My findings suggest that positive interaction between different reforms is found in those cases where equilibrium employment is lowest, i.e. in those cases where it is needed most. They also suggest that increasing labour market flexibility may or may not have a direct positive impact on employment (depending on other distortions) but will help to generate visible effects of other reforms on employment. Finally, when designing product and labour market reforms the devil may be in (what appear to be) the details.
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Appendices

A Labour supply elasticity

Labour supply can be derived from the first-order conditions for households:

\[
\frac{\partial U_j}{\partial N_j} = 0 \Rightarrow N^S_j = \left\{ \frac{1}{\kappa(1 + \frac{1}{\delta})} \frac{W_j}{P}(1 - R) \right\}^\delta,
\]

where I have used that individual households take aggregate wages and prices, the replacement rate and the level of taxation as given. Then it is easy to show that:

\[
\varepsilon_S = \frac{\partial N^S_j / \partial (W_j/P)}{N^S_j / (W_j/P)} = \delta.
\]

This derivation is based on the case of centralised bargaining. The same result is obtained in case of decentralised bargaining with social benefits depending on individual wages. In case of decentralised bargaining with social benefits depending on national average wage rates, it follows that \( \varepsilon_S = \delta/(1 - R) \). However, this does not preclude interpreting \( \delta \) as a measure for the wage-elasticity of labour supply also in this case. The multiplier \( 1 - R \) turns out to be important in explaining the employment impact of different social security arrangements (benefits depending on individual vs average wages). Also see Appendix C.
B  Interactions between reforms

B.1  Social benefits depending on average wages

The marginal impact of reforms on equilibrium employment can be derived by taking derivatives from equation (11) in the main text:

\[
\frac{\partial N}{\partial \beta} = \delta N \frac{(-1 + \frac{1}{1+\mu})/(1 - \beta)^2}{\frac{1}{1+\mu} - R - \frac{\beta}{1-\beta}},
\]

\[
\frac{\partial N}{\partial R} = \delta N \frac{-\frac{1}{1+\mu}}{\frac{1}{1+\mu} - R - \frac{\beta}{1-\beta}},
\]

\[
\frac{\partial N}{\partial \mu} = \delta N \frac{-\frac{1}{(1+\mu)^2}(1 - \beta) - R}{\frac{1}{1+\mu} - R - \frac{\beta}{1-\beta}}.
\]

It is then easy to show that all cross-derivatives (i.e. \(\frac{\partial}{\partial \beta} \frac{\partial N}{\partial \mu}\), \(\frac{\partial}{\partial \beta} \frac{\partial N}{\partial \delta}\), \(\frac{\partial}{\partial \beta} \frac{\partial N}{\partial R}\), \(\frac{\partial}{\partial \mu} \frac{\partial N}{\partial \delta}\), \(\frac{\partial}{\partial \mu} \frac{\partial N}{\partial R}\)) are negative. However, the cross-derivatives involving \(R\) (i.e. \(\frac{\partial}{\partial R} \frac{\partial N}{\partial \beta}\), \(\frac{\partial}{\partial R} \frac{\partial N}{\partial \mu}\), \(\frac{\partial}{\partial R} \frac{\partial N}{\partial \delta}\)) are equal to zero.

B.2  Social benefits depending on individual wages

The marginal impact of reforms on equilibrium employment can be derived by taking derivatives from equation (15) in the main text:

\[
\frac{\partial N}{\partial \beta} = \delta N \frac{\frac{1}{1+\mu} - 1}{(1 - \beta)(1 + \mu - \beta)},
\]

\[
\frac{\partial N}{\partial R} = \delta N \frac{-1}{1 - R},
\]

\[
\frac{\partial N}{\partial \mu} = \delta N \frac{-1}{(1 + \mu)^2(1 - \beta) - (1 - \beta)}.
\]

In this case, it is easy to demonstrate that the cross-derivatives \(\frac{\partial}{\partial \beta} \frac{\partial N}{\partial \mu}\), \(\frac{\partial}{\partial \beta} \frac{\partial N}{\partial \delta}\), \(\frac{\partial}{\partial \beta} \frac{\partial N}{\partial R}\), \(\frac{\partial}{\partial \mu} \frac{\partial N}{\partial \delta}\), \(\frac{\partial}{\partial \mu} \frac{\partial N}{\partial R}\) are negative, as before. However, the cross-derivatives involving \(R\) (i.e. \(\frac{\partial}{\partial R} \frac{\partial N}{\partial \beta}\), \(\frac{\partial}{\partial R} \frac{\partial N}{\partial \mu}\), \(\frac{\partial}{\partial R} \frac{\partial N}{\partial \delta}\)) are equal to zero.
B.3 Effectiveness of social benefit reforms compared

The employment impact of a change in the replacement rate when social benefits depend on the national average wage rate follows directly from appendix B1:

$$ \left( \frac{\partial N}{\partial R} \right)_{\text{avg}} = \delta \frac{-\frac{1}{1+\mu}}{\frac{1}{1+\mu} \left( \frac{1}{1-\beta} - R \right) - \frac{\beta}{1-\beta}}, $$

whereas the employment impact of a change in the replacement rate when social benefits depend on the individual wage rate follows directly from appendix B2:

$$ \left( \frac{\partial N}{\partial R} \right)_{\text{ind}} = \delta \left( -\frac{1}{1 - R} \right). $$

It is then easy to show that, in terms of absolute size, $\left( \frac{\partial N}{\partial R} \right)_{\text{avg}} > \left( \frac{\partial N}{\partial R} \right)_{\text{ind}}$.

C Employment outcomes in different situations

This appendix compares the expressions for equilibrium employment in four situations: (1) no distortions (2) labour and product market distortions with centralised wage bargaining (3) labour and product market distortions with decentralised wage bargaining and social benefits tied to individual wages (4) labour and product market distortions with decentralised wage bargaining and social benefits tied to average wages.

(1) In the absence of distortions, equilibrium employment is $N = \left( \frac{\alpha}{\kappa} \right)^{\delta}$.

(2) Under centralised wage bargaining, equilibrium employment is

$$ N = \left[ \frac{\alpha}{\kappa} \frac{1}{1+\mu} \left( \frac{1}{1-\beta} \right) \right]^{\delta}. $$

Compared to the situation without distortions, imperfect competition in the goods market ($\mu > 0$) causes firms to reduce output (and hence employment) to below the level they would choose under perfect competition. This explains the factor $\frac{1}{1+\mu}$ in the expression above. Unions with market power in labour market ($\beta > 0$) know they are unable to affect the real wage rate, so they negotiate in order to maximise employment. This explains the factor $\frac{1}{1-\beta}$.
Under decentralised wage bargaining and with social benefits tied to individual wages, equilibrium employment is

\[ N = \left\{ \frac{\alpha(1-R)}{\kappa(1-\beta)} \left[ \frac{1}{1+\mu} - \beta \right] \right\}^\delta = \left\{ \frac{\alpha}{\kappa} \left[ \frac{1}{1+\mu} \left( \frac{1}{1-\beta} \right) - \left( \frac{R}{1+\mu} \right) \frac{1}{1-\beta} - (1-R) \frac{\beta}{1-\beta} \right] \right\}^\delta. \]

There are two main differences compared to the situation of centralised wage bargaining. First, participants in decentralised negotiations do not look through fiscal issues: they do not take into account that higher benefits will need to be financed by higher taxes. Rather, they consider social benefits as a costless outside option in case of unemployment. As a result, workers (unions) will value employment less and choose to work less. This shows up in a multiplicative term \((1-R)\) in the first line of the previous equation or, equivalently, in an additive term \(-\left( \frac{R}{1+\mu} \right) \frac{1}{1-\beta}\) in the second line of this equation. Second, decentralised negotiations do not take into account that money wages will affect output prices and employment. As a result, they are more inclined to demand higher wages, which results in a lower equilibrium level of employment. This is reflected in an additive term \(-\beta\) in the first line of the equation or, equivalently, in an additive term \(-\left(1-R\right) \frac{\beta}{1-\beta}\) in the second line of this equation. Thus, decentralised negotiations imply two coordination failures that both have a negative effect on employment.

Under decentralised wage bargaining and social benefits tied to average wages, equilibrium employment is

\[ N = \left\{ \frac{\alpha}{\kappa} \left[ \frac{1}{1+\mu} \left( \frac{1}{1-\beta} \right) - \left( \frac{R}{1+\mu} \right) \frac{1}{1-\beta} - (1-R) \frac{\beta}{1-\beta} \right] \right\}^\delta. \]

There are the same two main differences compared to the situation of centralised wage bargaining. First, participants in decentralised negotiations do

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11 The first line of this equation is the version in the main text. The second line of this equation facilitates comparison to the situation of decentralised wage bargaining with benefits related to average wages.

12 The first line of this equation is the version in the main text, whereas the second line facilitates comparison to the situation of decentralised wage bargaining with benefits related to individual wages.
not look through fiscal issues. However, benefits being tied to average wages implies that decentralised unions do not take into account that the value of this ‘costless’ outside option increases when the wage claim increases. As a result, unions will now claim more moderate wages than in the previous case. Thus, the negative impact of this channel on employment is now smaller (an additive term \(-\frac{R}{1+\mu}\) rather than \((\frac{R}{1+\mu})\frac{1}{1-\beta}\) in the previous case). Second, decentralised negotiations do not take into account that money wages will affect output prices and employment, implying too high wage claims. However, given that decentralised unions (workers) do not take into account that benefits rise with wages in this case, labour supply will be based on the assumption that a wage increase results in an equally large increase in the gap between wages and social benefits, rather than an increase in this gap of only \(1 - R\) times the wage increase, as when they assume benefits rise along with the wage claim. As a result, the wage elasticity of labour supply is larger by a factor \(\frac{1}{1-R}\) (see also appendix A), so that the negative impact of too high wage claims on employment is now larger (an additive term \(-\frac{\beta}{1-\beta}\) rather than \(-(1 - R)\frac{\beta}{1-\beta}\) in the previous case).

When comparing both decentralised cases, it turns out that the second channel (impact on the slope of the labour supply curve) outweighs the first channel (impact on the incentive to demand high wages), so that equilibrium employment is lower if social benefits are tied to the average wage rate.
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