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Auteurs

Amélie Barbier-Gauchard, Francesco De Palma, Giuseppe Diana

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Faculté des sciences économiques et de gestion

Pôle européen de gestion et
d'économie (PEGE)
61 avenue de la Forêt Noire
F-67085 Strasbourg Cedex

Secrétariat du BETA

Géraldine Manderscheidt
Tél. : (33) 03 68 85 20 69
Fax : (33) 03 68 85 20 70
g.manderscheidt@unistra.fr
www.beta-umr7522.fr



Why could Northern labor market flexibility save the eurozone ?

Amélie BARBIER-GAUCHARD*,
Francesco De PALMA†,
Giuseppe DIANA‡

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Abstract: We consider a heterogenous labor market in a two-country monetary union. The domestic economy is characterized by a dual labor market with formal and informal sectors as observed in most Southern EMU economies. Among formal workers, wage-levels result from efficiency considerations. In the foreign economy, with reference to Northern EMU economies, we assume another type of wage rigidity explained by the presence of unions. More precisely, only wages are bargained between firms and employees as in the right-to-manage model. These rigidities lead to inefficient allocations of workers in each country: a misallocation of workers among sectors in the domestic country and unemployment in the foreign one.

In this context, the labor market flexibilization may appear as a relevant option for improving the situation of activity and employment in the monetary union. This is the reason why we investigate the overall effects of a decrease in trade union bargaining power in the foreign (Northern) economy. We show that, at the new equilibrium, a lower bargaining power in the foreign economy leads to a decrease in all prices and the effects are positive overall. In the foreign economy, the equilibrium level of production is higher, unemployment decreases and wages are lower. In the domestic one, the production also increases, the labor market benefits from a better allocation of workers between formal and informal sectors, and all wages are higher.

Keywords : efficiency wage, dualism, EMU, trade unions, bargaining

JEL classification : E60, F16, F41, J31

*BETA, University of Strasbourg (France), abarbier@unistra.fr.

†BETA, University of Strasbourg (France), f.depalma@unistra.fr.

‡LARGE, University of Strasbourg (France), giuseppe.diana@unistra.fr.

1 Introduction

The European context is clearly characterized by an economic slowdown. Indeed, most EMU Member States record very low, if not negative growth rates and their labor markets are struggling (unemployment, increase use of informal labor...). The public debt crisis prevents governments from using fiscal policy to sustain economic activity.

In such circumstances, among the different measures proposed both by institutional actors like the European Commission, the IMF or the OECD and by economists, structural reforms seem predominant. The flexibilization of the labor market is now a leitmotiv for many observers. As underlined by the OECD (2004), employment protection is an important feature in many European countries. The rigidity indicators produced by the OECD take into account different aspects of employment protection, such as labor legislation or trade union power.

Recent years have seen a general trend toward more labor market flexibility in Europe, as underlined by the European Commission (2012) and by Räsänen & al (2012). For instance, in 2003, Germany adopted the Hartz IV act putting pressure on the unemployed to return to work. Möller (2012) proposes an overview of labor market reforms in Germany, while Bispinck & al (2010) shed light on the continuous erosion of German collective bargaining in a European perspective. More recently, in 2012, Italy decided to make labor contracts more flexible, despite the lack of agreement with unions. Nunziata (2012) briefly discusses the fundamentals of the Italian labor market and emphasizes the importance of reforming labor market institutions to improve Italy's economic prospects. In Spain, seven important labor market reforms (between 1984 and 2011) have tried to correct the particular structure of the labor market as shown by Bentolila & al (2012). French labour market rules and policy have been intensively reformed over the last 20 years. Askenazy and Erhel (2012) show how anti-cyclical policy and structural flexibility have limited the rise of unemployment in France.

Although many existing studies assess the potential benefits of such labor market reforms (see for example Krebs and Scheffel (2013), Räsänen & al (2012), Burda and Hunt (2011), Jacobi and Kluge (2006) or Layard & al (2005)), the spillover effects are rarely considered. Since economies are interdependent through monetary and commercial relations, as is the case in the Eurozone, it could be relevant to analyze the overall consequences of a labor market reform on a union of countries.

In this paper, we consider a heterogenous labor market in a two-country monetary union. The domestic economy is characterized by a dual labor market with formal and informal sectors¹ as observed in most Southern EMU economies. Empirical evidence underlines the presence of a large informal sector in Southern EMU economies. Among formal workers, wages result from efficiency considerations following Shapiro and Stiglitz (1984). In the foreign economy, with reference to Northern EMU economies, we assume another type of wage rigidity explained by the presence of trade unions. More precisely, only wages are bargained between firms and employees as in the right-to-manage model developed by Nickell and Andrews (1983). These rigidities lead to inefficient allocations of workers in each country: a misallocation of workers among sectors in the domestic country and unemployment in the foreign one.

In this context, the labor market flexibilization may appear as a relevant option to improve the employment situation in the monetary union. This is the reason why we investigate the overall effects of a decrease in trade union bargaining power in the foreign (Northern) economy. We show that, at the new equilibrium, a lower bargaining power in the foreign economy leads to a decrease in all prices. The new macroeconomic outcome depends on the country, although effects are overall positive. In the foreign economy, the equilibrium level of production is higher, unemployment decreases and wages are lower. In the domestic one, the production also increases, the labor market benefits from a better allocation of workers between the formal and informal sectors, and all wages are higher.

The rest of this paper is organized as follows. The second section offers an overview of some features of the labor market in the EMU. The third section presents the model framework. The fourth section describes the characteristics of the equilibrium and the impact of union bargaining power. We conclude in the fifth section.

2 The labor market in the EMU: an overview

Before describing the model, it appears relevant to propose an overview of some distinctive features of European labor markets. More precisely, the purpose of this section is to provide facts and figures to support our theoretical framework, paying a particular attention to rigidities and formal/informal segmentation.

¹See also Barbier-Gauchard & al (2012).

2.1 Various forms of rigidity in Europe

Employment protection levels can be assessed through several indicators. For example, the OECD (2004) considers three major aspects of employment protection: individual dismissal of workers with regular contracts, additional costs for collective dismissals and regulation of temporary contracts. Venn (2009) presents updated estimates of the OECD employment protection indicators. As shown in Figure 1, his study reveals that workers are more protected in continental Europe than in other OECD countries like the USA, Canada, the UK, New Zealand, Ireland and Australia. Moreover, employment protection tends to be stricter in Southern countries than in Northern ones. This observation is particularly true for Spain and Greece.

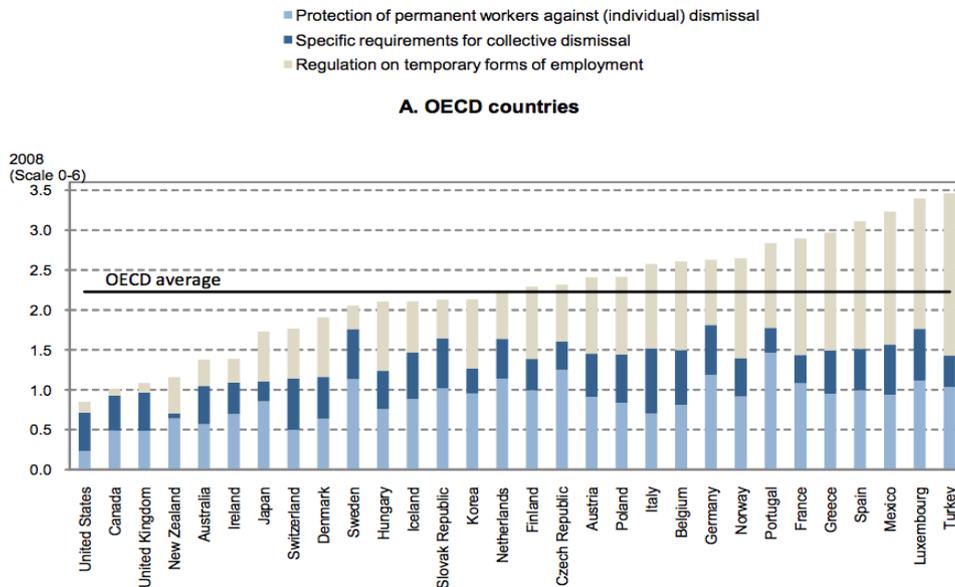


Figure 1: Strictness of employment protection in OECD countries, 2008
Source: Venn (2009)

Although the legislative aspects of employment protection are important, other factors must be considered. Among these factors, Venn (2009) stresses the importance of collective bargaining as a fundamental element of worker protection. One simple way to proxy the weight of union bargaining power is to use union density and bargaining coverage. Figure 2, extracted from Bispinck, Dribbusch, and Schulten (2010), presents the values of these two indicators for various groups of European countries. This figure reveals a high

degree of heterogeneity among EU member States.² However, one feature stands out: the important role of unions in Northern European countries with a union density close to 75% and a bargaining coverage of 87%. On the contrary, in the Southern economies, even if bargaining coverage appears to be significant, the lowest union density rates are observed.

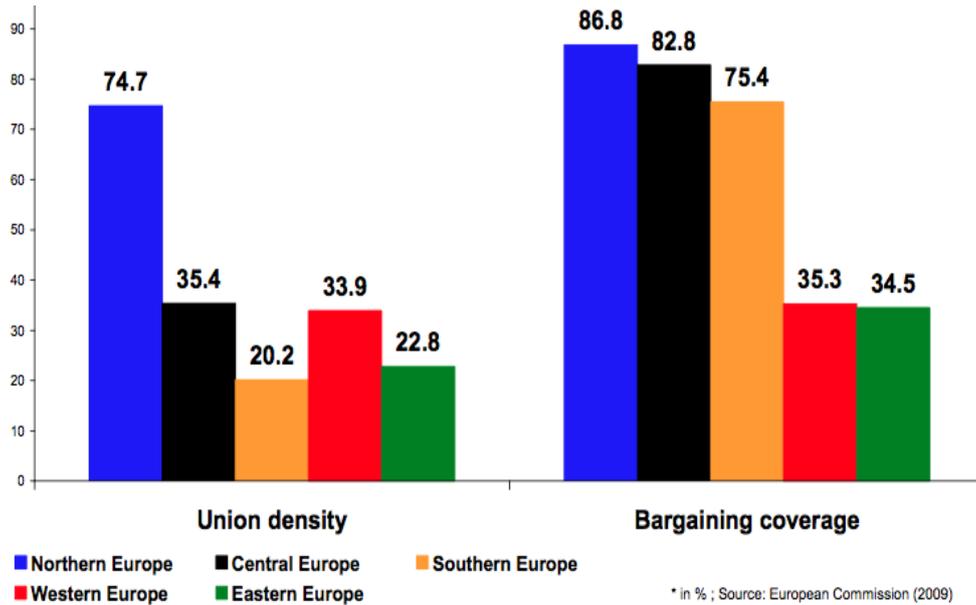


Figure 2: Trade union density and collective bargaining coverage in various groups of European countries (2005-2006). Source: Bispinck & al (2010)

2.2 Formal and informal sectors in Southern European countries

Among the different features of the labor markets, segmentation, or even dualism plays a particular role in Europe. The dualism of labor markets can be observed on several levels such as gender (European Commission (2009)), rural/urban sectors (Zenou (2009)) or skilled/unskilled workers (Teichgraber (2013)). Another form of dualism taken into account in this paper, is the segmentation of the labor market into formal and informal sectors. Andrews & al (2011) propose an analysis to better understand the informal economy that emphasizes its definition and its measurement. Although it's difficult to precisely define the shadow economy concept, one commonly used definition

²See also European Commission (2011).

is, as reported by Schneider & al (2010), "all currently unregistered economic activities that contribute to the officially calculated (or observed) GDP". Among the different explanations for the growth of the informal sector, Schneider & al (2010)³ insist on the weight of the taxes and social security contributions, the intensity of labor market regulation, the unemployment situation⁴ and the generosity of the social welfare system.

Obviously, measuring informality is an intrinsically complex task. Yet, several studies have shown that the shadow economy is a significant reality in Europe. Hazans (2011)⁵ estimates the share of the labor force employed informally in four sets of European countries. As shown in Figure 3, all Southern European countries appear to be heavily informal, with 20% to 53% of extended labor force. On the contrary, the other European countries have a lower level of informal workers, below 20% (except for Ireland, Poland and the United Kingdom).

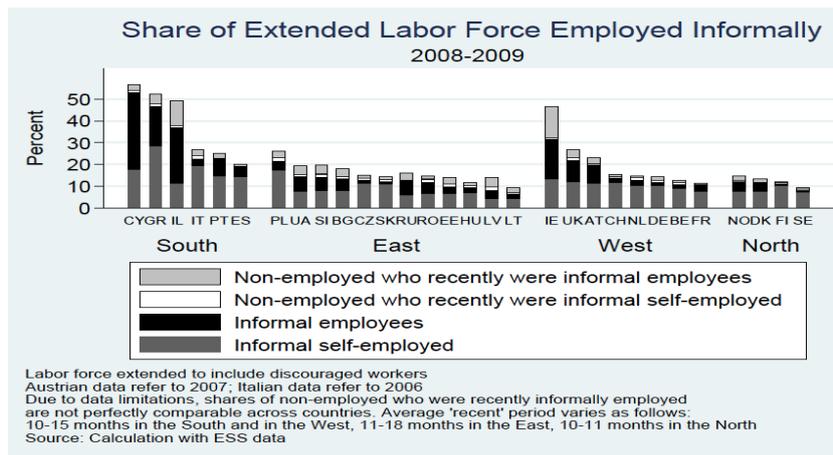


Figure 3: Share of the informal sector in selected European countries (2008-2009). Source: Hazans (2011)

³See also Schneider and Enste (2000).

⁴Moreover, this is a particularly importance factor during economic slowdown periods, characterized by a higher unemployment rate. Indeed, Alvarez-Parra and Sanchez (2009) point out that in economies with a sizable shadow economy, unemployment is a likely event.

⁵See also Schneider & al (2010).

3 Model framework

We consider a monetary union of two countries: country H (home country) and country F (foreign country). Each country produces a single tradable commodity, noted h and f respectively for country H and F . We denote p_h the price of commodity h and p_f the price of commodity f .

Moreover, we introduce a heterogenous labor market in the monetary union consistent with the facts and figures underlined in the previous section. Indeed, the domestic economy (the Southern country) is characterized by a dual labor market with formal and informal sectors. In the foreign economy (the Northern country) we assume the presence of unions.

3.1 Production and labor market in the domestic economy

In the domestic country, the labor market is segmented into two sectors: the primary sector includes formal workers and the secondary sector includes informal workers. Among formal workers, wages result from efficiency considerations, following Shapiro and Stiglitz (1984). On the contrary, in the secondary sector, wages are competitive. Workers who do not find a job in the formal sector, enter the competitive informal one.⁶ The two sectors contribute to the production of commodity h .

In the formal (or primary) sector, the aggregate production function of commodity h is:

$$Y_{h1}(e, L_1) = e^\beta L_1^\alpha \quad (1)$$

where Y_{h1} represents the production of commodity h , $e > 1$ is the worker's effort and L_1 the number of workers in the formal sector. We assume decreasing returns to scale ($\alpha + \beta < 1$) and $0 < \beta < \alpha < 1$. As effort is not observable, the employer has to set a non-shirking condition. As shown in appendix (A), from the non-shirking condition and first-order condition of profit maximization, wages and effort in the formal sector can be expressed as:

$$w_1 = \sigma w_2 \text{ with } \sigma = \frac{\alpha}{\alpha - \beta} \quad (2)$$

⁶It is important to note that this hypothesis does not imply the lack of official unemployment. Rather, It suggests that a worker who does not find a formal job will actually work in the informal sector even if he has an unemployed status. This is possible because labor relations in the informal sector are based mostly on casual arrangements, kinship or personal and social relations rather than contractual arrangements with formal guarantees, as stipulated by the ILO definition of the informal sector.

$$e^*(w_1) = \delta w_1 \text{ with } \delta > 0 \quad (3)$$

where w_1 and w_2 respectively represent the real wages of formal and informal workers.

The representative producer of commodity h in the formal sector maximizes his real profit $\frac{\Pi_{h1}}{P}$, where P is the general price level in the home country.⁷ Using equations (1), (2) and (3) and assuming that the firm incurs no hiring or firing costs:

$$\max_{Y_{h1}} \frac{\Pi_{h1}}{P} = \left\{ \frac{p_h Y_{h1}}{P} - \frac{w_1 Y_{h1}^{1/\alpha}}{e^*(w_1)^{\beta/\alpha}} \right\}$$

From the first-order condition, we obtain the supply of commodity h by the firm in the formal sector and the formal labor demand :

$$Y_{h1}(w_1, z) = (\alpha z)^{\frac{\alpha}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}} w_1^{\frac{\beta-\alpha}{1-\alpha}} \text{ with } \frac{\partial Y_{h1}}{\partial w_1} < 0 \text{ and } \frac{\partial Y_{h1}}{\partial z} > 0 \quad (4)$$

$$L_1^d(w_1, z) = (\alpha z)^{\frac{1}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}} w_1^{\frac{\beta-1}{1-\alpha}} \text{ with } \frac{\partial L_1^d}{\partial w_1} < 0 \text{ and } \frac{\partial L_1^d}{\partial z} > 0 \quad (5)$$

where $z = \frac{p_h}{P}$ is the price of commodity h relative to the general price level.

As a consequence, an increase in the efficiency wage implies a reduction in the formal labor demand and a decrease in commodity supply. Even if this latter negative effect seems obvious at first glance, it results from two opposite effects. On the one hand, we have a negative quantitative effect on production since a higher wage leads to a lower formal labor demand. On the other hand, we find a positive qualitative effect on output because a higher wage raises the optimal level of effort. From expression (4), the negative quantitative effect is larger than the positive qualitative effect, leading to an inverse relation between efficiency wage and production. Moreover, when relative price z increases, the real wage in the primary sector goes down involving a simultaneous increase in formal labor demand and in supply of commodity h .

In the informal (or secondary) sector, the production of commodity f is given by the following production function:

$$Y_{h2}(L_2) = L_2^\alpha \text{ with } \alpha < 1 \quad (6)$$

⁷The general price level P is precisely determined in subsection 3.3.

where Y_{h2} denotes the total quantity of commodity h produced in the informal sector and L_2 the number of informal workers. In this sector, the informal wage is fully flexible and determined by market forces.⁸

The profit maximization program is given by :

$$\max_{Y_{h2}} \frac{\Pi_{h2}}{P} = \left\{ \frac{p_h Y_{h2}}{P} - w_2 Y_{h2}^{1/\alpha} \right\}$$

From the first-order condition, the production of commodity h and the informal labor demand are:

$$Y_{h2}(w_2, z) = \left(\frac{\alpha z}{w_2} \right)^{\frac{\alpha}{1-\alpha}} \quad \text{with} \quad \frac{\partial Y_{h2}}{\partial w_2} < 0 \quad \text{and} \quad \frac{\partial Y_{h2}}{\partial z} > 0 \quad (7)$$

$$L_2^d(w_2, z) = \left(\frac{\alpha z}{w_2} \right)^{\frac{1}{1-\alpha}} \quad \text{with} \quad \frac{\partial L_2^d}{\partial w_2} < 0 \quad \text{and} \quad \frac{\partial L_2^d}{\partial z} > 0 \quad (8)$$

where production and demand for the informal workers are obviously increasing with relative price z and decreasing with real wage w_2 .

Let \bar{L}_H denote the total supply of labor in the domestic economy H , assumed to be constant. Firms in the primary sector set both wages and level of formal employment. Employers then hire formal workers among the total labor force in order to satisfy their labor demand. Workers who do not succeed in finding a job in the formal sector enter the informal sector where wages are the adjustment variable. Formally, the labor market equilibrium can be written as follows:

$$\bar{L}_H - L_1^d(w_1, z) = L_2^d(w_2, z) \quad (9)$$

In order to reduce the model, we decide to express all equilibrium variables only as functions of the real wage in the informal sector w_2 .

Combining equations (2), (5) and (8) with the labor market equilibrium (9), we can express the relative price z of commodity h as a function of the competitive real wage w_2 :

$$z(w_2) = \frac{1}{K} \left(\Phi w_2^{\frac{\beta-1}{1-\alpha}} + w_2^{\frac{-1}{1-\alpha}} \right)^{\alpha-1} \quad \text{with} \quad \frac{dz}{dw_2} > 0 \quad (10)$$

⁸We assume that the effort is perfectly observable and normalized to 1 for convenience. This assumption reflects the fact that productivity in the informal sector is lower than in the formal sector, as explained by Andrews & al (2011). Indeed, production in the informal sector often generates inefficiencies, either because firms limit their size below their optimal efficiency scale to avoid detection, or because of the use of backward production technologies.

where $K = \alpha \bar{L}_H^{\alpha-1}$ and $\Phi = \sigma^{\frac{\beta-1}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}}$.

Substituting z given by expression (10) in (5) and (8), the formal and informal labor demands are given by:

$$L_1^d(w_2) = \frac{\Phi \alpha^{\frac{1}{1-\alpha}}}{K^{\frac{1}{1-\alpha}} \left(\Phi + w_2^{-\frac{\beta}{1-\alpha}} \right)} \text{ with } \frac{dL_1^d}{dw_2} > 0 \quad (11)$$

$$L_2^d(w_2) = \frac{\alpha^{\frac{1}{1-\alpha}}}{K^{\frac{1}{1-\alpha}} \left(1 + \Phi w_2^{\frac{\beta}{1-\alpha}} \right)} \text{ with } \frac{dL_2^d}{dw_2} < 0 \quad (12)$$

An increase in relative price z creates an incentive for firms of each sector to raise their own level of output, implying higher formal and informal labor demands. Nevertheless, because of the full employment condition, the two sectors can not simultaneously satisfy their new labor demand. Consequently, as $w_1 > w_2$ (expression (2)), some workers leave the informal sector and enter the primary sector. The decrease in labor supply in the secondary sector results in a higher competitive wage level. Through efficiency considerations, wages in the formal sector have to increase.

Finally, substituting w_1 and z , respectively given by equations (2) and (10), in expressions (4) and (7), total supply of commodity h can be expressed as:

$$Y_h(w_2) = \left(\frac{\alpha}{K} \right)^{\frac{\alpha}{1-\alpha}} \frac{1 + \Lambda w_2^{\frac{\beta}{1-\alpha}}}{\left(1 + \Phi w_2^{\frac{\beta}{1-\alpha}} \right)^{\alpha}} \text{ with } \frac{dY_h}{dw_2} > 0 \quad (13)$$

where $\Lambda = \sigma^{\frac{\beta-\alpha}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}}$. This result shows that total production in the home country is not constant, although full employment is always satisfied. Indeed, it means that even if each worker is employed, the total level of production can evolve thanks to worker reallocation between the two sectors. An increase in competitive wage w_2 leads to a flow of workers from the informal to the formal sector. As a consequence, supply in the primary sector increases, whereas it declines in the secondary sector, as shown in Appendix (B). The overall effect is unambiguously positive.

3.2 Production and labor market in the foreign economy

In the foreign economy, commodity f is produced by a representative firm. The production function is:

$$Y_f(L_f) = L_f^\alpha \text{ with } 0 < \alpha < 1 \quad (14)$$

where Y_f designates to the production of commodity f and L_f refers to the total number of workers in the firm. As in the domestic economy, we introduce an imperfection in the labor market leading to wage rigidity. However, in this country, this lack of flexibility is explained by the existence of unions. Following Nickell and Andrews (1983), we assume a right-to-manage model: the bargaining between union and firm concerns only wages. Unions represent all employees and their aim is to maximize the utility of all its members.⁹ The objective function V_f of the union can be expressed as follows:

$$V_f = (w_f - \bar{w}_f)L_f \quad (15)$$

where w_f represents the real wage of labor, and \bar{w}_f corresponds to an unemployment benefit. The firm maximizes its profit function S_f :

$$\frac{\Pi_f}{P} = \frac{p_f Y_f}{P} - w_f L_f \quad (16)$$

The outcome of the bargaining process comes from the maximization of the following generalized Nash function:

$$\max_{w_f} S_f = \left\{ \frac{p_f Y_f}{P} - w_f L_f \right\}^{1-\gamma} \{(w_f - \bar{w}_f)L_f\}^\gamma \quad (17)$$

where $\gamma \in (0, 1)$ denotes the bargaining power of unions. Once worker remuneration is determined, the firm sets the employment level with respect to its labor demand.

From the first-order condition, the bargained wage is given by:

$$w_f^* = \left(1 + \frac{\gamma(1-\alpha)}{\alpha} \right) \bar{w}_f \quad (18)$$

We notice that the bargained wage is higher than the unemployment benefit, and all the more so when bargaining power is higher. Moreover, although only

⁹As in the domestic country, the indirect utility function of foreign worker is defined by $u(w, e) = w - e$, where e is normalized to zero for sake of simplicity.

wages are negotiated, unions are nevertheless sensitive to the employment situation. Indeed, the greater elasticity of labor demand α with respect to real wage, the closer to the unemployment benefit the bargained wage.

From the firm's optimization program, we can express the labor level at the bargained equilibrium :

$$L_f^* = \left(\frac{w_f^* P}{\alpha p_f} \right)^{\frac{1}{\alpha-1}} \quad (19)$$

and the supply of commodity f :

$$Y_f^* = \left(\frac{w_f^* P}{\alpha p_f} \right)^{\frac{\alpha}{\alpha-1}} \quad (20)$$

As a consequence, the equilibrium employment level is decreasing with respect to the bargained real wage. In other words, a rise in the bargaining power of unions also leads to more unemployment.

3.3 Demand for commodities and money in the monetary union

In this monetary union, consumers have three goods at their disposal: the two tradable commodities h and f and money. The representative consumer maximizes his utility function under budget constraint. The optimization program of consumers in each country $j = H, F$ can be expressed as:

$$\begin{cases} \underset{(C_j, M_j)}{\text{Max}} \left(\frac{M_j}{P} \right)^\theta C_j^{1-\theta} \text{ with } 0 < \theta < 1 \\ \text{s.t. } PC_j + M_j = \Omega_j, C_j > 0 \text{ and } M_j > 0 \end{cases}$$

with

$$C_j = (c_{hj}^\rho + c_{fj}^\rho)^{1/\rho} \text{ with } 0 < \rho < 1 \quad (21)$$

$$P = \left(p_h^{\frac{\rho}{\rho-1}} + p_f^{\frac{\rho}{\rho-1}} \right)^{\frac{\rho-1}{\rho}} \quad (22)$$

where C_j, M_j, Ω_j, P respectively represent, in country j , the aggregate consumption, the money demand,¹⁰ the total income and the general price

¹⁰As Sidrauski (1967), we assume money yields utility to model the liquidity services provided by money.

level.¹¹ Moreover, c_{hj} and c_{fj} denote the consumption of goods h and f by the consumer of country j . Finally, p_h and p_f correspond to the price of goods h and f .

The revenue Ω_j results from the nominal wage W_j , profit distributed by firms of country j and the fixed quantity of money in the monetary union \bar{M} . Preferences on goods are represented by a CES function (expression (21)), where $\rho < 1$ reveals that goods are imperfect substitutes, with $1/(1 - \rho)$ the elasticity of substitution.

This optimization program can be solved in two steps. First, we compute the optimal level of aggregate consumption C_j^* and money demand M_j^* . Secondly, we determine the optimal level of demand for each commodity c_{hj}^* and c_{fj}^* .

From the first-order conditions, we derive the optimal aggregate consumption and demand for money:

$$C_j^* = (1 - \theta) \frac{\Omega_j}{P} \quad (23)$$

$$M_j^* = \theta \Omega_j \quad (24)$$

Expressions (23) and (24) state that the money demand equals a share θ of the nominal income, whereas the optimal aggregate consumption corresponds to a share $1 - \theta$ of the real income. Knowing the share of income dedicated to consumption, we can now focus on optimal demand for each commodity in each country. In each country $j = H, F$, the program can be written as:

$$\begin{cases} \underset{(c_{hj}, c_{fj})}{Max} (c_{hj}^\rho + c_{fj}^\rho)^{1/\rho} \\ \text{s.t. } p_h c_{hj} + p_f c_{fj} = (1 - \theta) \Omega_j, c_{hj} > 0 \text{ and } c_{fj} > 0 \end{cases}$$

Optimal individual demands for each commodity h and f can be expressed as:

$$c_{hj} = (1 - \theta) \frac{\Omega_j}{P} \left(\frac{p_h}{P} \right)^{\frac{1}{\rho-1}} \quad (25)$$

¹¹The utility function of the representative consumer depends on aggregate consumption, money and effort. Preferences, assumed to be separable, are represented by a Cobb-Douglas function in money and goods, and a linear work disutility, consistent with the indirect utility function $u = w - e$ used in subsection 3.1. For $j = H, F$, the utility is given by: $U_j = \left(\frac{M_j}{P_j} \right)^\theta C_j^{1-\theta} - k_j \theta^\theta (1 - \theta)^{1-\theta} e_j$ with $k_H = 1$, $k_F = 0$. As the optimal level of effort has already been determined below, we can focus only on money and consumption.

$$c_{fj} = (1 - \theta) \frac{\Omega_j}{P} \left(\frac{p_f}{P} \right)^{\frac{1}{\rho-1}} \quad (26)$$

Summing up these individual demands, the aggregate demand D_i for $i = h, f$ is given by:

$$D_h(p_h, p_f) = (1 - \theta) \frac{1}{P(p_h, p_f)} \left(\frac{p_h}{P(p_h, p_f)} \right)^{\frac{1}{\rho-1}} (\Omega_H + \Omega_F) \quad (27)$$

$$D_f(p_h, p_f) = (1 - \theta) \frac{1}{P(p_h, p_f)} \left(\frac{p_f}{P(p_h, p_f)} \right)^{\frac{1}{\rho-1}} (\Omega_H + \Omega_F) \quad (28)$$

Due to the imperfect substitutability between the two goods, it is easy to check that the demand for each commodity is decreasing with respect to its price, and increasing with respect to the price of the other commodity.

4 Equilibrium and bargaining power

This section is devoted first to the analysis of the equilibrium and then to the study of the outcomes of a flexibilization of the Northern labor market, through a weakened bargaining power of unions.

4.1 Equilibrium

This monetary union is characterized by five markets: two commodity markets, two national labor markets and a money market. In order to determine the general equilibrium, we show that this model can be reduced to a two-equation system expressing the equilibrium condition on commodity markets.

The money market equilibrium is obtained when the total money demand (using expression (24) for each country) equals the fixed money supply in the monetary union. Then, the following condition must be satisfied:

$$M_H^* + M_F^* = \bar{M} \quad (29)$$

Using (24) and (29) in commodity demands (27) and (28), we obtain the following expressions:

$$D_h(p_h, p_f) = \frac{1 - \theta}{\theta} \frac{\bar{M}}{P(p_h, p_f)} \left(\frac{p_h}{P(p_h, p_f)} \right)^{\frac{1}{\rho-1}} \quad (30)$$

$$D_f(p_h, p_f) = \frac{1 - \theta}{\theta} \frac{\bar{M}}{P(p_h, p_f)} \left(\frac{p_f}{P(p_h, p_f)} \right)^{\frac{1}{\rho-1}} \quad (31)$$

Since we assume that goods are substitutes ($\rho < 1$), the sign of the partial derivatives of the commodity demands with respect to prices can be established without ambiguity:

$$\frac{\partial D_h(p_h, p_f)}{\partial p_h} < 0 \quad \text{and} \quad \frac{\partial D_h(p_h, p_f)}{\partial p_f} > 0 \quad (32)$$

$$\frac{\partial D_f(p_h, p_f)}{\partial p_h} > 0 \quad \text{and} \quad \frac{\partial D_f(p_h, p_f)}{\partial p_f} < 0 \quad (33)$$

These derivatives confirm traditional results: the demand for each commodity decreases when its price increases, and due to substitutability, increases with the price of the other commodity.

Concerning supply, using (13) and (20), we can express production of each commodity with respect to commodity prices as follow:¹²

$$Y_h = Y_h(p_h, p_f) \quad \text{with} \quad \frac{\partial Y_h(p_h, p_f)}{\partial p_h} > 0 \quad \text{and} \quad \frac{\partial Y_h(p_h, p_f)}{\partial p_f} < 0 \quad (34)$$

$$Y_f = Y_f(p_h, p_f) \quad \text{with} \quad \frac{\partial Y_f(p_h, p_f)}{\partial p_h} < 0 \quad \text{and} \quad \frac{\partial Y_f(p_h, p_f)}{\partial p_f} > 0 \quad (35)$$

The relation between commodity h supply and prices p_h and p_f seems to be obvious (increasing with the domestic price and decreasing with the foreign price). However, behind these correlations, more complex mechanisms intervene through the dual labor market. As explained in the previous section, modification of prices implies flows of workers between the two sectors. So, a higher price of the domestic commodity leads to a development of the formal sector which yields higher production. On the contrary, when foreign prices increase, total production of the domestic commodity decrease due to a reduction in the formal labor sector.

It is important to note that whatever the modified price is, z , the relative price of commodity h is affected, requiring adjustments on the dual labor market: modification of wages in the informal sector (see (10)), wages in the formal sector for efficiency considerations (see (2)), and of the level of effort (see (3)). Nevertheless, the relative price is impacted differently depending on the price modified as $\frac{\partial z(p_h, p_f)}{\partial p_h} > 0$ and $\frac{\partial z(p_h, p_f)}{\partial p_f} < 0$. In other words, when the foreign commodity price goes up, more inflation in the union emerges which reduces domestic production because of the decrease of firm's real profit. However, the negative effect of inflation on production is offset by additional income when the domestic commodity price rises.

¹²See appendix (C)

In a nutshell, when p_h increases, relative price, informal and formal wages, and effort are higher. The increase in total domestic production comes from a development of the formal sector at the expense of the informal sector. On the contrary, when p_f increases, relative price, informal and formal wages, and effort are lower. The decrease in total domestic production results from a development of the informal sector.

In the foreign economy, effects of price on supply of commodity f are more traditional. Indeed, an increase in foreign price p_f leads to an upward shift of labor demand. As the bargained wage remains constant, the level of employment and subsequent production rise. Conversely, a higher price of commodity h induces a higher inflation in the union, leading to a downward shift of labor demand. Thus, unemployment increases, while production is reduced.

As a consequence, equalizing aggregate demand (30) and (31) and total supply (34) and (35) for each commodity, the general equilibrium can be expressed by the two-equation system:

$$\begin{cases} D_h(p_h, p_f) = Y_h(p_h, p_f) \\ D_f(p_h, p_f) = Y_f(p_h, p_f) \end{cases} \quad (36)$$

Having analyzed the equilibrium, let us now shed light on the effects of a change in the bargaining power.

4.2 The impact of bargaining power

In the current European economic context, the European Commission campaigns for increased labor market flexibility. In our framework, such a trend can be captured by a weakened union bargaining power. Our aim is to assess the implications of a variation of the bargaining power γ on macroeconomic outcomes, at equilibrium.

Differentiating the equilibrium system (36), we obtain the following matrix expression:

$$\begin{pmatrix} \frac{1-\rho t}{\rho-1} - \Psi(1-t) & -\frac{\rho(1-t)}{\rho-1} + \Psi(1-t) \\ -\frac{\rho t}{\rho-1} - \frac{\alpha t}{\alpha-1} & \frac{1-\rho(1-t)}{\rho-1} + \frac{\alpha t}{\alpha-1} \end{pmatrix} \begin{pmatrix} \frac{dp_h}{p_h} \\ \frac{dp_f}{p_f} \end{pmatrix} = \begin{pmatrix} 0 \\ -\frac{\alpha\gamma}{\alpha + \gamma(1-\alpha)} \end{pmatrix} \frac{d\gamma}{\gamma}$$

where $t = p_h^{\frac{\rho}{\rho-1}} / [p_h^{\frac{\rho}{\rho-1}} + p_f^{\frac{\rho}{\rho-1}}]$, $0 < t < 1$.

From this matrix expression, we can deduce the elasticities of prices p_h and p_f with respect to bargaining power γ :

$$\xi_{p_h/\gamma} = \frac{dp_h/p_h}{d\gamma/\gamma} = -\frac{1}{\Delta} \frac{\alpha\gamma}{\alpha + \gamma(1 - \alpha)} \left[\frac{\rho(1 - t)}{\rho - 1} - \Psi(1 - t) \right] > 0 \quad (37)$$

$$\xi_{p_f/\gamma} = \frac{dp_f/p_f}{d\gamma/\gamma} = -\frac{1}{\Delta} \frac{\alpha\gamma}{\alpha + \gamma(1 - \alpha)} \left[\frac{1 - \rho t}{\rho - 1} - \Psi(1 - t) \right] > 0 \quad (38)$$

where Δ the determinant of (2x2) matrix is given by:

$$\Delta = \frac{1}{1 - \rho} + \Psi(1 - t) + \frac{\alpha t}{1 - \alpha} > 0$$

From relations (37) and (38), it is easy to check that $\xi_{p_h/\gamma} < \xi_{p_f/\gamma}$.

At the new equilibrium, a lower bargaining power in the foreign economy leads to a decrease in all prices. The new macroeconomic outcome depends on the country, although effects are positive overall. In the foreign economy, the equilibrium level of production is higher, unemployment decreases and wages are lower. In the domestic economy, the production also increases, the labor market benefits from a better allocation of workers between the formal and informal sectors, and all wages are higher.

More precisely, in the foreign economy, the increasing flexibility of the the labor market, through a lower bargaining power of unions, allows for a reduction in labor costs, which could be indicated by a downward shift of the supply curve of commodity f . This modification tends to decrease price p_f leading to a lower general price level P in the union of countries. This price evolution leads to a downward shift of domestic supply curve Y_h due to a rise in real profit. Additionally, downward inflation drop allows for higher purchasing power of money, and so a shift to the right of demand curve for each commodity D_h and D_f . As a consequence, all production levels are higher, whereas all commodity prices are lower,¹³ after the flexibilization of the labor market in the foreign economy.

On the labor market side, in the foreign economy, the reduced union bargaining power causes the real wage to fall. At the new equilibrium, the level of employment is higher due to the convergence of higher level of production, a lower level of labor cost, and a lower level of prices. In the domestic economy, worker flows between sectors result in production adjustments. As

¹³It is important to note that, on the demand side, two opposite price effects occur. First, the fall of the general price level increases the real-balance, which tends to increase demand. Second, the relative price effect p_h/P or p_f/P on demand is negative. Finally, the first effect dominates the second one.

production increases, formal sector firms hire workers who leave the informal sector. This inflow of workers in formal sector induces upward pressure on informal wages because of the reduction of the labor supply in the informal sector. The upward trend in the informal sector forces primary sector employers to increase formal wages, because of efficiency considerations.

5 Conclusion

In the European context, labor market flexibilization may appear as a relevant option to improve the employment situation in the monetary union. This is the reason why we investigate the overall effects of a decrease in the trade union bargaining power in the foreign (Northern) economy. We show that, at the new equilibrium, a lower bargaining power in the foreign economy leads to decrease in all prices. The new macroeconomic outcome depends on the country, although effects are positive overall. In the foreign economy, the equilibrium level of production is higher, unemployment decreases and wages are lower. In the domestic one, the production also increases, the labor market benefits from a better allocation of workers between the formal and informal sectors, and all wages are higher.

6 Appendix

A The non-shirking condition in the domestic economy

In the formal sector, effort is not observable, so that employers determine the efficiency wage developed by Shapiro and Stiglitz (1984). We assume that consumption and effort decisions are separable, and that they depend only on the real wage earned w and the disutility of effort e . The representative worker utility function is defined by $u(w, e) = w - e$. The level of effort provided by skilled workers is strictly positive when employed and not shirking in the primary sector, or zero when shirking while employed in the primary sector or working in the informal sector. The optimal effort level of a skilled worker is deduced by the following non-shirking condition:

$$w_1 - e \geq (1 - \pi)w_1 + \pi w_2 \quad (39)$$

where w_1 represents the real wage of formal workers in the primary sector and w_2 the real wage of informal workers in the secondary sector. The left hand-side in expression (39) measures the expected utility derived by a formal worker who is not shirking and provides a level of effort equal to e , while the right-hand-side measures the expected utility of a shirking worker as a weighted average of the wage earned if caught shirking and fired (with a probability π), and if not caught shirking (with a probability $1 - \pi$) in which case the level of effort is zero.

The level of effort required by firms is assumed to be such that formal workers are indifferent between shirking and not shirking, in which case workers choose not to shirk, so that condition (39) hold with equality. Solving for the required level of effort yields:

$$e(w_1, w_2) = \pi(w_1 - w_2) \quad (40)$$

Relation (40) shows that the level of effort produced by workers depends positively on the real wage difference between formal and informal sectors. Moreover, it can readily be established that an increase in the probability of being caught shirking raises the level of effort.

The representative producer of commodity h in the formal sector maximizes his real profit $\frac{\Pi_{h1}}{P}$, where P is the general price level in the home

country,¹⁴ that is, using equations (1) and (40) and assuming that the firm incurs no hiring or firing costs :

$$\max_{(Y_{h1}, w_1)} \frac{\Pi_{h1}}{P} = \left\{ \frac{p_h Y_{h1}}{P} - \frac{w_1 Y_{h1}^{1/\alpha}}{e(w_1, w_2)^{\beta/\alpha}} \right\}$$

The first-order conditions are :

$$\frac{\partial \frac{\Pi_{h1}}{P}}{Y_{h1}} = \frac{p_h}{P} - \frac{1}{\alpha} \frac{w_1 Y_{h1}^{(1-\alpha)/\alpha}}{e(w_1, w_2)^{\beta/\alpha}} = 0 \quad (41)$$

$$\frac{\partial \frac{\Pi_{h1}}{P}}{w_1} = -Y_{h1}^{1/\alpha} \left[\frac{e(w_1, w_2)^{\beta/\alpha} - \pi w_1 \frac{\alpha}{\beta} e(w_1, w_2)^{\beta/\alpha - 1}}{e(w_1, w_2)^{2\beta/\alpha}} \right] = 0 \quad (42)$$

From expression (42), we derive a relation between efficiency wage and competitive wage :

$$w_1 = \sigma w_2 \text{ with } \sigma = \frac{\alpha}{\alpha - \beta} \quad (43)$$

At equilibrium, wages in the formal sector are above the competitive wage in the informal sector. The optimal level of effort is deduced from expressions (40) and (41):

$$e^*(w_1) = \delta w_1 \text{ with } \delta = \frac{\beta \pi}{\alpha} \quad (44)$$

We find that at equilibrium, the level of effort increases with the formal sector wage.

B Level of production in home country in formal and informal sectors

Introducing w_1 and z , respectively given by equations (2) and (10), into expressions (4) and (7), we obtain :

$$Y_{h1}(w_2) = \Lambda \left(\frac{\alpha}{K} \right)^{\frac{\alpha}{1-\alpha}} \frac{w_2^{\frac{\beta}{1-\alpha}}}{\left(1 + \Phi w_2^{\frac{\beta}{1-\alpha}} \right)^\alpha} \text{ with } \frac{dY_{h1}}{dw_2} > 0 \quad (45)$$

$$Y_{h2}(w_2) = \left(\frac{\alpha}{K} \right)^{\frac{\alpha}{1-\alpha}} \frac{1}{\left(1 + \Phi w_2^{\frac{\beta}{1-\alpha}} \right)^\alpha} \text{ with } \frac{dY_{h2}}{dw_2} < 0 \quad (46)$$

where $K = \alpha \bar{L}_H^{\alpha-1}$, $\Phi = \sigma^{\frac{\beta-1}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}}$ and $\Lambda = \sigma^{\frac{\beta-\alpha}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}}$.

¹⁴The general price level P is precisely determined in the subsection 3.3.

C Elasticities of commodity supplies with respect to prices

From expressions of commodity supplies, we determine the elasticities with respect to price of each commodity. From commodity h supply, given by expression (13), we obtain:

$$\frac{dY_h}{Y_h} = \Psi_1 \frac{dw_2}{w_2} \text{ with } \Psi_1 = \frac{\beta}{1-\alpha} w_2^{\frac{\beta}{1-\alpha}} \left(\frac{\Lambda}{1 + \Lambda w_2^{\frac{\beta}{1-\alpha}}} - \frac{\alpha\Phi}{1 + \Phi w_2^{\frac{\beta}{1-\alpha}}} \right) > 0 \quad (47)$$

We then express $\frac{dY_h}{Y_h}$ with respect to $\frac{dz}{z}$. Thanks to equation (10), we have:

$$\frac{dz}{z} = \Psi_2 \frac{dw_2}{w_2} \text{ with } \Psi_2 = \frac{1 + \Phi(1-\beta)w_2}{1 + \Phi w_2^{\frac{\beta}{1-\alpha}}} > 0 \quad (48)$$

Combining expressions (47) and (48), it is straightforward that:

$$\frac{dY_h}{Y_h} = \Psi \frac{dz}{z} \text{ with } \Psi = \frac{\Psi_1}{\Psi_2} > 0 \quad (49)$$

Recalling that $z = p_h/P(p_h, p_f)$ and using expression (22), we obtain the elasticities of the general price level in the union of countries:

$$\frac{dP}{P} = t \frac{dp_h}{p_h} + (1-t) \frac{dp_f}{p_f} \text{ where } t = \frac{p_h^{\frac{\rho}{\rho-1}}}{p_h^{\frac{\rho}{\rho-1}} + p_f^{\frac{\rho}{\rho-1}}}, 0 < t < 1 \quad (50)$$

So, we deduce the elasticities of the relative price z with respect of p_h and p_f :

$$\frac{dz}{z} = (1-t) \left(\frac{dp_h}{p_h} - \frac{dp_f}{p_f} \right) \quad (51)$$

Introducing (51) into (49), we finally express $\frac{dY_h}{Y_h}$ with respect to $\frac{dp_h}{p_h}$ and $\frac{dp_f}{p_f}$:

$$\frac{dY_h}{Y_h} = \Psi(1-t) \left(\frac{dp_h}{p_h} - \frac{dp_f}{p_f} \right) \quad (52)$$

We conclude that $\frac{\partial Y_h(p_h, p_f)}{\partial p_h} > 0$ and $\frac{\partial Y_h(p_h, p_f)}{\partial p_f} < 0$.

From commodity f supply, given by expression (20), we could also express the elasticities with respect to the price of each commodity:

$$\frac{dY_f}{Y_f} = t \frac{\alpha}{\alpha - 1} \left(\frac{dp_h}{p_h} - \frac{dp_f}{p_f} \right) \quad (53)$$

with $\frac{\partial Y_f(p_h, p_f)}{\partial p_h} < 0$ and $\frac{\partial Y_f(p_h, p_f)}{\partial p_f} > 0$.

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