Northern labor market flexibility and Southern employment in the EMU

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Abstract: We consider an 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 of the Southern EMU economies. Among formal workers, wage results 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 Union. More precisely, only wage is 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 flexibilization of labor market may appear as a relevant option to improve the situation of employment in the monetary union. This is the reason why we investigate the overall effects of a decrease in the Union bargaining power in the foreign (Northern) economy. We show that, at the new equilibrium, a less bargaining power in the foreign economy leads to a decrease of 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 wage is lower. In the domestic one, the production also increases, labor market benefits from a better allocation of workers between formal and informal sectors, and all wages are more important.

Keywords : efficiency wage, dualism, EMU, union, bargaining

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1 Introduction

2 The Model

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

Moreover, we introduce an heterogenous labor market in the monetary union. Indeed, the domestic economy is characterized by a dual labor market with formal and informal sectors. In the foreign economy, we suppose the presence of union.

2.1 Production and labor market in the domestic economy

In the domestic country, the labor market is segmented in two sectors : the primary sector corresponds to formal workers and the secondary sector gathers informal workers. Among formal workers, wage results from efficiency considerations, following Shapiro and Stiglitz (1984). On the contrary, in the secondary sector, remuneration corresponds to a competitive wage. Workers who do not find a job in the formal segment, enter in the competitive informal one[1]. The two sector contributes to the production of the good h.

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

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

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

$$w_1 = \sigma w_2 \text{ with } \sigma = \frac{\alpha}{\alpha - \beta} \tag{2}$$

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

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

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

The representative producer of good h in the formal sector maximizes his real profit $\frac{\Pi_{h1}}{P}$, where P is the general level of prices in home country[2]. Using equations (1), (2) and (3) and assuming that 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 good h supply by firm in the formal sector and the formal labor demand :

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

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

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

As a consequence, an increase in the efficiency wage implies a reduction of formal labor demand and a decrease of good supply. Even if this last 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 yields to a lower formal labor demand. On the other hand, we find a positive qualitative effect on output because a higher wage rises the optimal level of effort. From expression (4), the negative quantitative effect is larger than the positive qualitative one, leading to an inverse relation between efficiency wage and production. Moreover, when the relative price z increases, the real wage in the primary sector goes down involving simultaneously a raise in formal labor demand and in good h supply.

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

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

where Y_{h2} denotes the total quantity of good h produced in the informal sector and L_2 is the number of informal workers. In this sector, the informal wage is fully flexible and determined by market forces[3].

[2] The general level of prices P is precisely determined in the subsection 2.3.

[3] We assume that the effort is perfectly observable and this last one is normalized to 0 for convenience.

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 good h and the informal labor demand are:

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

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

where production and level of informal workers demand 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, supposed to be constant. Firms in the primary sector set both wage 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 wage is the adjustment variable. Formally, labor market equilibrium can be written as follows:

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

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 good h as a function of the competitive real wage w_2 :

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

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

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

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

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

An increase in the relative price z create an incentive for firms of each sector to raise their own level of output, implying higher formal and informal labor demands. Nevertheless, because of 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 informal sector and enter the primary one. The decrease of labor supply in the secondary segment leads to raise the level of competitive wage. Through efficiency considerations, wage in the formal sector has to increase.

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

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

where $\Lambda = \sigma^{\frac{\beta-\alpha}{1-\alpha}} \delta^{\frac{\beta}{1-\alpha}}$. This result shows that the total production in home country is not constant although the full employment is always satisfied. Indeed, it means that even if each worker is employed, the total level of production can evolve thanks to workers 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, the supply in the primary sector grows up, whereas it declines in the secondary sector, as shown in Appendix (B). Finally, the overall effect is unambiguously positive.

2.2 Production and labor market in the foreign economy

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

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

where Y_f corresponds to the production of good f and L_f designs the total number of workers in the firm. As in the domestic economy, we introduce imperfection in the labor market leading to wage rigidity. However, in this country, this lake of flexibility is explained by the existence of union. Following Nickell and Andrews (1983), we admit a right-to-manage model: the bargaining between union and firm concerns only the wage. The union represents all employees and its aim is to maximize the utility of all its members[4].

[4] As 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 simplicity sake.

The objective function V_f of the union can be expressed as follows:

$$V_f = (w_f - \bar{w_f})L_f \tag{15}$$

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

$$\frac{\Pi_f}{P} = \frac{p_f Y_f}{P} - w_f L_f \tag{16}$$

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

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

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

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

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

We can notice that the bargained wage is higher than the unemployment benefit, even more that bargaining power is important. Moreover, although only wage is negotiated, union is notwithstanding sensitive to employment situation. Indeed, the greater elasticity of labor demand α with respect to real wage is, the closer to the unemployment benefit the bargained wage is.

From optimization program of the firm, we can expressed the labor level at the bargained equilibrium :

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

and the supply of good f:

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

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

2.3 Demands for goods and money in the monetary union

In this monetary union, consumers deal with three goods : the two tradable goods h and f and the money. The representative consumer maximizes his utility function under budget constraint. The optimization program for country $j = H, F$ can be expressed as:

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

with

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

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

where C_j, M_j, Ω_j, P respectively represent, in country j, the aggregate consumption, the money demand, the total income and the general level of prices[5]. 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 (C)), 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^*. Second, we determine the optimal level of demand for each good c_{hj}^* and c_{fj}^*.

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

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

[5]We precise that the utility function of the representative consumer depends on aggregate consumption, money and effort. The preference, supposed 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 the subsection 2.1. 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.

$$M_j^* = \theta \Omega_j \tag{24}$$

Expressions (23) and (24) states 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. We can now focus on optimal demand for each good in each country, knowing the share of income dedicated to consumption. In each country $j = H, F$, the program can be written as:

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

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

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

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

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

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

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

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

3 Equilibrium and bargaining power

3.1 Equilibrium

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

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

$$M_H^* + M_F^* = \bar{M} \tag{29}$$

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

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

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

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

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

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

Concerning supply side, using (13) and (20), we can express production of each good with respect to good prices as follow:[6]

$$Y_h = Y_h(p_h, p_f) \text{ with } \frac{\partial Y_h(p_h, p_f)}{\partial p_h} > 0 \text{ and } \frac{\partial Y_h(p_h, p_f)}{\partial p_f} < 0 \tag{32}$$

$$Y_f = Y_f(p_h, p_f) \text{ with } \frac{\partial Y_f(p_h, p_f)}{\partial p_h} < 0 \text{ and } \frac{\partial Y_f(p_h, p_f)}{\partial p_f} > 0 \tag{33}$$

The relation between good 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 occur through 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 domestic good leads to a development of formal sector which yields to higher production. On the contrary, when the foreign price increases, total production of domestic good goes down through a reduction of the formal labor sector.

It is important to note that whatever the modified price is, z the relative price of good h is affected, requiring adjustments on dual labor market: modification of wage in the informal sector (see (10)) , of wage in the formal sector for efficiency considerations (see (2)), and the level of effort (see (3)). Nevertheless, the relative price is differently impacted depending on the price

[6]See appendix (C)

modified as $\dfrac{\partial z(p_h, p_f)}{\partial p_h} > 0$ and $\dfrac{\partial z(p_h, p_f)}{\partial p_f} < 0$. In others words, when the foreign good price goes up, more inflation in the union emerges which reduces domestic production because of the decrease of firm real profit. However, the negative effect of inflation on production is offset by additional receipts when the domestic good price rises.

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

In the foreign economy, effects of price on good f supply are more traditionnal. Indeed, an increase in foreign price p_f yields to an upward shift of labor demand. As the bargained wage remains constant, the level of employment and subconsequent production rise. At the opposite, a higher price of good h induces a higher inflation in the union, leading a downward shift of labor demand. Thus, unemployment grows up, while production is reduced.

As a consequence, equalizing aggregate demand (30) and (31) and total supply (32) and (33) for each good the general equilibrium can be expressed by the two-equation system:

$$\begin{cases} D_h(p_h, p_f) = Y_h(p_h, p_f) \\ D_f(p_h, p_f) = Y_f(p_h, p_f) \end{cases} \tag{34}$$

Since the equilibrium is analyzed, we can shed light on the effects of a change in the bargaining power.

3.2 Impact of the bargaining power

In the current European economic context, the European Commission militates for an 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 the equilibrium.

Differentiating the equilibrium system (34), we obtain the following matrix expression:

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

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

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

$$\xi_{p_h/\gamma} = \frac{dp_h/p_h}{d\gamma/\gamma} = -\frac{1}{\Delta} \frac{\alpha\gamma}{\alpha + \gamma(1-\alpha)} \left[\frac{\rho(1-t)}{\rho - 1} - \Psi(1-t) \right] > 0 \qquad (35)$$

$$\xi_{p_f/\gamma} = \frac{dp_f/p_f}{d\gamma/\gamma} = -\frac{1}{\Delta} \frac{\alpha\gamma}{\alpha + \gamma(1-\alpha)} \left[\frac{1-\rho t}{\rho - 1} - \Psi(1-t) \right] > 0 \qquad (36)$$

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 (35) and (36), it is easy to check that $\xi_{p_h/\gamma} < \xi_{p_f/\gamma}$.

At the new equilibrium, a less bargaining power in the foreign economy leads to a decrease of 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 wage is lower. In the domestic one, the production also increases, labor market benefits from a better allocation of workers between formal and informal sectors, and all wages are more important.

More precisely, in the foreign economy, the increasing flexibility of labor market, through a lower bargaining power of Union, allows a reduction of labor cost, which could be embodied by a downward shift of the supply curve of commodity f. This translation tends to decrease the price p_f leading to a lower general level of price P in the union. This price evolution yields to a downward shift of the domestic supply curve Y_h due to a rise of real profit. In addition, the inflation drop allows a higher purchasing power of the money, and so a translation 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,[7] after the flexibilization of labor market in the foreign economy .

On the labor market side, in the foreign economy, a fall of Union bargaining power, involves a decrease in the real wage. At the new equilibrium, level of employment is higher through simultaneously a higher level of production, a lower level of labor cost, and a lower level of prices. In the domestic economy, the production adjustment takes place via worker flow between sectors. As production raises, firms of formal sector hire workers, who quit

[7] It is important to note that, on the demand side, two opposite price effects occur. First, the fall of the general level of price increase 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.

the informal segment. This inflow of workers in formal sector induces a upward pressure on informal wage because of a reduction of labor supply in the informal sector. Such a growing trend of remuneration on this second segment force employers of primary sector to enhance formal wage, because of efficiency considerations.

4 Conclusion

5 Appendix

A The non shirking condition in the domestic economy

In the formal sector, the 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 :

$$w_1 - e \geq (1 - \pi)w_1 + \pi w_2 \tag{37}$$

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 one. The left hand-side in expression (37) 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 (37) hold with equality. Solving for the required level of effort yields to :

$$e(w_1, w_2) = \pi(w_1 - w_2) \tag{38}$$

Relation (38) 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 good h in the formal sector maximizes his real profit $\frac{\Pi_{h1}}{P}$, where P is the general level of prices in home country[8], that is, using equations (1) and (38) and assuming that firm incurs no hiring or firing costs :

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

[8] The general level of prices P is precisely determined in the subsection 2.3.

The first order conditions are :

$$\frac{\partial \frac{\Pi_{h1}}{P}}{Y_{h1}} = \frac{p_h}{P} - \frac{1}{\alpha}\frac{w_1 Y_{h1}^{(1-\alpha)/\alpha}}{e(w_1,w_2)^{\beta/\alpha}} = 0 \tag{39}$$

$$\frac{\partial \frac{\Pi_{h1}}{P}}{w_1} = -Y_{h1}^{1/\alpha}\left[\frac{e(w_1,w_2)^{\beta/\alpha} - \pi w_1 \frac{\alpha}{\beta} e(w_1,w_2)^{\beta/\alpha-1}}{e(w_1,w_2)^{2\beta/\alpha}}\right] = 0 \tag{40}$$

From expression (40), we derive a relation between the efficiency wage and competitive wage :

$$w_1 = \sigma w_2 \text{ with } \sigma = \frac{\alpha}{\alpha-\beta} \tag{41}$$

At the equilibrium, wage in the formal sector is above the competitive wage in the informal sector. The optimal level of effort is deduced from expressions (38) and (39):

$$e^*(w_1) = \delta w_1 \text{ with } \delta = \frac{\beta\pi}{\alpha} \tag{42}$$

We find that at equilibrium, the level of effort is increasing 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), in expressions (4) and (7), we obtain :

$$Y_{h1}(w_2) = \Lambda\left(\frac{\alpha}{K}\right)^{\frac{\alpha}{1-\alpha}} \frac{w_2^{\frac{\beta}{1-\alpha}}}{\left(1+\Phi w_2^{\frac{\beta}{1-\alpha}}\right)^{\alpha}} \text{ with } \frac{dY_{h1}}{dw_2} > 0 \tag{43}$$

$$Y_{h2}(w_2) = \left(\frac{\alpha}{K}\right)^{\frac{\alpha}{1-\alpha}} \frac{1}{\left(1+\Phi w_2^{\frac{\beta}{1-\alpha}}\right)^{\alpha}} \text{ with } \frac{dY_{h2}}{dw_2} < 0 \tag{44}$$

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

C Elasticities of good supplies with respect to prices

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

$$\frac{dY_h}{Y_h} = \Psi_1 \frac{dw_2}{w_2} \text{ with } \Psi_1 = \frac{\beta}{1-\alpha} w_2^{\frac{\beta}{1-\alpha}} \left(\frac{\Lambda}{1 + \Lambda w_2^{\frac{\beta}{1-\alpha}}} - \frac{\alpha\Phi}{1 + \Phi w_2^{\frac{\beta}{1-\alpha}}} \right) > 0 \tag{45}$$

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

$$\frac{dz}{z} = \Psi_2 \frac{dw_2}{w_2} \quad \text{with} \quad \Psi_2 = \frac{1 + \Phi(1-\beta)w_2}{1 + \Phi w_2^{\frac{\beta}{1-\alpha}}} > 0 \tag{46}$$

Combining expressions (51) and (46), it is straightforward that:

$$\frac{dY_h}{Y_h} = \Psi \frac{dz}{z} \text{ with } \Psi = \frac{\Psi_1}{\Psi_2} > 0 \tag{47}$$

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

$$\frac{dP}{P} = t\frac{dp_h}{p_h} + (1-t)\frac{dp_f}{p_f} \text{ where } t = \frac{p_h^{\frac{\rho}{\rho-1}}}{p_h^{\frac{\rho}{\rho-1}} + p_f^{\frac{\rho}{\rho-1}}}, \; 0 < t < 1 \tag{48}$$

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

$$\frac{dz}{z} = (1-t)\left(\frac{dp_h}{p_h} - \frac{dp_f}{p_f}\right) \tag{49}$$

Introducting (49) into (47), we finally express $\frac{dY_h}{Y_h}$ with respect to $\frac{dp_h}{p_h}$ and $\frac{dp_f}{p_f}$:

$$\frac{dY_h}{Y_h} = \Psi(1-t)\left(\frac{dp_h}{p_h} - \frac{dp_f}{p_f}\right) \tag{50}$$

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

$$\frac{dY_f}{Y_f} = t\frac{\alpha}{\alpha - 1}\left(\frac{dp_h}{p_h} - \frac{dp_f}{p_f}\right) \tag{51}$$

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

References

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