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Abstract

The cultural and geographic proximity between two regions otherwise very distant (both in terms of factor endowment and of specialization pattern) makes the wage perceived as fair in the peripheral region dependent on the wage prevailing in the core region. As a consequence, the peripheral wage is too high and unemployment results. This problem is exacerbated by the greater international division of labor brought about by globalization, which increases the core-periphery labor productivity gap and so brings about a surge in unemployment in the periphery. Hence, this paper challenges, in a regional context, the view that a finer division of labor reduces unemployment, and offers an explanation of the growing differentials in the regional rates of unemployment observed in many EU countries in the last decades.

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1 Introduction

A striking peculiarity of the last decades European unemployment experience is its regional dimension: unemployment falls disproportionately, and increasingly, on the peripheral regions within most European countries[1].

Regional unemployment divergence has occurred in a period in which European countries have experienced a deeper economic integration, both among themselves and with the other OECD countries. It is widely believed that most of European trade is intra-industry and that the productivity gains it allows mainly stem from a finer international division of labor due to the increased variety of available intermediates.[2]

The existing literature on the relation between unemployment and the international division of labor shows that the availability of a greater variety of intermediate goods reduces unemployment. For instance, using the shirking version of the efficiency wages theory, Matusz

[1] For the evidence on regional unemployment divergence in Europe see, among others, Peri and Obstfeld (1998), and CER (1998). With reference to other non-EU industrial countries, the evidence relative to the USA and Canada, reported by Obstfeld and Peri, shows that the standard deviation of regional unemployment rates is lower and shows no tendency to increase. Other studies for the USA, e.g. Marston (1985) and Partridge and Rickman (1997), show that the inter-area unemployment differentials are stationary and that the high unemployment areas are those with attractive climates and amenities and high wages. This evidence is consistent with an equilibrium explanation of the inter-area unemployment differentials, according to which workers trade-off a higher risk of being unemployed for a higher wage.

The experience of the USA is in sharp contrast with the European experience, where the inter-area unemployment differentials are increasing and unemployment is generally higher in the peripheral, less developed regions. In this respect, a recent report by CER (1998) shows that the high unemployment regions in Europe have a low per capita income (30% below the EU average) and a similar production structure, in which manufacturing represents a lower than average share of output and is characterized by technologically stagnant industries such as food, mining, leather and apparel. On the contrary, the low unemployment regions are characterized by a 10% higher than average per capita income and a production structure in which manufacturing is prominent and diversified, with a prevalence of industries such as machinery, precision instruments and electronics.

[2] The first wave of papers applying the Dixit-Stiglitz formalization of monopolistic competition to the trade theory (e.g. Krugman (1979,1980,1981, Dixit-Norman, 1980, Helpman, 1981) emphasized the utility gains generated from intra-industry trade in consumers' goods. Since the seminal paper of Ethier (1982) the attention has shifted toward the productivity gains linked to two-way trade in producers' goods. As Ethier puts it: "I cannot resist the temptation to point out that producers' goods are in fact much more prominent in trade then are consumers' goods".

(1996) demonstrates that the intermediates trade-induced productivity gains yield higher real wages, thus relaxing the efficiency-wage constraint and generating an increase in employment.[3]

In this paper we challenge, in a regional context, the view that the division of labor reduces unemployment. We argue that European unemployment may be generated by the perverse interaction of globalization, a shorthand for increased international division of labor, with a specific labor market imperfection. In particular, we adapt to a North-South context the Akerlof-Yellen version of the efficiency wages to show that its interaction with a finer division of labor implies regional unemployment divergence.

The intuition is simple and can be summarized as follows. In the presence of markedly different regional factor endowments and a limited factor mobility, regions within a country specialize completely in the production of goods with different factor intensities. If the capital intensive sector uses intermediate goods more intensively than the labor intensive sector, then the productivity increase brought about by a deeper integration is greater in the region (the North) specializing in the intermediates intensive sector. In the absence of labor market imperfections, globalization results in a real wage increase in both regions together with North-South wage divergence. In the presence of a fair wage rigidity, however, the wage perceived as fair in the peripheral region depends on the wage prevailing in the core region. As a consequence, the southern fair wage grows too much relative to the southern market-clearing wage, and unemployment results.

Among the existing explanations of the core-periphery unemployment differentials, the textbook explanation points to the wage inflexibility due to the national minimum wage legislation prevailing in most European countries.[4] This orthodox explanation has been challenged in recent

[3]A similar reasoning applies when unemployment is generated from other mechanisms. See, for instance, Jansen and Turrini (1998).
[4]See, among others, the OECD Jobs Study (1995), and Dolado *et al*., (1997) for evidence from Spain.

years, both on theoretical and empirical grounds[5]. For instance, with reference to France, the Netherlands, Spain and UK, Machin and Manning (1997) and Dolado *et al*. (1996) find little evidence that minimum wages have a bad effect on jobs.

In this paper we argue that a national minimum wage floor may be only an apparent cause of peripheral unemployment, hiding the operation of a deeper real rigidity. Indeed, the main policy implication of the paper is that simply abolishing the national minimum wage may have only a limited impact on the peripheral rate of unemployment.

The paper is organized as follows. Section 2 illustrates the basic model. Section 3 discusses the effects of globalization on the North-South relative market-clearing wage. Section 4 introduces a labor market imperfection into the basic model, consisting of an adaptation of a fair wage hypothesis *à la* Akerlof-Yellen to a core-periphery context. Section 5 and 6 discuss the effects of globalization on peripheral unemployment and income in the presence of such a real rigidity in the labor market. Section 7 concludes.

2 The basic model

2.1 Assumptions

Consider a small open economy made up of two regions, which we call North (N) and South (S). We assume that there are two primary production factors, capital (K) and labor (L), and that they are immobile between the two regions. North is relatively endowed with capital, so that $K_N/L_N > K_S/L_S$. .

The rest of the world is made up of a *continuum* of unitary length of identical countries, each producing two final goods, which we call good 1 and good 2, and n differentiated intermediate goods. Taking good 2 as the numeraire, we denote by p_1 and p, respectively, the relative international price of good 1 and of each variety of intermediates with respect to good 2. Further,

[5]Card and Krueger (1995) argue that in the presence of a monopsonistic employer, a minimum wage floor may increase employment. They find empirical support to this prediction in their application to the U.S.

we assume that the two sectors producing final goods are perfectly competitive, while intermediate goods are produced by monopolistically competitive firms.

Following Rodriguez-Clare (1996), we assume that the production functions for final goods take the form[6]:

$$(1) \qquad Q_j = \left[\left(\sum_{i=1}^{N} z_{ij}^{\ r}\right)^{1/r}\right]^{1-\alpha_j} L_j^{\alpha_j-\gamma_j} K_j^{\gamma_j}, \qquad j = 1,2$$

where all the parameters are in (0,1). N is the number of intermediate goods available in the domestic country and z_{ij} is the amount of intermediate good of variety i used in production of good j. We assume the following:

$$(2) \quad \alpha_1 > \alpha_2, \quad \gamma_1 < \gamma_2$$

which implies that sector 2 uses intermediate goods and capital more intensively than sector 1.

The specification of the production function in (1) implies that there are constant returns to scale with respect to capital, labor and the aggregate $\left(\sum_{i=1}^{N} z_{ij}^{\ r}\right)^{1/r}$ of intermediate goods. The symmetric way in which z_{ij} enter in (1) implies that final goods producers use the same quantity of all available varieties, so that (1) reduces to:

$$(3) \qquad Q_j = N^{(1-\alpha_j)(1-r)/r} (Nz_j)^{(1-\alpha_j)} L_j^{\alpha_j-\gamma_j} K_j^{\gamma_j}$$

Note that for a given amount (Nz_j) of intermediate goods used in the production of final goods total factor productivity increases with N. These production functions then capture the idea that a greater division of labor increases efficiency[7].

[6]Rodriguez-Clare uses this functional form in a model which shows how an economy with a low division of labor may be stuck in an underdevelopment trap. In this model the intermediates are non traded, so that they must be produced locally. Since these goods are produced with decreasing average costs, small countries may suffer from a shallow division of labor, which brings about a low return to investment. As a consequence, and contrary to the predictions of the neoclassical growth theory, capital accumulation may not materialize.

[7]Production functions exhibiting productivity gains from the division of labor have been introduced by Ethier (1982). Now they are standard analytical tools, in particular in trade theory, in the endogenous growth literature, and in the field of economic geography.

In this paper by globalization we mean an increased international division of labor, so we model economic integration between the domestic country and the rest of the world as an increase in *N*, the number of intermediate goods available for production in the domestic country. In particular, we assume that $N = qfn$, where q is the share of foreign countries whereby the domestic country trades and f is the share of traded intermediate goods. This implies that a finer division of labor can be achieved either trough an increase in the number of trade partners, or trough an increased integration among the existing trade partners.[8]

Since intra-industry trade in differentiated intermediate goods affects productivity trough the imports of these inputs[9], and the domestic country is small with respect to the world economy, it proves convenient, in order to simplify the analysis without altering the main results of the paper, to assume that the domestic country does not produce intermediate goods. This implies that the two regions import all of the intermediate inputs they use in the production of final goods.

2.2 Interregional specialization of the domestic country

Equations (1) and (3) imply that the unit cost functions in the two regions are given by:

$$(4) \quad c_{jm} = a_j r_m^{g_j} w_m^{a_j - g_j} (p/t)^{1-a_j} N^{-(1-a_j)(1-r)/r}, \; j = 1,2; \; m = N, S$$

where: $a_j = (1-a_j)^{-(1-a_j)}(a_j - g_j)^{-(a_j - g_j)} g_j^{-g_j}$, r_m and w_m are, respectively, the rental rate and the wage rate in region *m*, and p/t is the price of intermediates inclusive of an iceberg transport cost *à la* Samuelson.

From (4) we can now calculate the relative cost of good 1 with respect to good 2 in the two regions:

[8]Alternatively, we may assume that globalization brings about a reduction in transport costs for intermediates. Since the effects of a reduction in transport costs are the same as an increase in *N*, in the rest of the paper we concentrate on latter for brevity.

[9]For an empirical confirmation of this theoretical implication see Cortes and Jean (1997) and Keller (1997). The evidence reported in these studies shows that sectoral productivity gains are highly associated with the sectoral import share.

$$(5)\quad \left(\frac{c_1}{c_2}\right)_m = \frac{a_1}{a_2}\left(\frac{w_m}{r_m}\right)^{g_2-g_1} w_m^{a_1-a_2}(p/t)^{-(a_1-a_2)} N^{((1-r)/r)(a_1-a_2)}$$

Factor rewards, w_m and r_m, depend upon factor endowments and production specialization. In particular, given the Cobb-Douglas specification of the production function in (1), if region m is completely specialized in the production of good j, then $w_m L_m / r_m K_m = (a_j - g_j)/g_j$. Rearranging yields:

$$(6)\quad w_m / r_m = [(a_j - g_j)/g_j](K_m / L_m)$$

Substituting (6) into (5) and denoting by $(c_1/c_2)_m^{(j)}$ the relative cost of good 1 when country m is completely specialized in good j we obtain:

$$(7)\quad \left(\frac{c_1}{c_2}\right)_m^{(j)} = \frac{a_1}{a_2}\left(\frac{a_j - g_j}{g_j}\right)^{g_2-g_1}\left(\frac{K_m}{L_m}\right)^{g_2-g_1} w(\mathrm{j})_m^{a_1-a_2}(p/t)^{-(a_1-a_2)} N^{((1-r)/r)(a_1-a_2)}$$

where $w(\mathrm{j})_m$ denotes the wage in region m when it is completely specialized in good j. Let $c_m = (c_1/c_2)_m^{(1)} \big/ (c_1/c_2)_m^{(2)}$ denote the ratio of relative costs in country m when it is completely specialized in good 1 and good 2, respectively. From (7), we have:

$$(8)\quad c_m = \left(\frac{(a_1-g_1)/g_1}{(a_2-g_2)/g_2}\right)^{g_2-g_1}\left(\frac{w(1)_m}{w(2)_m}\right)^{a_1-a_2}$$

Note that $c_m > 1$ implies that the relative supply curve is positively sloped and that the international equilibrium is stable and unique. If, on the contrary, $c_m < 1$, then the relative supply curve is negatively sloped and the possibility arises of multiple equilibria. In this paper we are not interested in the possibility of multiple equilibria, so that we look for the conditions ensuring that $c_m > 1$. In appendix A we show that $c_m > 1$ if and only if:

$$(9)\quad N < \tilde{N} = \left[\left(\frac{e_1}{e_2}\right)^{\frac{(g_2-g_1)a_1a_2}{(a_1-a_2)^2}} (p/t)\left(p_1^{1/a_1}\frac{b_1}{b_2}\right)^{\frac{a_1a_2}{(a_1-a_2)}}\left(\frac{K_m}{L_m}\right)^{-\frac{g_2a_1-g_1a_2}{(a_1-a_2)}}\right]^{\frac{r}{1-r}}$$

where $e_j = (a_j - \gamma_j)/\gamma_j$, $b_j = (a_j - \gamma_j)(1-a_j)^{(1-\alpha j)/\alpha j}$, $j = 1,2$

For the interpretation of condition (9) note that, as will be clear below, $w(1)_m / w(2)_m$ (and then c_m) is a decreasing function of N. The reason is that sector 2 uses intermediate goods more intensively than sector 1, and so takes a greater productivity advantage from an increase in N. Consequently, when N grows over a certain threshold value $\tilde{N}$, c_m becomes less than 1. Moreover, note that $\tilde{N}$ is greater the greater the relative price of good 1 (because $w(1)_m / w(2)_m$ is a positive function of p_1), the lower the capital-labor ratio (because good 1 is labor intensive), the greater the elasticity of substitution between intermediate inputs (because a greater r implies lower economies of scale, which in turn make less likely a negatively sloped relative supply curve) and the greater the relative price of intermediate inputs (because $w(1)_m / w(2)_m$ is a positive function of p/t).

We can now analyze the specialization pattern of the two regions. Because North is capital abundant with respect to South, (7) implies, for j =1,2: $(c_1 / c_2)_N^{(j)} > (c_1 / c_2)_S^{(j)}$. In addition, if condition (9) is satisfied, then, for m = N,S: $(c_1 / c_2)_m^{(1)} > (c_1 / c_2)_m^{(2)}$.

Figure 1 illustrates the relative cost curves $\left(\frac{c_1}{c_2}\right)_N^{(1)}$, $\left(\frac{c_1}{c_2}\right)_N^{(2)}$, $\left(\frac{c_1}{c_2}\right)_S^{(1)}$, $\left(\frac{c_1}{c_2}\right)_S^{(2)}$ as a function of N for N < $\tilde{N}$. They are positively sloped because, as mentioned above, sector 2 uses intermediate goods more intensively than sector 1 and so takes a greater cost advantage from an increase in N. Moreover, note that in this numerical example $(c_1 / c_2)_N^{(2)} > (c_1 / c_2)_S^{(1)}$ for N < $\tilde{N}$. As will be clear below, the interpretation of this inequality is that the production structure of the two regions is sufficiently different to imply that the relative cost of good 1 is higher in the North even when North is completely specialized in good 2 and South is completely specialized in good 1.

From Figure 1, we note that, for a given international relative price p_1 of good 1: i) if $N < N_1$, then both regions produce only good 1, whose relative price is always above its relative cost; ii) if

$N_1 < N < N_l$, then South produces only good 1 as before, while North produces both goods, because the relative price p_1 lies between the relative cost $(c_1 / c_2)_N^{(2)}$ corresponding to complete specialization in good 2 and the relative cost $(c_1 / c_2)_N^{(1)}$ corresponding to complete specialization in good 1; iii) if $N_l < N < N_u$, then North produces only good 2, while South produces only good 1; iv) finally, if $N_u < N$, then North produces only good 2, while South produces both goods.[10]

As will be clear below, for our purposes the interesting case is $N_l < N < N_u$, which implies complete specialization of each region in a different good. Accordingly, we investigate the parameter restrictions ensuring that condition iii) is satisfied. In particular, note that condition iii) implies: $(c_1 / c_2)_S^{(1)} < p_1 < (c_1 / c_2)_N^{(2)}$. In appendix B we show that this condition is satisfied if and only if:

$$(10) \quad N_l = \left(\frac{(p/t)(p_1/m_2)^{\frac{a_2}{a_1-a_2}}}{(K_N/L_N)^{\frac{a_1 g_2 - a_2 g_1}{a_1-a_2}}} \right)^{\frac{r}{1-r}} \leq N \leq \left(\frac{(p/t)p_1^{\frac{a_2}{a_1-a_2}}}{m_1^{\frac{a_1}{a_1-a_2}}(K_S/L_S)^{\frac{a_1 g_2 - a_2 g_1}{a_1-a_2}}} \right)^{\frac{r}{1-r}} = N_u$$

where $m_j = (a_1/a_2)\, e^{(\gamma 2 - \gamma 1)_j}\, b_j^{\,(a1-a2)}$. Note that, the greater the northern capital-labor ratio, the lower is N_l , and that the lower the southern capital-labor ratio, the greater is N_u . This implies that, if the two regions are sufficiently different in terms of factor endowments, then they specialize completely in their comparative advantage good and their pattern of specialization does not change as a consequence of globalization.[11]

3 Globalization and equilibrium relative wages

[10]Note that, if the curve $(c_1/c_2)_s^{(2)}$ crosses the international relative price at a point N_2 less then $\tilde{N}$, then in the range $N_2 < N < \tilde{N}$ both regions specialize completely in good 2. In the numerical example shown in the figure, however, N_2 is outside the relevant range.

[11]In section 5 we introduce labor market imperfections generating unemployment in the southern region. It follows that L_S is no longer equal to the full employment level $\tilde{L}_S$. From (10) in the text this implies that unemployment in the South reduces the upper bound N_u .The reason is that unemployment raises the capital-labor ratio used in production and is formally equivalent to an increase in the southern capital stock. Consequently, a paradoxical implication of a higher rate of unemployment in the peripheral region is that it may reverse its specialization pattern toward the capital intensive good. In this paper, the parameter

Assume that condition (10) is satisfied, so that North produces only good 2 and South only good 1. We can now analyze the effects of an increased international division of labor on the relative wages of the two regions. Final goods producers are price takers, so they equate the wage to the value marginal product of labor:

$$(11a)\quad w_N = (\alpha_2 - \gamma_2) L_N^{\alpha_2 - \gamma_2 - 1} N^{\frac{1-\alpha_2}{r}} z_N^{1-\alpha_2} K_N^{\gamma_2}$$

$$(11b)\quad w_S = p_1(\alpha_1 - \gamma_1) L_S^{\alpha_1 - \gamma_1 - 1} N^{\frac{1-\alpha_1}{r}} z_S^{1-\alpha_1} K_S^{\gamma_1}$$

Given the Cobb-Douglas specification of the production functions, the expenditure for intermediate goods and labor income are a constant share of revenue. So we can write:

$$\frac{(p/t)Nz_S}{w_S L_S} = \frac{1-\alpha_1}{\alpha_1 - \gamma_1}, \qquad \frac{(p/t)Nz_N}{w_N L_N} = \frac{1-\alpha_2}{\alpha_2 - \gamma_2}.$$ Rearranging yields:

$$(12)\qquad z_S = \left(\frac{1-\alpha_1}{\alpha_1 - \gamma_1}\right)\frac{w_S L_S}{(p/t)N}, \qquad z_N = \left(\frac{1-\alpha_2}{\alpha_2 - \gamma_2}\right)\frac{w_N L_N}{(p/t)N}$$

Plugging (12) into (11) and rearranging we can obtain the labor demand in the two regions as a function of the number of available intermediate goods:

$$(13a)\quad w_N = b_2 (K_N / L_N)^{\frac{\gamma_2}{\alpha_2}} N^{\frac{(1-r)(1-\alpha_2)}{r\alpha_2}} (p/t)^{-\frac{1-\alpha_2}{\alpha_2}}$$

$$(13b)\quad w_S = p_1^{\frac{1}{\alpha_1}} b_1 (K_S / L_S)^{\frac{\gamma_1}{\alpha_1}} N^{\frac{(1-r)(1-\alpha_1)}{r\alpha_1}} (p/t)^{-\frac{1-\alpha_1}{\alpha_1}}$$

Note that an increase in the international division of labor, through an increase in N, determines an upward shift of both regions' labor demand curve. For a given labor supply this entails a higher wage in both regions. The reason for this is that a finer international division of labor, achieved trough globalization, increases efficiency and consequently raises the marginal product of labor. Note, however, that these efficiency gains are asymmetric. In fact, denoting by w the southern wage relative to northern wage, from (13) we have:

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values of the model are such that a higher rate of unemployment stemming from globalization is not enough to reverse the trade pattern of the periphery. See appendix C.

$$(14) \qquad w = \frac{w_S}{w_N} = p_1^{\frac{1}{a_1}} \frac{b_1}{b_2} \frac{(K_S / L_S)^{g_1/a_1}}{(K_N / L_N)^{g_2/a_2}} N^{-\frac{1-r\,a_1-a_2}{r\quad a_1 a_2}} (p/t)^{\frac{a_1-a_2}{a_1 a_2}}$$

From (14) we see that, since $a_2 < a_1$, the southern wage relative to the northern wage decreases as globalization proceeds.[12] Figure 2 illustrates this result.

The intuition for this result is that the efficiency gains allowed by a greater international division of labor crucially depend on the production structure of a region. In particular, a region producing traditional labor intensive goods may benefit less from the opportunity of importing a greater variety of intermediate inputs with respect to a region producing more sophisticated, intermediates intensive goods.

4 Introducing labor market imperfections

This paper is motivated by an analysis of the determinants of the growing inter-area differentials in the rates of unemployment observed in many European countries. The central message of this work is that being the periphery of a rich country can be very costly in terms of unemployment. The reason for this is that there are many lessons whereby the wage of the periphery is affected by the wage prevailing in the core and, as a consequence, it is too high relative to the market-clearing wage. The economic literature and the policy debate have often stressed the role played by nominal rigidities, such as a national minimum wage floor, in causing the high unemployment rates observed in many peripheral regions within EU countries. While we do not neglect the importance of such rigidities, in this paper we emphasize the role played by real rigidities. In particular, we find that the fair wage hypothesis developed by Akerlof and Yellen (1990) may shed light on this issue. In their seminal paper they assume that "workers have a conception of a fair wage; insofar as the actual wage is less then the fair wage, workers supply a corresponding fraction of normal effort". Although the authors apply this hypothesis to the

[12]Note that, as for the case of an increase in *N*, an increase in t (reduction in transport costs) reduces the southern relative wage. The reason is that the cost reduction generated from a reduction in transport costs is greater in the intermediates intensive sector, in which North is specialized.

context of the skilled-unskilled relations in order to explain the concentration of the unemployed among the unskilled workers, we find this hypothesis particularly relevant to the problem at issue. In fact, we find reasonable to assume that individuals working in the peripheral region have a conception of a fair wage that depends upon the wage received by identical individuals working in the central region. As a consequence, the fair wage of individuals working in the periphery is generally too high with respect to the market-clearing wage and unemployment may result. Further, the gap between the fair wage and the market-clearing wage is wider the wider the core-periphery labor productivity gap. As a consequence, the fair-wage rigidity binds more and more in the presence of any mechanism that exacerbates the core-periphery productivity gap. As we will see below, globalization is one such mechanisms.

Following Akerlof and Yellen, we assume that:

(15) $e = \min(w/w^*,1)$

where e is the effort supplied by the worker, w^* the fair wage and w the actual wage. Note that worker's effort never exceeds 1, where $e = 1$ represents normal effort[13].

The fair wage is a weighted average of the wage received by the reference group (the wage received by workers in the other region, in our application) and the market-clearing wage:

(16a) $w_S^* = bw_N + (1-b)w_S^C$;

(16b) $w_N^* = bw_S + (1-b)w_N^C$

where w_S^C and w_N^C are the market clearing wages in the two regions, defined as those wages that would clear the regional labor markets when workers exert full effort regardless of the wage they are paid. Adopting a marshallian definition of market-clearing wage, we can write:

(17a) $w_S^C = w_S - (\overline{L}_S - L_S)d_S$;

(17b) $w_N^C = w_N - (\overline{L}_N - L_N)d_N$;

[13]In order to justify their assumption of an upper bound for e, the authors cite some experimental results showing that overpayment does not increase input.

where $\delta_S = -\partial w_S / \partial L_S$, $\delta_N = -\partial w_N / \partial L_N$ and $\bar{L}_S$ and $\bar{L}_N$ are the full employment levels of L_S and L_N in the two regions[14].

Equation (14) shows that the southern wage relative to northern wage is inversely related to N. This implies that, for N sufficiently large, $w_S < w_N$. . For instance, Figure 2 shows that the southern wage ranges from 30 to 60 per cent of northern wage in the relevant range (i.e. for $N_l < N < N_u$), for the parameter values reported in appendix C. It follows that northern workers' fair wage, w_N *, is less than the market-clearing wage, $w_N{}^C$. As a consequence, they exert full effort and the competition for workers among northern firms implies that these workers are paid their market-clearing wage.

In the South, on contrary, the fair wage w_S * is greater than the market-clearing wage $w_S{}^C$, because it depends on the wage prevailing in the North, where labor productivity is higher. As a consequence, southern workers would not exert a normal effort at the market-clearing wage (i.e., $e = w^C_S / w_S^* < 1$).

As far as southern firms are concerned, in the presence of excess supply of labor, they are free to set the wage at any level. They choose the wage so as to minimize w_S / e, the marginal cost of effective labor. From (15) we see that, for any wage between zero and w_S* the marginal cost of effective labor is constant and equal to w_S* . Hence, if we assume, following Akerlof and Yellen, that firms pay the fair wage whenever they are indifferent, then we have that southern workers are paid their fair wage and that they exert normal effort ($e_S = 1$)[15]:

(18) $w_S = w_S^*$

Plugging (18) and (17*a*) into (16*a*) yields:

[14]Note that, given the Cobb-Douglas specification of the production function, the labor demand curve is non linear and δ approaches infinity as L goes to zero. This implies that w^C approaches minus infinity as L goes to zero. The reason for this is that, in presence of a non linear labor demand curve, equation (17) is a good approximation of the market-clearing wage only in the neighborhood of full employment.

[15]Southern firms never pay a wage greater than the fair wage, because workers' effort never exceeds normal effort (see (15)).

$$(19) \qquad w_S^* = w_N - \frac{1-b}{b} d_S(\bar{L}_S - L_S)$$

Condition (19) represents the fair wage constraint (FWC) in the southern labor market. Plugging w_N from (13*a*) and $d_S = \frac{g_1}{a_1} L_S^{-(1+\frac{g_1}{a_1})} p_1^{\frac{1}{a_1}} b_1 K_S^{\frac{g_1}{a_1}} N^{\frac{(1-r)(1-a_1)}{r a_1}} (p/t)^{-\frac{1-a_1}{a_1}}$ into (19) we obtain:

$$(20) \; w_S^* = N^{(1-r)/r} \left(b_2 \left(\frac{K_N}{\bar{L}_N} \right)^{g_2/a_2} (p/t)^{-\frac{1-a_2}{a_2}} N^{\frac{1-a_2}{a_2}} - \frac{1-b}{b} \frac{\bar{L}_S - L_S}{L_S^{1+\frac{g_1}{a_1}}} \frac{g_1}{a_1} b_1 p_1^{1/a_1} K_S^{\frac{g_1}{a_1}} (p/t)^{-\frac{1-a_1}{a_1}} N^{\frac{1-a_1}{a_1}} \right)$$

From (20) we can see that the fair wage constraint implies a positive relation between w_S and L_S. The reason is that when L_S grows, unemployment decreases in the South and determines an increase in the fair wage, which approaches w_N for L_S tending to the full employment level $\bar{L}_S$.

Employment in the South is determined by the intersection of the labor demand curve (equation (13*b*)) with the FWC curve (equation (20)). These curves are illustrated in Figure 3.

This model then implies full employment in the North and unemployment in the South. The intuition is that the geographic and cultural proximity between two regions otherwise very distant (both in terms of factor endowment and of production specialization) makes the wage perceived as fair in the peripheral region dependent upon the wage received in the core region. As a consequence, the peripheral wage is too high and unemployment results.

5 Globalization and unemployment in the peripheral region

As mentioned above, by globalization we mean an increasing international division of labor through the exchange of a greater variety of intermediate goods. This can be achieved either by an increase in the number of trading countries or by an increase in the number of traded intermediate goods among the existing trade partners. In either case, the main effect is an increase in *N*, the variety of intermediates available for production in each country.

From (13) note that an increase in N determines an upward shift in the southern labor demand curve. So globalization implies, all else equal, a positive labor demand shock and a reduction in unemployment. But all else is not equal. In fact, from (20) we see that the fair wage is a positive function of N (remind that $a_2 < a_1$). Accordingly, an increase in N implies an upward shift in the fair wage constraint, as illustrated in Figure 4. The end result is an increase in unemployment[16]. To see this, from (13*b*) and (20) note that, for given L_S, , w_S^*/w_S is increasing in N. As a consequence, starting from a situation in which $w_S = w_S^*$, an increase in N implies, for given L_S , $w_S^* > w_S$. This implies that southern firms must reduce L_S in order to restore the equality between the fair and the actual wage.

The reason for this result is that in the face of diverging regional wages, individuals working in the periphery react by adjusting their fair wage according to the increase in the wage received by northern workers. As a consequence, firms reduce employment in the South in order to increase the marginal productivity of labor and reduce the fair wage, which varies inversely with the excess supply of labor.

Finally, equating (13*b*) and (20) yields L_S and the rate of unemployment in the South, $u_S = (\overline{L}_S - L_S) / \overline{L}_S$ as implicit functions of N. Figure 5 illustrates u_S as a function of N for the parameter values reported in appendix C. Note that, since u_N equals zero, Figure 5 also represents the evolution of the North-South unemployment differential as globalization proceeds.

To summarize, we have shown that in the presence of a markedly different interregional production structure, an increasing international division of labor brought about by globalization implies diverging regional wages. Absent substantial labor mobility, this tendency toward divergence is opposed by a real rigidity, the fair wage constraint in our example, linking the peripheral wage to the wage received in the richer North. This rigidity, while reducing (in the

[16]Note that a reduction in transport costs has the same effect as an increase in N: it shifts upward both the fair wage curve and the labor demand curve, causing an increase in unemployment.

limit, canceling) wage divergence, brings about divergence in the regional rates of unemployment.

6 Globalization and the peripheral output

Finally, we want to illustrate the implications of the preceding analysis as far as the peripheral output is concerned. In particular, we want to show that being periphery of a rich country can be very costly in terms of output loss, and that this problem is exacerbated by globalization. To see this, note that output in the South (I_S) equals the value added of good 1 production:

$$(21) \quad I_S = a_1 p_1 Q_1 = a_1 p_1 N^{\frac{1-a_1}{r}} z_S^{1-a_1} L_S^{a_1-g_1} K_S^{g_1}$$

where z_S is given by (12); w_S and L_S are the solution of the system of equations (13*b*) and (20). Since this system cannot be solved analytically, we proceed by numerical simulation. The results are illustrated in Figure 6 for the parameter values reported in appendix C. This figure shows the output of the periphery as a function of the degree of international division of labor for different values of b. This is a crucial parameter in our model, because it captures the dependence of the peripheral wage on the wage of the core region. The greater is b, the less is the core-periphery wage gap and the greater the core-periphery unemployment differential. From Figure 6 we see that higher values of b are associated with lower levels of peripheral output, because of the higher rate of unemployment they imply. Moreover, note that the evolution of peripheral output as globalization proceeds critically depends on the value of b: it can increase, be substantially stationary or even decrease if b is sufficiently high. Finally, Figure 6 reports the evolution of output for $b = 0$, i.e. in the absence of any fair wage constraint. It can be thought of as the output evolution of a small open economy identical in every respect to the southern region, except that it is not the periphery of a richer North. Accordingly, the vertical distance between this curve and one of the corresponding curves for the South represents the output loss the South incurs simply for being linked to the North. Note that this output loss is

exacerbated by globalization because, as shown above, an increased international division of labor brings about an upward pressure on the southern wage which raises the excess supply of labor in the South.

As a final remark, note that in this model globalization has striking implications for income distribution in the South. In fact, while the number of unemployed workers grows and the per capita income grows slowly and possibly even decreases, the wage of southern workers grows fast because it is linked to the fast growing wage in the North. So, in this model, southern wages grow at the expense of the rest of the southern community.

7 Final remarks

In the last decades, the largest EU countries have experienced a dramatic increase in the average rate of unemployment, which has fallen disproportionately and increasingly on the peripheral regions. This divergence in the regional rates of unemployment has coincided with the growing openness of the manufacturing sector experienced by European countries.

In order to contribute to the explanation of these facts, we have formulated a simple model in which globalization is the engine of regional unemployment divergence because it perversely interacts with a specific labor market imperfection. In particular, we have adapted to a core-periphery context the Akerlof and Yellen's fair wage constraint. This rigidity, while reducing wage divergence, is responsible for the divergence in the regional rates of unemployment.

It would be easy to show that globalization has similar implications for the core-periphery unemployment divergence when the peripheral unemployment is generated from other mechanisms, such as a national minimum wage floor linked to northern labor productivity or a North-South transfer proportional to northern income. The policy implications are radically different, however. When unemployment is caused by a minimum wage floor or an unemployment subsidy, simply abolishing them is sufficient to restore full employment in the peripheral region. On the contrary, when unemployment is caused by a fair wage constraint, the

only way to restore full employment in the South is by changing the specialization pattern of the region. This requires an increase in the capital endowment of the South, which may be much more difficult to achieve.

Our model assumes, instead of explaining, the virtual absence of interregional labor mobility within European countries. This is not completely satisfactory, however, because labor mobility is a powerful adjustment mechanism in other industrial countries, and hence more effort should be done to clarify why European workers do not leave the high unemployment areas[17].

Finally, having highlighted that, in presence of an increasing international division of labor, different labor market imperfections may have similar economic effects but different policy implications, we suggest, as a direction for further research, an empirical investigation of the actual relevance of the various potential sources of regional unemployment persistence in the increasingly globalized EU countries.

Appendix A

We want to show that $c_m > 1$ implies condition (9) in the text. From (8) note that c_m depends on the ratio between $w(1)_m$ and $w(2)_m$, where $w(j)_m$ equals the value marginal product of labor in sector j. So, for $j = 1, 2,$ we can write:

$$(A.1) \qquad w(j)_m = p_j(\alpha_j - \gamma_j) L_m^{\alpha_j - \gamma_j - 1} N^{\frac{1-\alpha_j}{r}} z(j)_m^{1-\alpha_j} K_m^{\gamma_j}$$

Given the Cobb-Douglas specification of the production function we know that the expenditure for intermediate inputs is a constant share of output. So, after rearranging terms, we can write:

$$(A.2) \qquad z(j)_m = \left(\frac{1-\alpha_j}{\alpha_j - \gamma_j} \right) \frac{w(j)_m L_m}{(p/t)N}$$

Plugging (A.2) into (A.1) and rearranging, yields:

$$(A.3) \qquad w(j)_m = p_j^{\frac{1}{a_j}} b_j (K_m / L_m)^{\frac{g_j}{a_j}} N^{\frac{(1-r)(1-a_j)}{r a_j}} (p/t)^{-\frac{1-a_j}{a_j}}$$

where $b_j = (a_j - \gamma_j)(1-a_j)^{(1-\alpha j)/\alpha j}$. Plugging (A.3) into (8) in the text for j = 1, 2, setting $c_m > 1$ and solving for N yields condition (9). Q.E.D.

Appendix B

We want to show that $(c_1/c_2)_S^{(1)} < p_1 < (c_1/c_2)_N^{(2)}$ implies condition (10) in the text. Plugging (A.3) with $j = 1$ into (7) we have that $p_1 > (c_1/c_2)_S^{(1)}$ implies the following:

$$(B.1)\ p_1 > p_1^{(a_1-a_2)/a_1} b_1^{a_1-a_2} \frac{a_1}{a_2} \left(\frac{a_j - g_j}{g_j}\right)^{g_2-g_1} \left(\frac{K_S}{L_S}\right)^{(g_2 a_1 - g_1 a_2)/a_1} (p/t)^{-(a_1-a_2)/a_1} N^{\frac{(1-r)(a_1-a_2)}{r a_1}}$$

Rearranging yields the second inequality of condition (10). Similarly, plugging (A.3) with $j = 2$ into (7), we have that $p_1 < (c_1/c_2)_N^{(2)}$ implies the following:

$$(B.2) \quad p_1 < b_2^{a_1-a_2} \frac{a_1}{a_2} \left(\frac{a_j - g_j}{g_j}\right)^{g_2-g_1} \left(\frac{K_N}{L_N}\right)^{(g_2 a_1 - g_1 a_2)/a_2} (p/t)^{-(a_1-a_2)/a_2} N^{\frac{(1-r)(a_1-a_2)}{r a_2}}$$

Rearranging yields the first inequality of condition (10). Q.E.D.

Appendix C

The simulations of Figures 1-6 set the following parameter values:

$$a_1 = 0.8,\ a_2 = 0.6,\ g_1 = 0.2,\ g_2 = 0.3,\ K_N = 140,\ K_S = 5,$$
$$\tilde{L}_N = \tilde{L}_S = 100,\ p = 1,\ p_1 = 2,\ t = 0.8,\ b = 0.05,\ r = 0.5.$$

These parameter values imply $N_l = 37$, $N_u = 140$ and $\tilde{N} = 265$. Further, they imply that in the presence of unemployment in the South (see note 17) N_u is reduced to 118.

[17] On the potential causes of the limited mobility among European regions see, for instance, Attanasio and Padoa-Schioppa (1991), and Faini *et al*. (1997).

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Figures

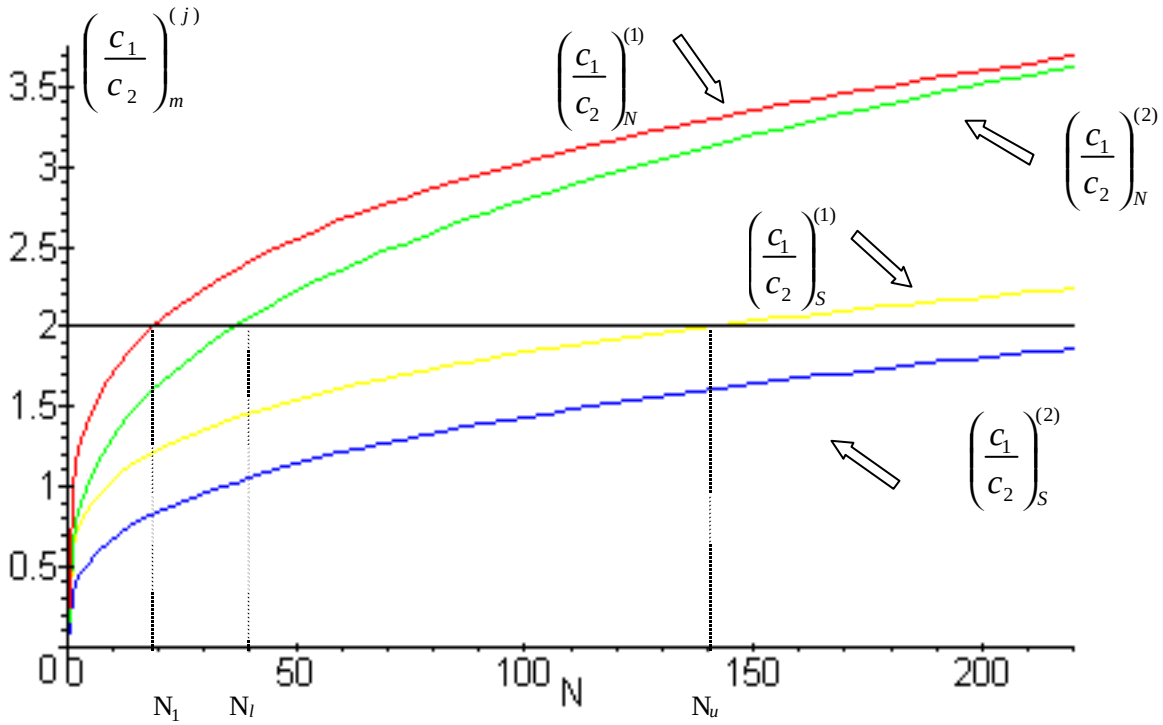

Figure 1

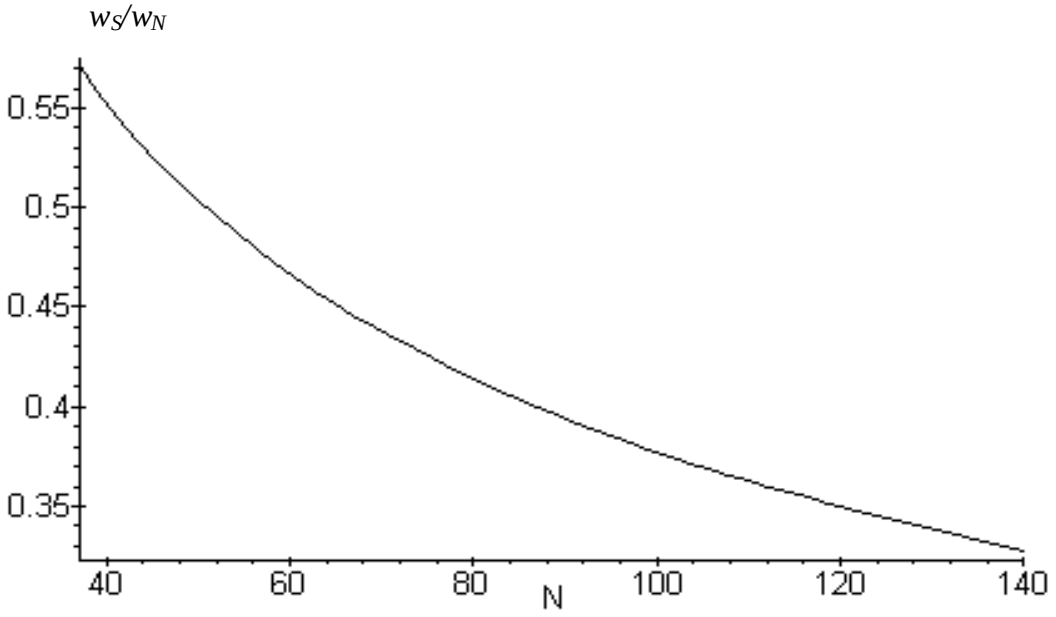

Figure 2

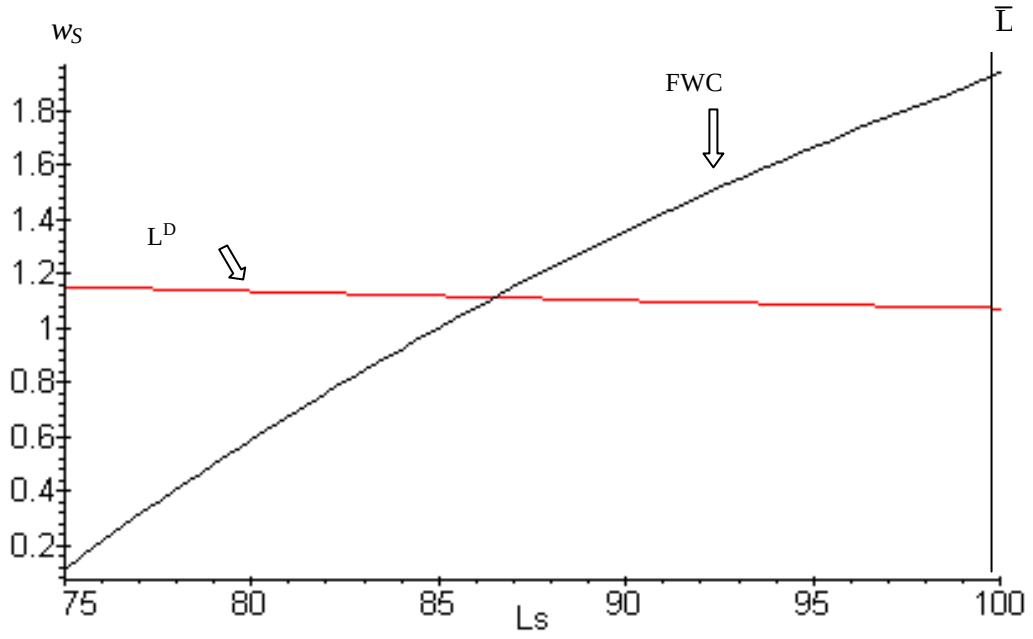

Figure 3

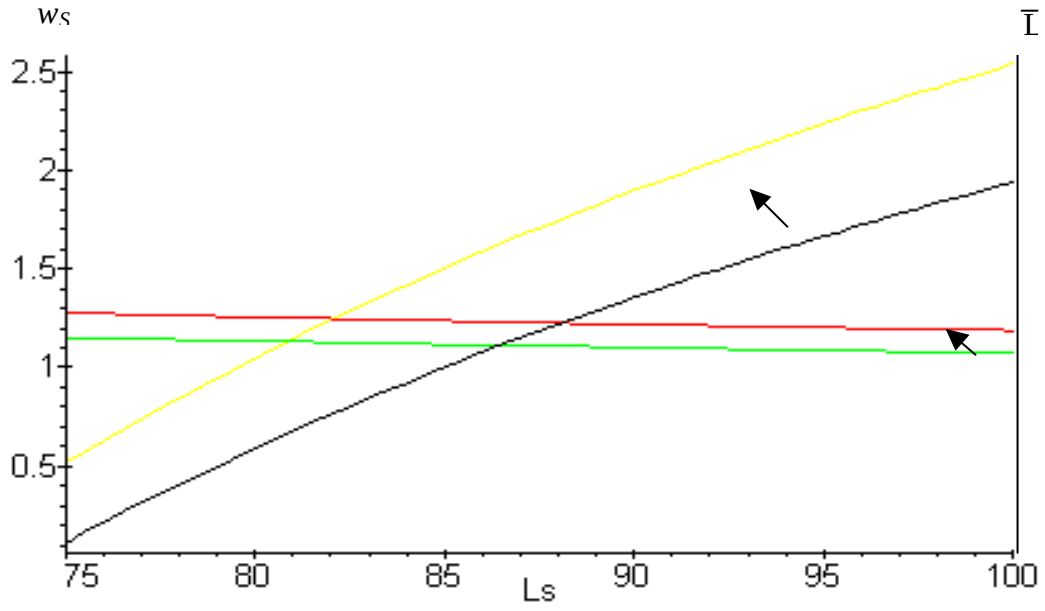

Figure 4

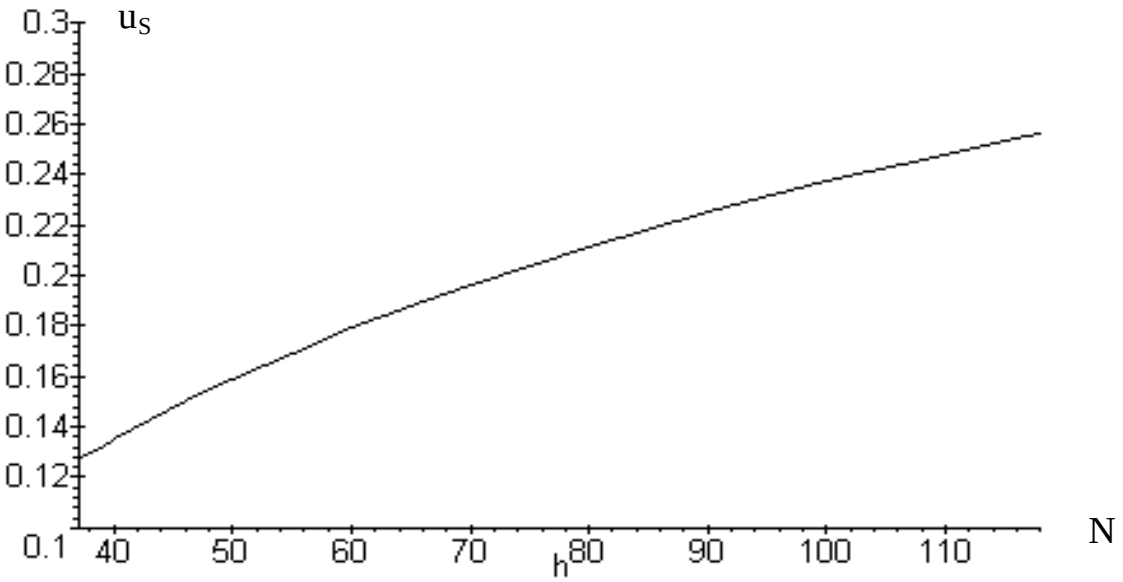

Figure 5

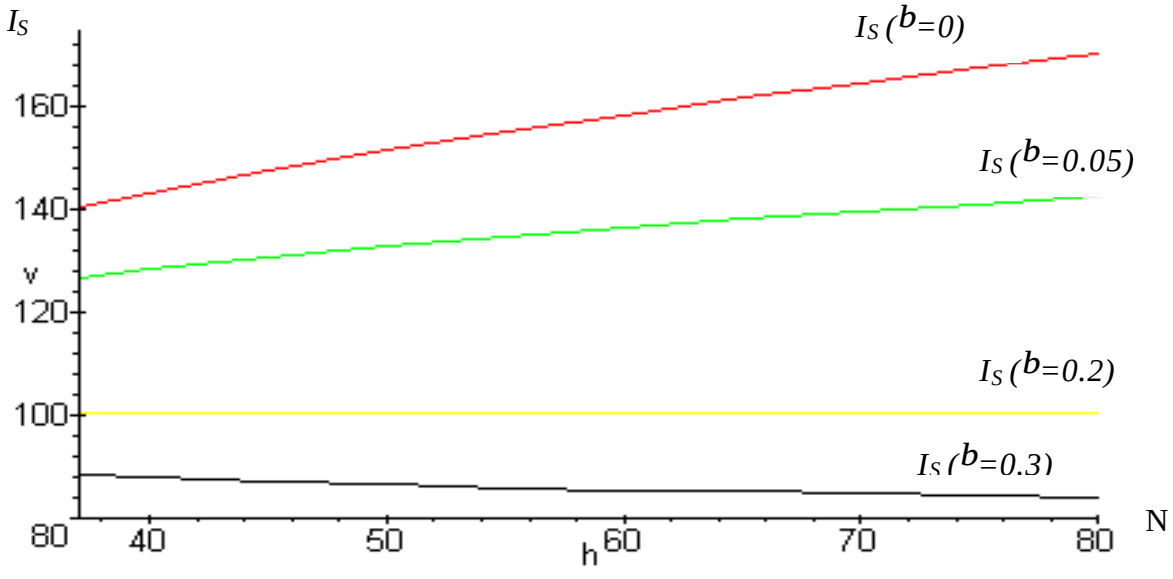

Figure 6