Efficiency Wages and Unemployment in a Global Economy

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Abstract

This paper considers trade in an asymmetric $2 \times 2 \times 2$ world, the two countries being labelled America and Europe. In America, the labor market is perfectly competitive, with flexible wages ensuring full employment. Europe faces unemployment due to efficiency wages. We derive the conditions for there to be factor price equalization (FPE) in this world. It is shown that for every distribution of labor between the two countries, there exists a range of skill allocations leading to FPE. Focusing on the FPE case, we show that labor accumulation in either country decreases wage rates in both countries and increases both the level and the rate of unemployment in Europe. The magnitude of changes in all variables depends on where the labor accumulation occurs. In contrast, skill accumulation in either country benefits labor in both, and the magnitude of the effects is independent from where the skill accumulation occurs. Finally, the entry of newly industrialising countries into the world economy hurts labor in both countries. In all cases, the labor market outcomes in either country are determined by labor market institutions in both.
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1 Introduction

In an influential paper, Davis (1998) argued that national labor market outcomes depend on the labor market characteristics in the rest of the world if the countries in consideration are linked via trade in goods. The point made in this paper is important because it casts into doubt the common practice of conducting cross-country studies of labor market institutions and outcomes in order to determine the effects of the former on the latter. As argued in Davis's paper, this "comparative" approach misses out the links between national labor markets that work through international trade in goods. What was needed, the argument goes, is a truly "global" approach that takes into account these general equilibrium links.

Davis (1998) illustrates the global approach in a simple $2 \times 2 \times 2$ model where the world consists of flexible-wage America and rigid-wage Europe, and factor prices for the two factors labor and skill are equalized internationally. In America, flexible factor prices lead to full employment. Europe is characterized by unemployment of unskilled labor due to a fixed minimum wage above the market clearing level.[1] There are two recurring patterns in the chain of results that Davis derives. First, for a given minimum wage in Europe, changes that happen outside America have no bearing whatsoever on the American economy. This results from the fact that the European minimum wage fixes the terms of trade, and hence the only link by which shocks from the rest of the world could affect America is cut off. Second, the labor market effects in Europe of any economic shock that happens to either country or the world as a whole are amplified by the fact that America does not have a minimum wage. Intuitively, given that all prices are fixed under the joint assumption of a minimum wage and the presence of factor price equalization, the adjustment process following any economic shock has to operate through quantities, in particular the endogenous level of employment. If only Europe has a minimum wage in place, it bears the full burden of adjustment. These two patterns in the results provide clear support for the claim that the link between national labor market characteristics and outcomes crucially depends on labor market characteristics in the rest of the world.

[1] This follows Brecher (1974).

The aim of the present paper is to analyze to which extent the interdependence between national labor markets holds in a model which is similar to Davis (1998) but for the fact that the wage for unskilled labor is determined in general equilibrium. This appears to be a worthwhile undertaking because the absence of terms-of-trade effects in Davis (1998) is a direct consequence of his assumption of an exogenously determined fixed wage rate.[2] And, as shown above, the model's implication of constant terms of trade figures prominently in explaining the two recurring patterns in the results derived by Davis. In addition, the endogenous determination of wages and unemployment rates appears to be desirable in itself both from a theoretical and an empirical point of view. The labor market model introduced below generates a strictly negative equilibrium relation between the rate of unemployment and the wage rate. While the particular approach used in this paper is a variant of the Akerlof and Yellen (1990) fair wage model, there is a multitude of other models that generates this type of equilibrium locus. This fact is stressed, and much of the respective literature is cited, by Blanchflower and Oswald (1995) who present ample empirical support for a negatively sloped equilibrium locus in wage-unemployment space which they call the wage curve. Importantly, while the wage curve is compatible with different models of the labor market, it is incompatible with a model that features a competitive labor market plus a minimum wage.

It will be shown that the Davis model loses many of its peculiar characteristics once we endogenize the determination of wage rates. On the other hand, it remains true that labor market characteristics in either one of the countries influences labor market outcomes in both. Hence, the global approach strongly advocated by Davis keeps its appeal if we drop his assumption that unemployment in part of the world is due to an exogenously fixed wage rate. Many of the more specific results need to be modified once this assumption is done away with.

[2]More precisely, it is the consequence of the dimensionality of the model which has more endogenously determined goods prices (two) than endogenously determined factor prices (one). Hence, as is well known, there is only one relative goods price which is compatible with diversification. Adding one more flexprice factor to the minimum-wage model would lead to flexible terms of trade again. In this paper, we will not pursue this route further and stick to the $2 \times 2 \times 2$ framework though.

2 The Model

The model is set up in three steps. First, the well known two-sector full employment model of a closed economy is introduced. This serves mainly the purpose of introducing the notation used later on.[3] Second, we introduce the efficiency wage mechanism into the closed economy which will be shown to generate involuntary unemployment in equilibrium. Third, it is shown how the equilibrium in the closed efficiency wage economy can be related to the equilibrium in a two-country trading world consisting of America and Europe, where the efficiency wage mechanism is effective only in Europe. This follows the approach popularized by Dixit and Norman (1980) to analyze a trading world with factor price equalization by comparing it to an equilibrium where the whole world is a single country – the so-called integrated equilibrium.

2.1 The Closed Economy with Full Employment

The closed flexible-wage economy is assumed to produce the two goods X and Y using the factors labor L and skill H. Good Y serves as the numeraire and is assumed to be labor intensive relative to X at all common factor price ratios. Product markets are perfectly competitive, and production functions in both sectors exhibit constant returns to scale. Both factors of production are supplied inelastically in the quantities L^W and H^W, respectively. Finally, preferences are assumed to be homothetic with both goods being essential in consumption. With w as the return to labor, r as the return to skill, and P as the relative price of X, the zero profit conditions for the two sectors are given by the equality of goods prices to unit costs, i.e.

$$c_X(w,r) = P \qquad\qquad c_Y(w,r) = 1. \tag{1}$$

It is assumed here that flexible factor prices clear the markets for both skill and labor. Hence, the employment ratio of skill relative to labor, denoted by h, equals their endowment ratio $h^W \equiv H^W/L^W$. Equilibrium in the closed economy is then given by the

[3] Wherever possible, the notation of Davis (1998) is used.

following two relations:

$$P = \lambda(h) \qquad \text{with} \qquad \lambda'(h) < 0 \tag{2}$$

$$w = \psi(P) \qquad \text{with} \qquad \psi'(P) < 0 \tag{3}$$

For a given $h = h^W$, (2) gives the equilibrium relative goods price and (3) gives the equilibrium wage rate. The sign of λ' follows from the assumptions of good X being skill intensive and consumers having homothetic preferences. Under these assumptions, the Heckscher-Ohlin theorem ensures that the higher the skill-to-labor endowment of a country, the lower is its autarky price of the skill intensive good. The sign of ψ' is implied by the factor intensity assumption alone. Under this assumption, it follows from the Stolper-Samuelson theorem that an increase in the price of X decreases the wage rate.

2.2 Efficiency Wages in the Closed Economy

In the next step, the efficiency wage mechanism is introduced into the closed economy. The mechanism is assumed to be effective only for labor, whereas the price for skill continues to be determined in a competitive market, and hence skill is fully employed throughout.[4] It is assumed that employees are able to choose their effort at work, and that the amount of effort supplied depends on their personal fairness conception. In particular, following the fair wage-effort hypothesis of Akerlof and Yellen (1990), the effort workers are willing to supply depends positively on the differential between the actual wage rate they receive and a reference wage rate z. The reference wage from a single worker's point of view is not exogenous but assumed to depend positively on the expected wage rate w^e and some standard wage rate $\bar{w}$ which is fixed in units of the *numéraire*. Workers are assumed to be identical but for their employment situation. Each worker – employed or unemployed – supplies one unit of labor, and hence w^e equals labor income per head. It includes an income of zero for the unemployed, and therefore $w^e \equiv w(1-U)$ where U is the rate of unemployment. The standard wage rate may either be determined by collective

[4] The particular efficiency wage model presented here is taken from Kreickemeier and Schoenwald (2002), where its properties are spelt out in greater detail.

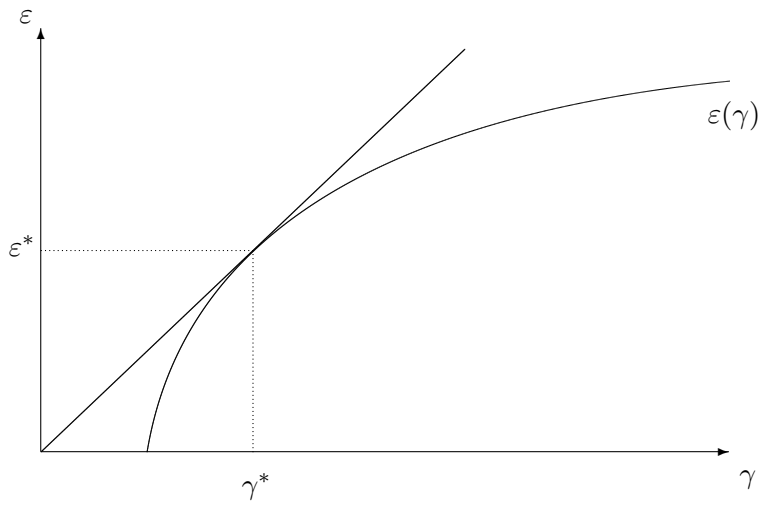

Figure 1: The optimal wage differential

bargaining or be equal to a minimum wage rate – which is assumed to be non-binding in the framework considered here.

Formally, the reference wage is given by $z = z(w(1-U), \bar{w})$ with the partial derivatives with respect to both arguments being strictly positive. In addition, $z(\cdot)$ is assumed to be linearly homogeneous in $(w(1-U), \bar{w})$. This is a natural assumption to make since it implies that a proportional increase in all variables relevant for the workers' fairness conception yields a proportional increase in the index relative to which they assess the fairness of their wage. Finally, $z(\cdot) \to 0$ as $w(1-U) \to 0$ is assumed in order to exclude the extreme case of $U = 1$ in equilibrium. The effort supplied by the workers is denoted by $\varepsilon = \varepsilon(\gamma)$ where $\gamma \equiv w/z$ and $\varepsilon' > 0$. In order to ensure the existence of a unique equilibrium, it is assumed that $\varepsilon(\cdot)$ takes on a value of zero up to some positive level of γ and is strictly concave above this threshold.

Firms are wage setters but they are assumed to treat the reference wage parametrically. Under this assumption, profit maximization can be thought of as a two-stage process, just as in the standard efficiency wage model of Solow (1979). In step one, firms set the wage rate such as to minimize the wage rate for labor in efficiency units. In step two, they hire workers up to the point where the value marginal product of labor is equal to the wage

set in step one. In equilibrium, all firms choose the same wage, and this wage satisfies the modified Solow condition

$$\frac{\partial \varepsilon}{\partial \gamma}\frac{\gamma}{\varepsilon} = 1. \tag{4}$$

This result is illustrated in figure 1. As the firms treat z parametrically, minimizing the cost of efficient labor w/ε from their point of view is equivalent to minimizing γ/ε. Hence, profit maximizing wage setting leads the firms to choosing a wage that is compatible with γ^*, with the resulting equilibrium effort being ε^*.

Equation (4) has several noteworthy implications. First, both the effort and the differential between wage and reference wage are determined solely by the effort function and hence are constant throughout any comparative statics exercise. Here, we take advantage of this feature of the model by normalizing the equilibrium effort to one. This simplification leads to both the full employment and the efficiency wage economy having the same labor endowment in efficiency units which allows us to focus on the effects of differences in the rate of employment between the two scenarios. Second, the profit maximizing wage rate changes one for one with the endogenously determined reference wage, and is therefore itself endogenous.

Of particular interest here is the functional relationship between the profit maximizing wage rate and the rate of unemployment. Formally, we have the equilibrium condition $w = \gamma^* z(w(1-U), \bar{w})$, and it can be easily verified by implicit differentiation that $\partial w/\partial U < 0$.[5] Hence, we can write

$$w = \alpha(U) \qquad \text{with} \qquad \alpha'(U) < 0 \tag{5}$$

which gives combinations between the wage and the rate of unemployment that are compatible with workers supplying the profit maximizing level of effort. The assumptions on $z(\cdot)$ made above imply that $\alpha(U) \to 0$ as $U \to 1$. Using the terminology of Akerlof and Yellen (1990), (5) is called the fair wage constraint. As mentioned in the introduction, a relation like (5) can be and has been derived from different non-competitive models of

[5] In showing this, use has to be made of the fact that the elasticity of z with respect to $w(1-U)$ is strictly between zero and one.

the labor market. The implications of the present analysis do in no way depend on the particular approach used as a foundation for this relation.

Furthermore, given that we assumed full employment of skill, there is by definition a relationship between the rate of unemployment U, the endowment ratio h^W and the employment ratio h:

$$U = 1 - \frac{h^W}{h} \equiv \beta(h, h^w) \qquad \text{with} \qquad \frac{\partial \beta}{\partial h} > 0. \tag{6}$$

This relation is identical to the "Brecher relation" stated in Davis (1998) but for the fact that we have divided both sides by L^W.[6] Taken together, equations (2), (3), (5) and (6) determine the endogenous variables P, w, U and h in the closed efficiency wage economy. Note that contrary to the full employment model, the "Heckscher-Ohlin relation" (2) now describes possible combinations between two endogenous variables.

It is convenient to illustrate the determination of equilibrium using a figure similar to figure 1 of Davis (1998). This is done in figure 2. The graphical representations of equations (2), (3), (5) and (6) in the four quadrants are straightforward and do not need further elaboration. The upward sloping curve in quadrant 1, labelled "FWC" is implied by (3), (5) and (6): For a given "Stolper-Samuelson relation" (3), it gives combinations of h and P which are compatible with workers supplying the profit maximizing level of effort along the fair wage constraint. It can be easily verified that there is a unique equilibrium for the closed economy, with the equilibrium values of the respective variables being denoted by a *.

The basic difference to the model of Davis (1998) is transparent if one compares figure 2 to Davis' figure 1. While the exogenous w^* in Davis (1998) uniquely determines the equilibrium values of P, h and U, the fair wage constraint $\alpha(U)$ in the present model provides the missing link that allows the endogenous determination of equilibrium values for all four variables.[7] Variations of figure 2 will be the key tool for deriving comparative static

[6] Note that the form of (6) does not depend on the particular mechanism generating unemployment. Observing this, we will not use the term "Brecher relation" in the following because it appears to suggest a connection to the minimum wage model originally due to Brecher (1974).

[7] In the Davis paper, U denotes the number of unemployed rather than the rate of unemployment. This difference does not matter for the argument just made.

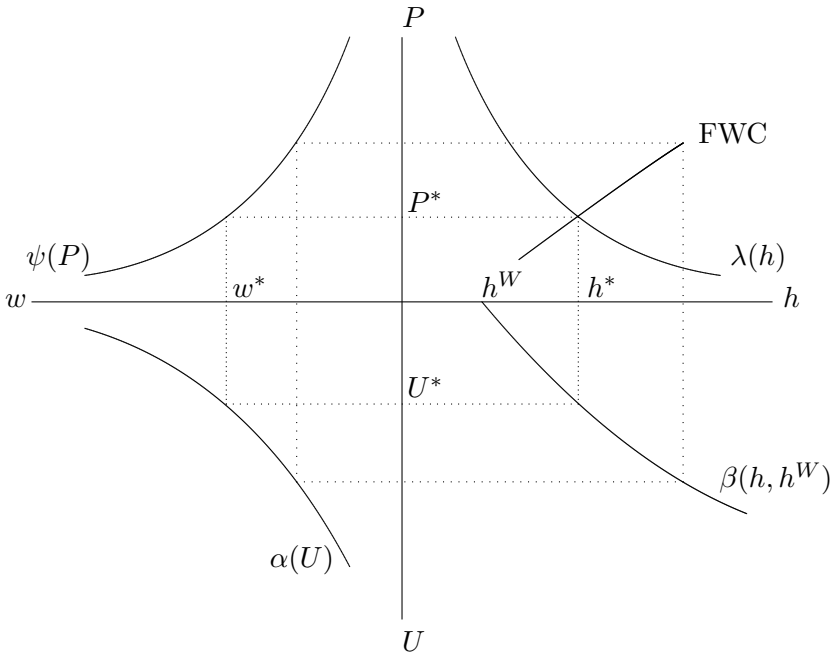

Figure 2: The Closed Economy Equilibrium

results in the next section. The minimum wage model used by Davis can be interpreted as a limiting case of the efficiency wage model presented here: if the reference wage z is equal to the exogenous standard wage $\bar{w}$, the market wage is constant in equilibrium as well, i.e. we have $\alpha'(U) = 0$. One can see immediately that this would lead to a horizontal FWC curve in the upper right quadrant in figure 2. This limiting case is obviously formally equivalent to a standard minimum wage model.

2.3 Conditions for Factor Price Equalization

In the next step, the equilibrium for the closed efficiency wage economy just derived is re-interpreted as describing the situation of the whole world in which both goods and factors are freely mobile. This approach has been popularized by Dixit and Norman (1980).[8] They show under which conditions free goods trade in a world consisting of

[8] An earlier application can be found in Travis (1964).

more than one country is sufficient to replicate the equilibrium of the integrated world, with all prices and aggregate quantities in both situations being the same. Davis (1998) showed that the concept of an integrated equilibrium can be sensibly applied even in a situation where the two countries have different institutions. In particular, Davis compares an integrated world which has a minimum wage in place with a two-country world which is characterized by a minimum wage in one country (Europe) and a fully flexible wage, leading to full employment, in the other (America). He then goes on to show that there are factor allocations which allow the asymmetric two country world to replicate the integrated equilibrium.

Here, we undertake an exercise similar to Davis (1998) in that the world factor endowment is split between "Europe" and "America". Hence, we have $H^W = H^A + H^E$ and $L^W = L^A + L^E$, with A and E being country superscripts. Europe inherits all properties of the integrated world, i.e. it is characterized by involuntary unemployment due to the fair wage mechanism described above. In contrast, in America there is full employment of labor with firms being assumed to act as wage takers in a competitive labor market. It is now straightforward to show that the Dixit-Norman technique of replicating an integrated equilibrium in a two-country setting cannot be applied in the present context. In particular, we have the following result.

Lemma 1. *It is impossible to find a division of labor between the two countries that leads to both countries having the same factor prices as the integrated efficiency-wage world.*

The proof is by contradiction. Assume that the endowment split leaves world factor prices unaltered. An unaltered wage rate elicits the profit maximizing effort from the European workers – and hence is chosen by European firms – if and only if after the endowment split Europe has the same rate of unemployment as the integrated world had before. But a constant rate of unemployment in Europe implies a decreasing *average* rate of unemployment in the world compared to the integrated equilibrium. This means a lower average skill intensity of production and hence a higher relative price of the skill intensive good. Any change in relative goods prices however is incompatible with both countries having the same factor prices as in the integrated equilibrium.

It is now checked whether there are allocations of factors to the two countries that lead to free trade equilibria in which the factor prices, although different from the integrated equilibrium, are the same in both countries. As a first step, we construct a *hypothetical* one-country world with efficiency wages which has

(i) the same skill endowment as the two-country world,

(ii) the same average skill intensity of production as the two-country world, and

(iii) the same rate of unemployment as Europe.

In analogy to the Dixit-Norman terminology, this hypothetical one-country world is called the *virtual integrated equilibrium* (VIE). Let s^L be the European share of the labor force. With unemployment only in Europe, the average unemployment rate in the world is Us^L, where U now denotes the European rate of unemployment. Hence, the equivalent to (6) in the asymmetric two-country world becomes

$$U = \frac{1}{s^L}\left(1 - \frac{h^W}{h}\right) \equiv \beta(h, h^W, s^L), \tag{7}$$

where

$$h \equiv \frac{H^W}{L^A + L^E(1-U)}$$

in this new context is reinterpreted as the the average skill intensity of world production. Denote the variables pertaining to this VIE by a $\widetilde{}$. In order to satisfy conditions (i) to (iii), the virtual endowment ratio $\widetilde{h}^W \equiv H^W/\widetilde{L}^W$ has to solve the equation $\beta(h, \widetilde{h}^W) = \beta(h, h^W, s^L)$, holding h constant at the level of the two-country world. Substituting from (6) and (7) yields

$$\widetilde{h}^W = h + \frac{h^W - h}{s^L}, \tag{8}$$

and solving for $\widetilde{L}^W$ this becomes

$$\widetilde{L}^W = L^W\left(\frac{1 - Us^L}{1 - U}\right). \tag{9}$$

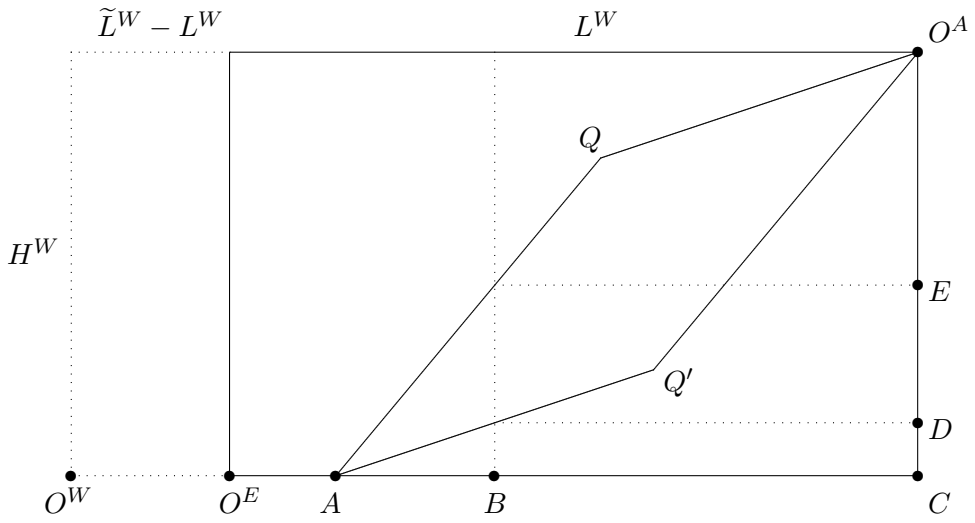

Figure 3: The virtual integrated equilibrium

Equation (9) is to be interpreted as follows. If a free trade equilibrium for a given combination of L^W, U and s^L is characterized by FPE, then this equilibrium replicates the VIE with labor endowment $\widetilde{L}^W$ given by (9). It is important to note that $\widetilde{L}^W$ does not depend on the allocation of the world skill endowment between the two countries. Hence, for a given value of s^L international reallocations of skill do not change the associated VIE.

The concept is illustrated in figure 3. European and American factor endowments are measured from origins O^E and O^A, respectively. The width of the *solid* box gives the world labor endowment, its height the world skill endowment. The European labor endowment $L^E = s^L L^W$ is given by $\overline{O^E B}$, the European unemployment rate U by $\overline{O^E A}/\overline{O^E B}$. Then the virtual labor endowment $\widetilde{L}^W$, and hence O^W, is determined by the the condition that $\overline{O^W A}/\overline{O^W C}$, the rate of unemployment in the VIE, be equal to $\overline{O^E A}/\overline{O^E B}$. Vectors $\overline{AQ}$ and $\overline{AQ'}$ are the factor inputs into X and Y production, respectively, in the VIE. Let s^H be the European share of the world skill endowment. It is now immediate that the two-country world will replicate the VIE given in figure 3 if and only if $\overline{CD}/\overline{CO^A} \leq s^H \leq \overline{CE}/\overline{CO^A}$. Note that figure 3 shows only the "snapshot" for a given value of s^L. Changing the labor allocation between countries leads to a different VIE.

Having introduced the VIE concept, we are now in a position to prove that there is a

non-degenerate FPE set in the present model. In particular, the following holds:

Proposition 1. *Let (s^L, s^H) be the fractions of the world labor and skill endowments, respectively, which are allocated to Europe. Then, for every s^L with $0 < s^L < 1$ there exists a range of skill allocations $[s_1^H, s_2^H]$ with $0 < s_1^H < s_2^H < 1$ which leads to factor price equalization.*

The proof is straightforward. From (9), it follows that $\partial \widetilde{L}^W / \partial U > 0$ for all $s^L, U < 1, L^W > 0$. In addition, we have $\widetilde{L}^W(\cdot) = L^W$ for $U = 0$, and $\widetilde{L}^W(U) \to \infty$ as $U \to 1$, given that $s^L < 1$ and $L^W > 0$. This implies that for *every* combination of $L^W > 0$, $s^L < 1$ and $U < 1$ there exists a corresponding and unique VIE. Since it has been assumed that X production is more skill intensive than Y production at all common factor price ratios, there is a non-degenerate interval $[s_1^H, s_2^H]$ that leads to a replication of the VIE by the two-country world and hence to internationally equalized factor prices.

Now, the FPE set can be described formally in a manner very similar to the standard model. Let goods be indexed by i, countries by j. Then, the divisions of world factor endowments that replicate the VIE can be described as

$$FPE = \left\{ \begin{array}{c} [(H^A, L^A), (H^E, L^E)] \; \exists \; \lambda_{ij} \geq 0 \\ \\ \text{such that } \; \sum_j \lambda_{ij} = 1 \\ \\ (H^A, L^A) = \sum_i \lambda_{iA} (\widetilde{H}(i), \widetilde{L}(i)) \\ \\ (H^E, L^E) = \sum_i \lambda_{iE} (\widetilde{H}(i), \widetilde{L}(i)) + (0, L^E \cdot U) \\ \\ i = X, Y \quad j = A, E \end{array} \right\} \tag{10}$$

Here, $\widetilde{H}(i)$ and $\widetilde{L}(i)$ denote the amounts of skill and labor, respectively, employed in sector i in the VIE with factor endowments $(H^W, \widetilde{L}^W)$, where $\widetilde{L}^W$ is given by (9). These conditions state that in order to replicate the VIE it must be possible for the two-country world to use the skill intensities of the VIE and thereby achieve full employment for both

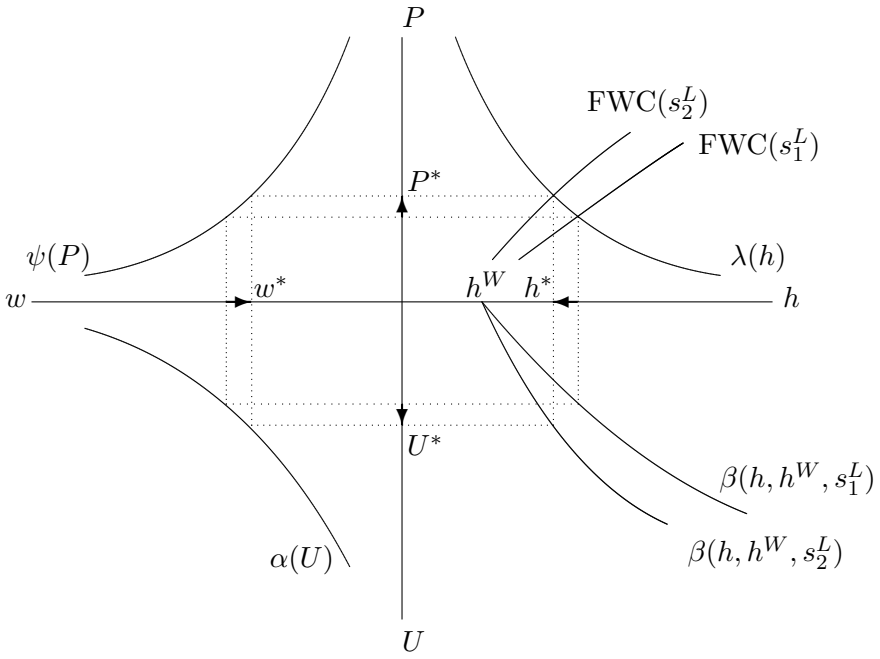

Figure 4: Varying the Relative Size of Europe's Labor Force

skill and labor in America as well as full employment for skill and an unemployment rate of labor in Europe equal to that of the VIE.

It has been stressed that every redistribution of labor between Europe and America, implying a change in s^L, leads to a change in the corresponding VIE. Clearly, this involves a change in skill intensities. Therefore, in contrast to both the full employment model and the minimum wage model considered by Davis (1998), the FPE region of the present model is characterized by non-constant goods and factor prices.[9] More specifically, it follows from (8) that $\partial \widetilde{h}^W / \partial s^L > 0$, which implies that decreasing the relative size of the European labor force within the FPE region increases the labor endowment of the

[9]On a general level, this result is due to the assumed asymmetry between the two countries. An analogous result can be produced in a full employment model if it were assumed that the two countries have different demand structures. In this case, redistributing consumers between countries would influence prices. See Uzawa (1959) and Albert (1994). In Davis (1998), prices are constant within the FPE region despite the asymmetry between the countries because he assumes them to be so.

respective VIE. The effects can be verified by means of figure 4. Decreasing s^L from s_1^L to s_2^L rotates $\beta(\cdot)$ outwards. If FPE holds throughout, changes in equilibrium values of the variables of interest are indicated by arrows. Hence, decreasing the relative size of the European labor force leads to a lower skill intensity of production, a higher relative price of the skill intensive good, a lower wage and to a higher rate of unemployment in Europe.[10]

This implies that migration of workers between the two countries in the presence of FPE would have real consequences: Let $\Delta L^A = -\Delta L^E$ be the amount of migration from Europe to America. The resulting change in equilibrium values of U, h, P and w is again given by the arrows in figure 4 because the considered flow of labor amounts to a decrease in s^L. The result is independent from whether the migrants were employed or unemployed before emigration to America. However, the effects on the workers staying in Europe depend on the previous employment status of the migrants.

Consider first the case where the migrants were employed initially. In this case, stayers who had a job initially are unambiguously hurt by the emigration because they – as their American colleagues – experience a decline in wages. On the other hand, some of the staying workers who were unemployed initially will find employment following the emigration of their formerly employed colleagues.[11] However, the increase in the European rate of unemployment implies that the absolute number of employed workers in Europe must have fallen. Hence, the number of newly employed workers in Europe is smaller than the number of emigrants. It is now straightforward to derive the implications for the case where the migrants were unemployed initially. With unemployed workers leaving Europe, stayers that were employed initially are hurt in one of two ways. Those who stay employed experience a wage decline – again, the same as their American colleagues. In addition, some of them lose their job. This leaves the migrants as the only group who gains.

Figure 4 can also be used to illustrate the importance of the general equilibrium approach, i.e. the extent to which labor market outcomes in one country depend on institu-

[10] In figure 4, $\widetilde{h}^W$ can be found by drawing a β-curve with $s^L = 1$ through the respective equilibrium point (U^*, h^*). The resulting (endogenous) intersection point with the h-axis gives $\widetilde{h}^W$.

[11] This is seen in figure 4 by noting that the average skill intensity of world production decreases.

tions in the other. In particular, we ask the two questions

(i) What is the effect of America *not* having the efficiency wage mechanism on the European labor market?

(ii) What is the effect of Europe's efficiency wage mechanism on the American labor market?

In accordance with the rest of the paper, FPE is assumed here. In order to answer question (i), assume that $s_2^L < s_1^L = 1$ in figure 4. Under this condition, and with s_2^L as the relative size of the European labor force, the arrows indicate the difference it makes for Europe that America's labor market is perfectly competitive rather than characterized by the European efficiency wage mechanism.[12] Hence, the absence of the efficiency wage mechanism in America negatively affects European workers, leading to lower wages and a higher rate of unemployment. Turn now to question (ii). The wage rate with competitive labor markets in both countries is given by $\psi[\lambda(h^W)]$. Comparing this to w^* in figure 4, it can be seen that the presence of Europe's efficiency wage mechanism positively affects American workers by leading to a higher wage.

3 Comparative Statics

We now conduct two comparative static exercises which appear to have particular interest from a policy point of view. First, the impact of factor accumulation in one of the countries on wages and employment is analyzed. Second, we look at the entry of newly industrializing countries into the trading world. For both cases, the model of Davis (1998) generates strong results. Part of the aim of this section is to scrutinize to what extent the special nature of the labor market distortion assumed by Davis is responsible for these results.[13] An obvious second benchmark case would be given by the full employment

[12] Clearly, the case of America and Europe being identical in all respects, including the labor market characteristics, is indistinguishable from the case where Europe encompasses the whole world, implying $s^L = 1$.

[13] In a model that otherwise uses the framework of Davis (1998), Oslington (2002) analyzes the case where Europe is fully specialized in the production of the skill intensive good. He shows that under this

model. However, we will consider instead the more general benchmark of a constant rate of unemployment which is not necessarily zero. With respect to the comparative static effects, it is immaterial whether the rate of unemployment in Europe is constant at some positive level or zero.[14] And using a positive rate of unemployment as a starting point allows us to sensibly compare comparative static effects of our model, which is characterized by unemployment in the initial equilibrium, to this benchmark.

3.1 Factor accumulation in America and Europe

In analyzing the effects of factor accumulation, we will assume that both countries will continue to produce both goods, i.e. old and new factor endowments of the two countries are such that they are within the FPE region described by (10). Clearly, under this condition it is impossible for factor accumulation in either country to explain divergent wage trends in Europe and America because factor prices are equalized throughout. In this respect, the present model is not different from either the full employment or the minimum wage model.

The effects of factor accumulation in either region can be analyzed in a straightforward way using figure 4. Consider first the simpler case of skill accumulation. At a given rate of unemployment, skill accumulation in either country increases the average skill intensity of world production. This puts downward pressure on the price of the skill intensive good and, via the Stolper-Samuelson relation, upward pressure on the wage rate. A higher wage rate at a constant rate of unemployment is incompatible with the fair wage constraint, however. Hence, the rate of unemployment falls, leading to a new equilibrium where the first round effects just described are attenuated. In figure 4 this can be verified by shifting $\beta(h, h^W, s)$ to the right, holding s constant (not drawn). The result can be summarized as follows.

Proposition 2. *Skill accumulation in either country leads to a decrease in the European*

assumption many of Davis' results no longer hold.

[14] We have assumed above that unemployed workers receive an income of zero. Then, Europe having labor endowment L^E and a constant rate of unemployment U is equivalent to it having full employment and a labor endowment $L^E(1-U)$.

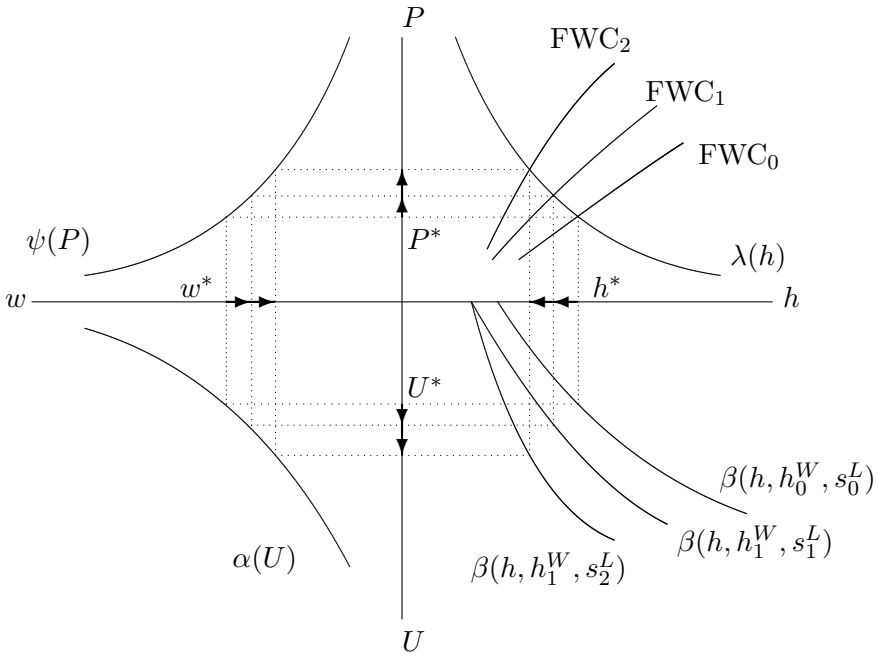

Figure 5: Labor Accumulation in America and Europe

rate of unemployment and to an increase in wages in both countries. The effects are independent from the location of skill accumulation.

Several aspects of this result are worth noting. To begin with, the model shares the property of both the minimum wage and the full employment model that the effects of skill accumulation on prices and unemployment are independent from where the accumulation occurs. Furthermore, and in contrast to the minimum wage model, there are price effects of skill accumulation. However, by comparing the equilibrium effects with the first round effects, one can see that the price effects are smaller than in a hypothetical situation with a constant rate of employment. Hence, at least with respect to skill accumulation one can argue that the efficiency wage model captures the middle ground between the minimum wage model where all labor market adjustment occurs through quantities and the full employment model where all labor market adjustment occurs through prices.

The effects of labor accumulation are shown in figure 5. The growth of the labor

force in either of the two countries decreases h^W (from h_0^W to h_1^W), and hence shifts $\beta(\cdot)$ to the left. In addition, accumulation in America decreases s^L (from s_0^L to s_2^L), thereby tilting $\beta(\cdot)$ outwards around the new intersection point with the h axis. Analogously, accumulation in Europe increases s^L (from s_0^L to s_1^L), which tilts $\beta(h, h^W, s^L)$ inwards. In both cases, the new β function lies below its original position. This can be verified by partially differentiating (7), holding h constant, which yields

$$\frac{\partial \beta}{\partial L^E} = \frac{L^E - L^W}{(L^E)^2} + \frac{H^W}{h}\frac{1}{(L^E)^2} = \frac{1-U}{L^E} > 0 \tag{11}$$

$$\frac{\partial \beta}{\partial L^A} = \frac{1}{L^E} > \frac{\partial \beta}{\partial L^E} > 0 \tag{12}$$

Working through the adjustment process in the diagram shows that in the new equilibrium wages have fallen in both countries, Europe experiences a higher rate of unemployment, the average skill intensity of world production has fallen and the price of the skill intensive good is higher. The effects are stronger when the labor accumulation occurs in America than when in occurs in Europe. Hence, we have

Proposition 3. *Labor accumulation in either country leads to an increase in the European level and rate of unemployment, and to a decrease in wages in both countries. With accumulation occurring in America, wages in both countries decrease by more, the European rate of unemployment increases by more and the European level of unemployment increases by less than with accumulation in Europe.*

Interestingly therefore, in the present model we have to modify the result from both the full employment and the minimum wage model that labor market outcomes in a world with factor price equalization depend only on global factor supplies. Here, the country in which labor accumulation takes place plays a role in determining the labor market outcomes in both countries. Using the terminology introduced above, this occurs because depending on the country in which labor accumulation takes place the world is moved to a different VIE. This is because obviously the location of labor accumulation affects s^L, the European proportion of the labor force.

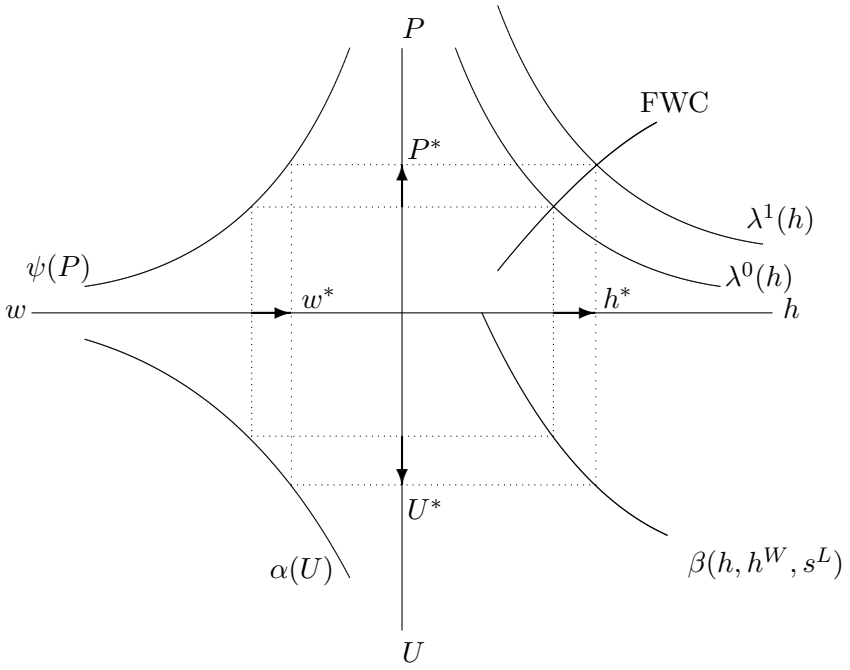

Figure 6: The entry of NICs into world trade

3.2 Entry of NICs into world trade

Consider now the entry of newly industrializing countries (NICs) into the trading world, i.e. the virtual integrated equilibrium comprising America and Europe. It is assumed that at the relative world market price of the VIE, the NICs as a group are net exporters of the labor intensive good.[15] Again, the comparative static effects can be shown by a variant of the familiar four-quadrant diagram, assuming that factor price equalization between America and Europe continues to hold.

In figure 6, the entry of NICs into world trade shifts the Heckscher-Ohlin relation outwards, i.e. from position λ^0 to position λ^1. The vertical distance between the two curves measures the amount by which this change would make P, the relative world market price

[15]This assumption is quite general in the sense that restrictions for the trade between NICs and the VIE countries are not ruled out. Similarly, technology differences between both groups of countries are allowed for. Clearly, if trade was restricted or technologies between the two groups of countries was different, factor prices between NICs and the VIE countries would not be equalized.

of the skill intensive good, go up for a given average skill intensity of production in the VIE countries. This would be the price change occurring in a model with a constant rate of unemployment. The horizontal distance between the two curves measures the amount by which the average skill intensity of production in the VIE countries would have to increase in order to accommodate the entry of the NICs into world trade at constant relative goods prices. This is the case described by Davis (1998). The equilibrium changes in P^*, w^*, U^* and h^* are indicated in figure 6 by arrows.[16] Hence, we have

Proposition 4. *The entry of NICs into the world trading system decreases wages in Europe and America, and it increases the rate of unemployment in Europe.*

It can hence be seen that the entry of NICs into world trade has a negative effect on workers in both America and Europe. American workers experience a loss in real wages through a standard Stolper-Samuelson effect induced by the decrease in the relative price of the labor intensive good. Those European workers who stay employed experience the same decline in real wages as their American colleagues. In addition, some of them lose their employment, and hence their wage income falls to zero. The results of the present model are in marked contrast to the minimum wage model where American workers are not affected at all by the entry of NICs into world trade. This strong implication of the Davis (1998) model does no longer hold in a world with endogenously determined prices.

However, labor market outcomes in America and Europe still depend on the labor market institutions in the respective other country. In order to see this, assume first that in America the same efficiency wage mechanism as in Europe was in place, with both initial equilibria otherwise being identical. With employment in both countries adjusting to changing prices, the decrease in the wage rate and the increase in the rate of unemployment in Europe following the shock from NICs would be smaller than in the asymmetric two country world.[17] Therefore, the flexible American labor market harms European workers.

[16] It is possible for h^* and P^* to rise at the same time because the VIE countries as a group are now exporting the skill intensive product.

[17] This result can be derived using figure 6 by drawing a function $\beta(\widetilde{h}^W, h, 1)$ through the original equilibrium point and going through the adjustment mechanism induced by dislocating $\lambda(\cdot)$ as described above.

Conversely, the efficiency wage mechanism in Europe leads to smaller wage declines than in a hypothetical world with competitive labor markets in both countries and therefore a constant average skill intensity of world production. This is easily verified by inspection of figure 6. Hence, the negative effects of the NIC shock for American workers are mitigated by employment adjustment in Europe, i.e. an increase in the European unemployment rate.

4 Conclusion

This paper underlines the importance of a global approach to analyzing the interaction between labor market institutions and outcomes. Earlier, it has been shown by Davis (1998) that this is true in a model where effectively all prices are fixed and international factor price equalization holds. The contribution of the present paper is to extend this analysis to a framework where goods and factor prices are determined endogenously and as a consequence of any economic shock there are price adjustments. As an important theoretical result, it is shown that despite internationally divergent labor market institutions, there is a non-degenerate factor price equalization set in the present model. This allows us to focus, as in Davis (1998), on the FPE case, thus making the importance of switching to a model with endogenously determined prices more transparent. Despite the added complication of endogenous goods and factor prices, the model is easily tractable – in fact, all comparative static results can be derived with the help of a convenient four-quadrant diagram. As in Davis (1998), there are important effects from labor market institutions in one country to labor market outcomes in the other, working through the integrated world market for goods. However, with flexible prices, shocks anywhere in the world now do have an effect on American factor markets. The "insulation" result for the American economy derived by Davis does not survive the transition from a fixprice model to a flexprice model.

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