Does European Unemployment Prop Up American Wages? National Labor Markets and Global Trade

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I consider trade between a flexible-wage America and a rigid-wage Europe. In a benchmark case, a move from autarky to free trade doubles European unemployment. American wages rise to the European level. Entry of the unskilled "South" to world markets raises European unemployment. Europe's commitment to the high wage wholly insulates America from the shock. Immigration to America raises American income, but lowers European income dollar for dollar, while European unemployment rises. Absent South-North migration of the unskilled from 1970–1990, Europe could have maintained the same wage with from one-eighth to one-fourth less unemployment. (JEL F11, J31, E24)

I. A Global Approach

In recent years, factor market developments in the United States and United Kingdom have contrasted sharply with those in continental Europe. In the United States and United Kingdom, the relative wage of the unskilled has declined significantly. In the span of a decade (1979–1989) the wage of a U.S. worker in the 90th percentile relative to that of one in the 10th percentile rose by over 20 percent (Richard B. Freeman and Lawrence F. Katz, 1995). This rising wage inequality was much less evident in continental Europe. However, unemployment has risen sharply in Europe. The early postwar decades are now thought of as a "Golden Age" for Europe, with unemployment rates of 2 to 3 percent. Beginning in the 1970's these rates have climbed dramatically, reaching double digits in many of these countries (Center for Economic Policy Research [CEPR], 1995).

An extensive empirical literature has considered the provenance of these factor market developments. The studies are of two principal types (Freeman and Katz, 1995). The individual country studies provide a rich account of local developments in institutions, factor supplies, and demand conditions. The comparative (cross-country) studies abstract from local idiosyncracies to search for common themes. However, even the comparative studies suffer from an important drawback: they remain a collection of individual stories. They do not pretend to provide a common framework—and the consistency this enforces—to provide a unified account.

This suggests the value of a third approach, which may be termed "global." It is, in the first instance, a general equilibrium story. Consistency is enforced by the fact that there is a simultaneous determination of equilibrium in all of the factor markets. Naturally, tractability limits the degree of local institutional detail that may be considered. Considering some important differences in factor market institutions will nonetheless be an important feature of such an approach.

However, a global approach is more than just general equilibrium. It aims at a *unified* explanation of very divergent experience. There are two reasons for seeking such a unified account. First, many of the shocks hitting the industrial "North" are common—for

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example, the entry to the integrated world economy of important new trading partners from the newly industrializing "South."¹ If we are to believe such accounts, we need to see how these shocks interact with a variety of local institutions. A more subtle—but by this more important—reason for considering a global approach is that the consequences even of purely local institutions and shocks often depend crucially on the links to the global market.

The paper joins two elements that have figured prominently in these discussions, but whose implications have not previously been worked out in a consistent manner. The first is the stylized characterization of America as a flexible-wage economy, and Europe as an economy in which a variety of institutions unions, explicit minimum wages, etc. make wages more rigid.² The second is the Heckscher-Ohlin model, widely acknowledged to be the appropriate framework for examining movements in relative wages (Paul R. Krugman, 1996).

Thus, we will build a model of world trade between a flexible-wage America and a minimum-wage Europe. In doing so, we build on the classic work of Richard A. Brecher (1974a, b). The America versus Europe dichotomy has been featured in a variety of recent work.³ The distinctive feature of the

¹ Another source of common shocks—those due to global technological change—is analyzed in Davis (1998).

² There are alternative approaches to introducing unemployment into general equilibrium trade models. For example, Steven J. Matusz (1996) develops an elegant model merging elements of efficiency-wage unemployment with monopolistic competition to show how the increased market size due to trade can raise real wages, so reduce equilibrium unemployment in both countries. This provides insight for questions such as European integration. The simpler model that is developed here, though, captures the essential elements of relative demand shifts that have been seen as the heart of recent developments in both Europe and America. See, e.g., Kevin M. Murphy (1995).

³ This includes Giuseppe Bertola and Andrea Ichino (1995), Freeman and Katz (1995), Krugman (1994, 1995), and Adrian Wood (1994). Bertola and Ichino develop an insightful approach that identifies rising volatility of idiosyncratic shocks as a potential account of the growing wage dispersion in the United States and rising un-

present work is the explicit focus on factor markets in *both* countries, and particularly on their interaction owing to their link via trade in goods.

This paper confirms that national factor market institutions matter. They profoundly affect global patterns of output, employment, and wages. Surprisingly, though, in the present context they have no power in accounting for cross-country differences in the evolution of relative wages. Often forgotten in this context is that even countries with distinctive factor market institutions are linked by world commodity prices and producers' zero profit conditions. Hence an account of the observed wage trends must move beyond an appeal to local institutional differences.

This paper is comprised of seven parts. Section II examines the consequences of differing labor-market institutions for countries linked by world commodity trade in homogeneous goods. Section III examines the contrasting impacts on the stylized America and Europe posed by the appearance of newly industrializing countries. Section IV examines the effects of factor accumulation in the two countries on wages and unemployment. Section V considers the implications of South-North migration for unemployment in Europe. Section VI returns to the issue of divergent wage experience between America and Europe. Section VII concludes.

II. National Labor Markets and Global Trade

A. Unemployment in the Global Equilibrium

The aim of this paper is to develop a model of trade between two countries, one of which has flexible wages, while the other imposes a binding minimum wage on unskilled labor. It is convenient to develop this in three stages. The first considers a conventional

employment in Europe. Their focus on homogeneous labor suggests a story of growing within-group dispersion. The remaining papers are closer to the approach of the present paper, focusing on heterogeneous labor. Here I provide a consistent general equilibrium model integrating the flexible/rigid dichotomy in the context of heterogeneous labor.

two-sector general equilibrium model of a closed economy and establishes some relations that are key to later analysis. The second introduces a binding minimum wage within the closed economy. Finally, I show the isomorphism between this economy and the two-country trading world of interest.⁴

Consider a closed flexible-wage economy. There are two factors of production: skill and labor (also termed the unskilled). They are available in fixed supply given respectively by H^{w} and L^{w} (shortly these will be the world endowments of a two-country world). These are used to produce two goods under constant returns to scale. Assume that at any common factor prices, good X is skill intensive relative to Y. Assume that preferences are homothetic, and that both goods are necessary in consumption. Let w be the return to labor, r the return to skill, and P the relative price of X in terms of Y. Then the competitive cost conditions insure that for each sector price equals unit cost:

(1)
$$c_X(w, r) = P$$
 $c_Y(w, r) = 1$.

Assume that marginal products are always strictly positive. Then flexible wages insure full employment. Factor market clearing requires that employment in the two sectors equal the world endowment:

(2)
$$H_X + H_Y = H^W$$
 $L_X + L_Y = L^W$.

By Walras' law, goods market clearing is insured by equality of demand and supply of good X.

Three relations are key to our analysis. The first is a relation between the price P in a closed economy and the endowment ratio, $h^{w} \equiv H^{w}/L^{w}$, of that economy. The Heckscher-Ohlin theorem insures that a rise in skill abundance reduces the relative price of

⁴ Two additional papers have independently considered two-country models with unemployment. N. Boccard et al. (1996) develop a political economy model focused on redistribution and "social dumping." Paul Oslington (1996) considers trade patterns and "false" comparative advantage in a factor price equalization (FPE) setting, suggesting that transport costs may resolve indeterminacies in the cross-country distribution of unemployment. the skill-intensive good. This relation can be expressed as:

(3)
$$P = \lambda(h)$$
, where $\lambda'(h) < 0$.

The second is the Stolper-Samuelson relation between goods prices and factor prices. Given the assumption that X is always the skill-intensive sector, this defines a monotonic relation, of which I focus on only a part. By Stolper-Samuelson:

(4)
$$w = \psi(P)$$
, where $\psi'(P) < 0$.

Thus given the endowment ratio of the closed economy, h^w , one can determine directly the equilibrium goods price in the flexible-wage case, $P^F = \lambda(h^w)$. Likewise, one can derive the resulting flexible wage, $w^F = \psi(P^F) =$ $\psi(\lambda(h^w))$, as well as the associated skilled wage. These suffice to establish the basic characteristics of the world equilibrium.

I now introduce within the closed economy a binding minimum wage for labor at rate $w^* > w^F$. This will be consistent with an equilibrium featuring diversified production if and only if the relative goods price is $P^* =$ $\psi^{-1}(w^*) < P^F$. However, these will be the equilibrium goods and factor prices if and only if employed factors are in the ratio $h^* =$ $\lambda^{-1}(\psi^{-1}(w^*)) > h^w$. The flexible rental for skill insures that it will always be fully employed. However with a binding minimum wage, this need not be true for labor. Thus the manner in which relative employed factors rise to h^* is for the denominator to fall via unemployed labor. With w^* given, h^* is determined, and H^w and L^w are the fixed world endowments. Let N be the level of labor actually employed. Then simple algebra shows that unemployment in this economy, $U = L^{W} - N$, is given by the third key relation (Brecher):

(5)
$$U^* = L^W - H^W / h^*$$
$$\equiv \beta(h^*; H^W, L^W),$$
where $\beta'(h^*) > 0.$

These three key relations characterizing the minimum-wage economy can be considered

in Figure 1. The Heckscher-Ohlin relation, $P = \lambda(h)$, appears in quadrant one. The Stolper-Samuelson relation, $w = \psi(P)$, appears in quadrant two. Finally, the link between endowments, the employment ratio, and the level of unemployment is depicted in quadrant four. In the flexible-wage case, the employment ratio equals the endowment ratio h^{W} . This determines wages, prices, and unemployment as w^F , P^F , and zero, respectively. In the minimum-wage case, the path of determination is different. The given minimum wage $w^* > w^F$ directly determines the goods price, the employment ratio, and the unemployment level as P^* , h^* , and U^* , respectively.

The basic link between the minimum wage and the appearance of unemployment in this economy is very simple. For competitive firms to pay the high wage w^* , this must be supported by an appropriate goods price P^* . When the minimum wage binds, the appropriate goods price will be attained only if the relative scarcity of the labor-intensive good rises relative to the flexible-wage equilibrium. And this will occur only if a sufficient amount of labor is unemployed.

I now establish an isomorphism between the closed economy with a minimum wage and a trading world in which one economy imposes a minimum wage while the other maintains a flexible wage. This relies on a concept introduced by Avinash K. Dixit and Victor F. Norman (1980) known as the integrated equilibrium. This establishes conditions under which trade in goods alone suffices to establish the same world equilibrium as occurs in the closed economy with both goods and factor mobility.

Consider, then, a world of two countries with free trade and zero transport costs. One country—America—has flexible wages. The other country—Europe—has imposed a minimum wage at the level w^* . The technologies and preferences in the two countries are identical to those in the closed economy. The technologies are constant returns to scale, while the preferences are identical and homothetic. Let a bar over a variable represent the level of that variable in the integrated equilibrium. Let *i* index goods and *j* index countries. The set of di-



FIGURE 1. UNEMPLOYMENT IN GENERAL EQUILIBRIUM

visions of world endowments among the two countries consistent with replicating the integrated equilibrium can then be described. This is called the FPE set, and is described as:

$$FPE = \begin{cases} [(H^{A}, L^{A}), (H^{E}, L^{E})] | \exists \lambda_{ij} \ge 0 \\ \text{such that } \sum \lambda_{ij} = 1, \\ (H^{E}, L^{E}) = \sum_{i}^{j} \lambda_{i,E}(\bar{H}(i), \bar{L}(i)) \\ + (0, U^{*}) \\ (H^{A}, L^{A}) = \sum_{i} \lambda_{i,A}(\bar{H}(i), \bar{L}(i)) \\ i = X, Y \quad j = A, E \end{cases}$$

These conditions are very intuitive. If the integrated equilibrium is to be replicated, then world unemployment must be at the same level as in the integrated economy. But unemployment cannot arise in the flexiblewage America. Hence Europe must endure the entire integrated equilibrium level of unemployment, U^* , to maintain the wage w^* . Beyond this, we need only satisfy the conventional restrictions in terms of *employed* factors. These require that both countries use the integrated equilibrium techniques (with the skill intensities $h_X^* = H_X^*/L_X^*$ and $h_Y^* =$ H_Y^*/L_Y^*), that the integrated equilibrium

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output in both sectors be divided among the countries, and that this exactly exhaust employed factors in the two countries (which exist in the ratio h^*).⁵ The FPE set is depicted as the bold parallelogram in Figure 2. The level of world (hence European) unemployment is indicated by the line segment $O^E U$.

This allows me to state a key result: Under the conditions noted above, international trade equalizes factor prices between the flexiblewage and the minimum-wage economies. The proof is simply that under free and costless trade, competitive producers in the two countries face the same goods prices, have the same technologies, and are (at least weakly) diversified. The equality of factor prices then follows directly from the common competitive cost conditions.

This is an important result. Even in the face of sharply divergent factor market institutions, free commodity trade in a global market fully equalized factor prices. As will be considered more fully below, this will sharply restrict the nature of shocks that can be appealed to in explaining divergent wage trends between Europe and America.⁶

⁵ Since preferences are assumed to be identical and homothetic, the level of spending by the unemployed does not matter for the pattern of world spending. Implicitly, though, it is assumed that any spending by the unemployed is financed via lump-sum transfers.

For analytic simplicity, I developed this within a conventional Heckscher-Ohlin framework. One feature of this model-that American and European goods are perfectly homogeneous-may appear crucial to the results on FPE and consequent international spillovers to European unemployment. However, such an impression would be incorrect, at least in the longer run with which this model is concerned. It would be straightforward, although not as clean, to consider a model in which the homogeneous goods X and Y were replaced by two monopolistically competitive industries, $\{X\}$ and $\{Y\}$, each with many varieties (see Elhanan Helpman and Krugman, 1985). In this case, all goods, wherever produced, are imperfect substitutes for all others. Yet under the same institutional assumptions, one could still apply precisely the same integrated equilibrium approach to again demonstrate factor price equalization with unemployment in Europe alone. What is crucial for the strong result is that European and American labor of the various categories are effectively homogeneous. In such a case, a disturbance may in the short run introduce a divergence from unity in the rel-



FIGURE 2. UNEMPLOYMENT IN THE INTEGRATED WORLD ECONOMY

B. Trade and Unemployment

I have shown how to construct a model of trade between a flexible-wage economy and one with a minimum wage. But I have not yet examined what impact trade has on these economies relative to autarky. It is convenient to start with a highly stylized example that establishes a benchmark. Further insight into the workings of this model will be provided by the many comparative statics in later sections.

Take as a benchmark a world in which Europe and America are alike in every respect endowments, technologies, and preferences. The one exception is that America has a flexible wage, while Europe has a minimum wage at level w^* , assumed to bind in autarky. As before, technologies are constant returns to scale. For simplicity, assume that preferences of the representative consumer are homothetic.

ative price of European and American varieties. This could give rise to cross-country factor price inequalities. However in the long run, this will induce entry, exit, and other adjustments that return us to the integrated equilibrium and restore full factor price equalization. Thus, to depart from this paper's results in the long run, it does not suffice to observe that American and European goods are imperfect substitutes. One must believe that on a deep level, American and European labor of the various classes are different factors.



FIGURE 3. BENCHMARK: FREE TRADE DOUBLES EUROPEAN UNEMPLOYMENT

Figure 3 depicts the salient aspects of the equilibrium.⁷ The technological production frontier, CC', is common to America and Europe. In Europe, to support the wage w^* , the equilibrium price must be P*. The consumption ratio of Y to X at P^* is given by $\alpha(P^*)$. Thus under full employment, production at prices P^* in Europe would be at A, and demand at A'. This implies an incipient excess demand for X, tending to raise P and lower w below w^* . The incipient fall in the wage is instead stanched via a decline in unskilled employment in Europe. With goods prices fixed at P^* , this is just the Rybczynski theorem in reverse, shifting output along a minimum wage-constrained production possibility frontier (PPF) indicated by AB. Autarky equilibrium in Europe is at E, at which the constrained supply exactly matches the demand at prices P^* . The shift of production in Europe from A to E reflects the contraction of employment just necessary to eliminate the excess demand indicated by AA'. By contrast, in America, the autarky equilibrium features a price $P > P^*$ and so an unskilled wage $w < w^*$ (not depicted). There is no unemployment in America.

Now consider the equilibrium when America and Europe trade freely. In order to support

⁷ This builds on a diagram of Brecher (1974a); see also

Krugman (1995).

the minimum wage w^* , Europe still needs to maintain the price P^* in equilibrium. At prices P^* , the American net trade offer is indicated by AA'. Thus world equilibrium at these prices requires that Europe be willing to make this trade at prices P^* . This requires that European production be at point F, and absorption at F'. As demand is homothetic, and production linear at all points along AB, the loss of employment in moving from E to F matches the preexisting unemployment indexed by AE.8

This implies a striking contrast between Europe and America in the labor market. Europe's commitment to a high wage gave rise to unemployment in autarky. In this stylized example the opening of Europe to trade with America doubles European unemployment, as it is forced to absorb the full integrated equilibrium level of unemployment to sustain w* for both. In America, the absence of unemployment in autarky came at the cost to workers of a lower real wage. However once trade commenced, American workers came to share the high European wage even as they suffered none of the unemployment that sustains that wage. The fact that they suffer no unemployment is a consequence of the flexible wage in America. The fact that they nonetheless share the European high wage under trade follows from the fact that trade links goods prices, that both countries remain diversified, and that producers still must meet price-equals-unit-cost conditions. In effect, trade has forced European workers to bear the burden of high unemployment to maintain not only their own high wage, but that in America as well.

How robust is this result? This is most easily illustrated by placing the same information in a framework of export supply and import demand. As we have seen, the minimum-wage constraint makes European export supply at price P* multivalued, corresponding to various levels of unemployment. Graphically, this implies that the constrained export supply curve has a horizontal segment that corresponds to the

⁸ An alternative way of seeing this is to note that $\beta(h^*;$ H^{W}, L^{W}) is linear homogeneous in H^{W} and L^{W} for a fixed h^* , and that opening to America is the same as doubling the world endowments (since Europe absorbs all of the unemployment).

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FIGURE 4. AMERICAN IMPORT DEMAND DETERMINES EUROPEAN UNEMPLOYMENT

Rybczynski segment of the constrained PPF. In Figure 4 this is depicted along with the American import demand curve for the case in which the countries are otherwise identical.

Now consider perturbations in the position of the American import demand curve, and consider their implications for unemployment and wages. So long as the American import demand curve cuts the export supply curve of Europe between A and B, the equilibrium price will be P^* , so the wage will be w^* . In all such cases, were Europe to abandon the minimumwage policy, both European and American wages would fall in the free trade equilibrium. The effect of trade with America on European unemployment depends on whether the American import demand curve cuts the European export supply curve in the region TB, ET, or AE. If the equilibrium is in the region TB, then European unemployment will more than double, reaching its maximum at B. If in the region ET, European unemployment will be higher than in autarky, although at less than the double rate. If, instead, the equilibrium is in the region AE, then trade with America actually lowers European unemployment. It continues to be true in all three cases, though, that under free trade high American wages depend on the European minimum-wage policy fully as much as European wages do."

⁹ When contemplating the recent unemployment experience of Europe, one should not read from this that it was *caused* by increasing integration with America.

III. Shocks from the South: Implications for Europe and America

The impact of growing trade with developing countries on labor markets in developed countries has been a source of great concern. It was at the heart of the vigorous opposition of the AFL-CIO to the North American Free Trade Agreement, and has figured prominently in the presidential campaigns of Ross Perot and Patrick Buchanan. Correlate concerns have been raised over rapid integration of Eastern Europe into the markets of the European Union.

The evidence for the growing trade, particularly in manufactures, is indisputable. In the period 1970–1990, the less-developed countries (LDC) share in manufactured imports of the United States and Europe more than doubled—rising to more than a third for the United States (Freeman, 1995). Correspondingly, the share of manufactures in total nonfuel exports from LDCs rose from less than one-fourth in 1970 to nearly three-fourths by 1989 (Wood, 1994).

However, what role—if any—this played in the factor market developments in Europe and America is still in contest. Wood (1994) has been the strongest proponent of the view that trade with the LDCs has mattered. Qualified support for this view has come from Edward E. Leamer (1995). By contrast, Krugman and Robert Z. Lawrence (1993) have argued forcefully that the volume of trade is insufficient to account for relative wage movements in the United States. Similarly, Franco Modigliani (1995 p. 7) insists that the argument that increased trade with developing countries raised unemployment in Europe is "nonsense, reflecting economic illiteracy."

Krugman (1995) examined the impact of a trade shock on a minimum-wage Europe and a flexible-wage America, concluding that it would raise unemployment in the former and reduce wages in the latter. However his study,

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Rather this is designed to provide a simple window on the trade-offs a country may face between a wage target and unemployment in an open economy. In the benchmark case, the unemployment cost of any given wage target is higher by a factor of two.

on a theoretical plane, belongs to the category earlier identified as "comparative." That is, he examines this one country at a time. As we will see, the results change importantly when we turn to a global approach, in which Europe and America exist within the same world economy.¹⁰

I begin again with a flexible-wage America, and a minimum-wage Europe. For simplicity, and without loss of generality, I shift the base case to consider that in which P^* is the American autarky price. This is also the European autarky price with the minimum wage in place. And so when free trade is allowed between America and Europe, P^* remains the equilibrium price, with no actual trade taking place. Europe has the same level of unemployment as in autarky, and both have the same wages in autarky as under free trade.

I now consider the introduction of a previously isolated region, which will be called the NICs, to the American and European free trade system. Assume that the NICs have a strictly downward-sloping import demand curve, and at prices P^* are importers of the good X. My concern will be to trace through the implications of this for Europe and America. In the diagram, this can be represented as a rightward shift of the joint American-NIC import demand curve. However, so long as Europe is not completely driven out of the Y industry, and given Europe's commitment to its minimum wage, the world price P^* does not change (see Figure 5).

At an unchanged world price, the American import demand is unchanged. So the United States absorbs none of the imports from the NICs. American wages continue to be protected by the European commitment to a highwage policy. In Europe, by contrast, there will



FIGURE 5. A NICS SHOCK RAISES EUROPEAN UNEMPLOYMENT, LEAVES AMERICA UNAFFECTED

be a surge of imports from the NICs.¹¹ The impact of this is similar to that analyzed above. Given the European commitment to a highwage policy, this will not show up in reduced wages, but rather in higher unemployment.

This integrated global economy presents an important contrast with the results of Krugman (1995). There he treated the American and European cases as though they were part of different global economies. However, as is seen here, the links via goods trade are crucial for understanding the broader story. So long as Europe maintains a commitment to both free trade and a high-wage policy, America is fully insulated from the NIC shock.

IV. Global Labor Supplies, European Unemployment

A. Discussion

Leading labor economists have identified cross-country differences in the evolution of the labor force as an important explanatory factor in the divergent evolution of wages between continental Europe and the United

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¹⁰ This comparative theoretical approach is at work as well in an argument by the Center for Economic Policy Research (1995 p. 53). It is argued there that evidence, as in Lawrence and Matthew J. Slaughter (1993), exculpating Stolper-Samuelson in America, likewise refutes claims that trade with the newly industrialized countries (NICs) may have raised unemployment in Europe. However, as the discussion here makes clear, one reason that increased trade with the NICs may not account for falling wages in America is precisely that it *does* raise unemployment in Europe.

¹¹ The actual pattern of trade—whether NICs deliveries are to America or Europe—is inconsequential. The important point is that the price P^* defines the world net offer to Europe. Europe must absorb this net offer to maintain the price P^* , and so accept the employment consequences.

States and United Kingdom (Katz and Murphy, 1992; Katz et al., 1995). As insightful as this line of research has been, it would be more satisfying to consider this in a theoretical framework in which the cross-country structure of labor demand is endogenous. It might seem obvious that cross-country differences in the levels and growth rates of relative factor supplies should help to explain differences in relative wages. However, this need not be true when countries are linked by commodity trade. In fact, the absence of such a relation is the central message of Paul A. Samuelson's factor price equalization theorem (1949). Under the conditions in which that

(1949). Under the conditions in which that theorem is valid, the structure of relative wages depends on the evolution of the global labor force.¹² However cross-country differences in the composition or growth rates of the labor force will contribute nothing to an understanding of divergent wage trends. Given that it has been seen that the model with unemployment likewise yields factor price equalization, it can likewise be concluded that differential labor-force growth will not help to account for divergent wage patterns.

Although changes in relative factor supplies will not play a role in accounting for crosscountry differences in relative wages, they will be essential for understanding the evolution of unemployment in Europe. There will be a correlate to the factor price equalization theorem: The level of European unemployment depends on global-not local-factor supplies. One consequence of this is that dramatic changes in American factor accumulation-the shifts due to baby booms and busts-may leave their most profound mark not on American but on European labor markets. By contrast, the unemployment rate in Europe will depend importantly on where factor accumulation occurs. The conditions under which European unemployment falls are less stringent when

¹² In fact, this extends to a more general setting. It is straightforward to write down a model in which only a subset of the world enjoys factor price equalization (Davis et al., 1997). Subject to the general restrictions underlying FPE (see Dixit and Norman, 1980), the site of endowment changes among those sharing FPE matters neither for comparative nor absolute wages. factor accumulation is in Europe than in America.

The model also features an important asymmetry. The fixed European minimum wage insulates America from all shocks caused by factor accumulation in Europe. But the reverse is not true. Factor accumulation in America has very profound effects on Europe.

In the conventional Heckscher-Ohlin framework, the central theorem dealing with endowment changes is that of Rybczynski. It says that at fixed goods prices, an increase in the endowment of a factor leads to a more-thanproportional increase in output in the sector that uses that factor intensively, and a contraction in the other sector. At the initial equilibrium price this would be expected to create an excess supply of the good that uses that factor intensively, lowering its equilibrium relative price, and by Stolper-Samuelson reducing the return to that factor. In the conventional setting, at fixed prices, changes in the endowment of one country have no effect on output supplies in the other.

B. Derivation of Principal Results

I now turn to a systematic evaluation of the impact of factor accumulation in the present model. I begin by considering the implications for the global economy, and then turn to examine how these effects are distributed according to where the accumulation takes place. It is assumed throughout that Europe's minimum wage at w^* remains binding and that both economies are diversified.

Several observations will make the derivation of the results more transparent. Europe's commitment to maintain the high wage w^* is likewise a commitment to maintain a domestic relative price P^* , as given by the zero profit conditions for the two goods. With free trade, this will also be the world relative price. We saw above that the common goods prices yield factor price equalization. Cost-minimizing firms with identical technologies will then pick the same factor intensities in both countries, denoted h_X^* and h_Y^* . With P^* fixed in all equilibria that are considered, these factor intensities will also be fixed. Because of identical and homothetic demand, P* also fixes the ratio in which X and Y will be consumed. This im-

plies directly that world output at equilibrium must be supplied in the same proportion. This absorbs factors in the proportion h^* $[=\lambda^{-1}(P^*)]$. This represents both the minimum skill intensity that the world economy needs to yield the wage w^* in a flexible-wage world, and the actual skill abundance of total employed factors in the world with at least one economy with a minimum wage at w*. Unemployment will arise when the actual world endowment, h^w , is such that $h^w < h^*$. The Rybczynski theorem is usually stated for a fixed exogenous price. Here we consider the case in which the price is held fixed by the commitment of Europe to maintain the minimum wage. Finally, recall that unemployment can be written as $U^* = L^w - H^w/h^*$.

Although my principal interest is in the effects of factor accumulation, it is convenient to begin with a version of the Heckscher-Ohlin theorem for trade between a flexible-wage economy and a minimum-wage economy. Let h^{A} denote the skill-to-labor ratio in flexiblewage America. Given a minimum wage w* that binds where applied, and that both economies are diversified, the world employment ratio of skill to labor is fixed at h^* . The flexible-wage America will be an exporter of the skill intensive good if and only if $h^A > h^*$. The minimum-wage Europe will have a complementary trade pattern. The easiest way to see how the Heckscher-Ohlin theorem works here is simply to delete Europe's unemployed from Figure 2. They do not contribute income, so consume only from transfers that they will spend in the same pattern as those employed. Having done this, the diagram just becomes the conventional Heckscher-Ohlin model, although now in terms of employed factors.

I now turn to the results concerning accumulation of factors. A rise in the world endowment of skill raises employment of labor so as to maintain employed factors in the ratio h^* . As a result, output of both goods rises proportionally. If the skill accumulation occurs in flexible-wage America, it will have conventional Rybczynski effects, raising the output of X more than proportionally and decreasing the local output of Y. However this also affects Europe, which has a rise in employment. Recalling that $U^* = L^W - H^W/h^*$, it follows that $\Delta U^* = -\Delta H^W/h^*$. Thus it has Rybczynski effects skewed the other direction, with output of Y rising more than proportionally, and output of X declining. The net impact of the output changes in the two countries must, as noted, raise output of X and Y in proportion to the initial world output.

If instead the skill accumulation occurs in minimum-wage Europe, we have a very different picture. In Europe we fail to have conventional Rybczynski effects. Incipient excess supply of X threatens to raise the wage above w^* at the initial level of employment. This allows employment to rise by $\Delta N = \Delta H^w/h^*$. That is, total employment of factors in Europe has risen in exact proportion to total initial employment in the world as a whole, h^* . Thus, output in Europe expands proportional to initial world output. America is entirely unaffected, as its net trade vector is fully determined by the constant price ratio P^* .

Now consider the effect of accumulation of labor. At the global level, unemployment rises by the full increment to the labor force, so $\Delta U^* = \Delta L^w > 0$. There is no effect on global output. If the accumulation occurs in minimum-wage Europe, unemployment rises directly with no effect on output in either country. However, if accumulation of labor happens in America, there are very dramatic shifts. America continues to have conventional Rybczynski effects, raising the output of Y more than proportionally, and reducing the output of X. Income in America rises linearly, so $\Delta I^A = w^* \Delta L^A$. Europe is also strongly affected. In fact, European unemployment rises one for one with accumulation of labor in America. And European income falls dollar for dollar with the rise in American income. Its shift in output exactly offsets that of America, so that global output is unchanged.

V. South-North Migration and Unemployment

A. Migration in a Model of Adjusted Factor Price Equalization

In this section I develop a model of endogenous South–North migration that builds on Daniel Trefler (1993, 1996), and use this to consider the consequences for European unemployment. Think of a North composed of Europe and America. They are just as before, with Europe imposing a minimum wage and America having a flexible wage. Following Trefler (1993), it is assumed that factor price equalization between North and South holds, but only when labor is measured in efficiency (rather than natural) units. For simplicity I neglect the possibility that there are efficiency differences across countries in skill. Let L_E^w and N_E^w be the world labor force and employment when measured in efficiency units, and let $h_E \equiv H^w/N_E^w$. Then it is a straightforward application of our previous model to show that when Europe imposes a minimum wage at the level w^* , unemployment of labor is given as

(6)
$$U^* = L_E^W - H^W / h_E^*.$$

Consideration of the incentives for migration forces us to consider an issue familiar from the standard Ricardian trade model, namely the reason for variation in efficiency units per natural unit of labor. Cross-country variation that reflects only individual characteristics of the workers would provide no motive for migration, so are neglected.¹³ If instead this also reflects cross-country technological differences, then labor will have a reason for migration-access to the superior Northern technology.¹⁴ Let ϕ^N and ϕ^S reflect laboraugmenting productivity differences specific to the location of production. By choice of units, let $\phi^N = 1$. Assuming that labor productivity is higher in the North restricts $\phi^{s} \in$ (0, 1).

Let the efficiency equivalent labor force for the North and South be L_E^N and L_E^S respectively, where $L_E^N + L_E^S = L_E^W$. Let L^S be the number of nationals of the South, some of whom in the latter period move to the North. Let L^N be the number of nationals of the North

¹³ Moreover this would be reflected in a nativeimmigrant wage gap. Since empirical estimates suggest that such gaps are small (on the order of 10 percent) for workers with similar backgrounds, these can safely be ignored for present purposes.

¹⁴ This also implies that "outsourcing" to the South may have the same implications as developed here for migration. The key element is the matching of Northern technology and Southern workers, which increases the effective world supply of unskilled labor, rather than the locale in which this matching occurs. (all of whom remain there). Then prior to migration, the world labor force measured in efficiency units is $L_E^W = L^N + \phi^s L^s$. When migration of size M occurs from South to North, this changes to $L_E^{W'} = L^N + \phi^s (L^s - M) + M$. As labor was already in excess supply, and noting that H^W and h_E^* are unaltered by the migration, the change in the world labor force measured in efficiency units is equivalent to the rise in European unemployment. This is given as:

(7)
$$\Delta U^* = \Delta L_E^W = (1 - \phi^S)M.$$

Thus two parameters, ϕ^s and M, identify the contribution of South–North migration to European unemployment. In this world with FPE in efficiency units, technologically based differences in productivity (ϕ^s) will be identified by the increment in wages to those who migrate from South to North. M is the amount of migration from developing countries to the OECD.

B. Migration Induced by Large Endowment Differences

I now consider an alternative way to model the impact of migration on unemployment in rigid-wage Europe. The most plausible alternative yields conclusions which are qualitatively similar, though quantitatively more dramatic. Consider the case in which the motive for migration is a failure of FPE because of large differences across countries in factor composition. Let there be three goods, X, Y. and Z, in decreasing order of skill intensity. As before, the minimum wage in the North is set in terms of the numeraire, Y. For simplicity, assume the technologies are Leontief. Skill-abundant countries of the North produce the relatively skill-intensive goods X and Y, while the skill-scarce South produces Y and Z. As in the conventional two-factor, multiple production cone Heckscher-Ohlin model, the labor-scarce North enjoys higher wages, motivating immigration from the South. Consider the impact of the migration of a single worker from South to North. By the Rybczynski theorem, the migrant leads to an expansion in Y production in the North, and a contraction in X output at the initial prices. Moreover, the

loss of an unskilled worker in the South leads to an expansion of Y in the South (since this is its relatively skilled industry), and a contraction of Z output. Thus output movements in both countries are putting downward pressure on the relative price of Y (upward pressure on prices of both X and Z). This suggests the conventional result that migration places pressure for wages to rise in the source country and fall in the destination country. By how much would unemployment have to rise in the North to relieve this pressure? A full answer would require a more complete specification. Note, though, what would happen if unemployment in the North were to rise exactly one for one with immigration at the initial prices. Then the immigration would have left unskilled employment, so output in the North of X and Y, unchanged. However, there would still have been the effect on output in the South, raising output of Y and reducing that of Z. This suggests residual pressure for both the prices of X and Z to rise relative to Y to move toward equilibrium. If in fact the price of X did rise, this would push the Northern unskilled wage below the minimum. And this suggests that to meet the minimum wage, unemployment in the North would have to rise by a factor of more than one for one relative to migration from the South.

C. An Empirical Application

An extensive literature has considered the impact of immigration on labor-market outcomes of natives. Rachel M. Friedberg and Jennifer Hunt (1995) provide a valuable survey. The analytic approach pursued here is closest to that of George J. Borjas et al. (1992). I consider a simple counterfactual based on the theoretical models developed above: How would European unemployment have differed if unskilled immigration to the North (America and Europe) from 1970-1990 had been constrained to zero? The parsimonious specification of the two theoretical models above imply that two parameters suffice to answer this question: (1) the number of unskilled migrants from South to North; and (2) the wage gain for those who migrate. For the former, I will take a conservative definition, using the estimate of the 1970-1990 flows of unskilled migrants from the South who entered the labor force in the United States, a figure calculated as approximately 4.4 million (see the Appendix). For the latter I note that Trefler (1993), using International Labour Organization data that fit his FPE model well, calculated U.S. wages for aggregate labor relative to those of various other countries, for example coming up with figures ranging from a U.S. advantage of 20 to 1 relative to Bangladesh, 5 to 1 relative to Yugoslavia, and 3.3 to 1 relative to Colombia. No doubt an important element in this is differences in skill composition. However, direct evidence on the wage gains of individual migrants suggests that the gains that motivated the migration may be substantial. For the purposes of the calculations for Model A, I will assume conservatively that the wage gain relative to that earned premigration ranges between a factor of 2 and 3. Thus, under the hypothesis of the adjusted-FPE Model A, as reflected in equation (7), the counterfactual yields incremental European unemployment of between 2.2 million and 2.9 million. Under the hypothesis of Model B, the multicone approach, the corresponding incremental unemployment would be something greater than 4.4 million. If it is noted that in 1993 there were 17 million unemployed in Europe, the ceteris paribus figures suggest that absent this unskilled immigration, the same wage in Europe could have been targeted with a reduction of between one-eighth and onequarter of this unemployment.

These figures are meant only to suggest an order of magnitude-that these effects could matter empirically. The data underlying these calculations is rough, while the model to which they are applied is sharp. Moreover, it would be inappropriate here, as in any ceteris paribus experiment, to infer from this that unskilled immigration "caused" the rise in European unemployment. Nevertheless, the possibility that unskilled immigration to the North could matter for European employment, given a commitment to a specific wage, is not implausible. This was in fact the point of the very restrictive immigration policies of Europe post-1973. Yet while the front door may have been shut, the open door provided for unskilled immigration to the United States implied incipient downward pressure on wages on both sides of the Atlantic. Europe's commitment to high wages forced it to adjust to these pressures via higher unemployment.

VI. Divergent Wage Experience

This paper began with the observation that American and European factor market experience has diverged in two respects: rising unemployment in Europe, but not in America, and a growing skilled-unskilled wage gap in America, but not in Europe. A great deal has been said about the former, and so the latter will be addressed here.

The conjunction of relative factor demand shocks and institutional differences has been an important theme in explanations of the divergent relative wage experience of America and Europe. Thus the demonstration that this wage divergence does not in fact arise in the standard model is an important analytic contribution of this paper. However, the divergent experience still needs to be understood.

From an analytic perspective the crucial insight is that shocks that move us from one integrated equilibrium to another will not explain the wage divergence. Thus endowment changes, demand shocks, and global technology shocks are all consistent with maintaining FPE across the countries, in spite of the institutional differences.

This leaves a variety of amendments to the baseline model that could potentially explain the divergent experience. One class concerns divergent evolution of policies or technological shocks. The factor price link comes through producers' zero profit conditions. For FPE we need free trade, zero internal taxes, common technologies, and diversified production, in addition to the conventional assumptions. Thus differences in the evolution of trade and fiscal policy, idiosyncratic technology shocks (e.g. convergence), or specialization can lead FPE to break down, so offer paths for interpreting the divergent wage experience. The role of technical change in understanding these factor market developments is considered at length in Davis (1998).

However one need not rely on divergent policies or technological shocks to explain the divergent wage experience. If one adds a little more structure to the basic framework, alternative accounts are possible. For example, Davis and Trevor A. Reeve (1997) develop a model of endogenous human capital accumulation in a framework that is otherwise identical to that developed here. In their model, the threat of unemployment has feedback effects on individuals' decisions to accumulate human capital. Since unemployment is prevalent in Europe but not in America, even common shocks can lead to divergent accumulation decisions, hence wage outcomes.

Thus the basic framework that has been developed is consistent with a variety of accounts of the divergent wage experience between America and Europe. Importantly, the principal insights that have been developed in this paper are robust to consideration of any of these variations.

VII. Conclusion

This paper has one overarching message. Even when factor markets are strictly national, with idiosyncratic institutional features, they cannot be considered in isolation when goods markets are global. This strongly suggests the importance of a unified "global" approach to explaining recent factor market developments in Europe and America. This will be an important complement to existing studies, which are either of individual countries or comparative.

A striking example of the importance of the global perspective emerges in the contrasting effects of trade on a flexible-wage America and a minimum-wage Europe. In the central example, a move from autarky to free trade doubles the European unemployment rate while leading American wages to converge to the high European level.¹⁵

¹⁵ Why was European unemployment lower than that in America pre-1973, yet higher thereafter? One account would be to think of there being two components of unemployment—one frictional and the other due to rigidities. For a variety of reasons, America may have a higher base frictional rate than Europe. If in one period the rigidities are nonbinding in Europe, it may be found that total unemployment is relatively low. If in another period those rigidities do bind, it may instead be found that unemployment there is relatively high.

Moreover, commodity trade leads local institutional features to have important spillover effects on other countries. These go far beyond the simple general equilibrium fact that they will affect the level of wages and the composition of production. They may fundamentally alter the nature of a country's relation with the international environment. For example, if Europe and America are both flexible-wage economies, then the entry of the NICs to world markets may depress wages in each. However, we saw that when Europe imposed a minimum wage, it absorbed the full impact of the NIC shock and wholly insulated America from its effects. That is, a local European institutional feature has sharply altered America's relation to the trading world.

The local institutional features may likewise introduce important asymmetries in the relations between the countries. As noted, America is wholly insulated from external shocks, including factor-supply shocks in Europe. By contrast, factor-supply shocks in America have very powerful effects in Europe. A striking example occurs with an increase in the supply of labor in America. This raises American income, yet lowers European income dollar for dollar, while raising European unemployment one for one.

The importance of considering the links via commodity trade is particularly important when thinking about the evolution of wages. In spite of important differences in factor market institutions, which in a closed economy would induce differences in factor prices, goods trade here insures full factor price equalization. Thus insofar as policy makers in a country see a trade-off between the two, the willingness of one to bear high unemployment spills over to raise wages in both.

The major analytics of this paper have been derived in a framework in which America and Europe replicate an integrated equilibrium with factor price equalization. This contributes greatly to the transparency of the results. As well, it has emphasized the important point that Europe's commitment to a minimum wage cushions the impact of a variety of shocks on America. However it also suggests an important respect in which additional inquiry is indicated. A key stylized fact we want to understand is the divergent relative wage experience of America and Europe. Insofar as the shocks considered here move the world economy between equilibria featuring factor price equalization, they will not account for this fact. I have indicated a variety of directions in which the framework may be amended to account for this fact. This suggests the value of extensions that may help to identify which of these may matter most empirically.

This paper has derived these results in a stylized model. Care should be taken in reading these results too readily into actual historical experience. Nonetheless the issue that it raises of the powerful interaction between local factor market institutions and global goods markets is no doubt very important. And the results are sufficiently provocative to warrant closer examination.

Appendix: Author's Calculation of the Contribution of South–North Migration to the World Effective Stock of Unskilled Labor

As discussed in the text, over the last two decades Europe has pursued a restrictive immigration policy, while America has had strong growth in immigration, particularly among the unskilled. The stock of foreign population in Europe grew by 2.9 million from 1981–1991 (John Salt et al., 1994). However, much of this growth is from the end of the period, and naturally the growth of the unskilled labor force would be less than this. Since I want to be conservative, and since Europe's policy was overtly restrictive, for the purposes of my calculations I will assume that there was zero Southern unskilled immigration to Europe.

The calculations for America (here just the United States) must of necessity be imprecise. The desired category of immigrants is not readily available, so must be calculated. Here I detail those calculations, first for legal immigrants. The stock of foreign-born persons 18 years of age or older in the United States in 1990 was 17.7 million (U.S. Department of Commerce, Bureau of the Census [1990], Table 3: Social Characteristics of Selected Ancestry Groups by Nativity, Citizenship and Year of Entry: 1990). Of these, 6.9 million entered between 1980–1990 (U.S. Depart-

ment of Commerce, Bureau of the Census, 1990). The 1970's saw approximately 4.5 million immigrants to the United States (Borjas, 1990 p. 6). Of these, close to 4 million would have been aged 18 or over (Borjas, 1990 p. 41). Summing, the 1970-1990 immigration of those aged 18 and over would have been approximately 10.9 million. The labor-force participation rate for male immigrants is approximately 90 per cent (Borjas, 1990 p. 41), while that for women is lower, which I will estimate by the native female participation rate of circa 50 percent. Thus the average laborforce participation rate will be taken as 70 percent. This implies that of the 10.9 million immigrants aged 18 and over, approximately 7.6 million would be in the labor force. Of the 1990 stock, approximately 60 percent of those aged 18 or over had a high-school education or less (U.S. Department of Commerce, Bureau of the Census, 1990). Thus of these 7.6 million in the labor force, a little over 4.5 million would fall into the category of the unskilled. Not all of these, though, come from the South. If we define the South operationally as Asia (except Japan), Africa, and the Americas (except Canada), approximately threefourths of immigrants in the 1970's came from the South (Borjas, 1990 p. 230). If it is conservatively assumed that the unskilled were no more likely to come from the South than from the North, this would imply that the contribution of legal immigration from the South to the unskilled labor force in the North is approximately 3.4 million.

To this must be added the contribution to the labor force by illegal immigration. While newspaper reports of illegal immigration are often huge, the work of Borjas et al. (1991) suggests that in 1980 the stock of Mexican illegal immigrants to the United States was 1.8 million. I do not have data that provide similarly careful estimates for illegal flows for 1970-1990, or that incorporate the full complement of countries of the South. Realizing that this leaves out flows from the 1980's from Mexico, as well as all flows from other countries of the South, while it includes some who arrived prior to 1970, I will (with a great dollop of optimism) take the figure of 1.8 million as the relevant measure of inflows from 1970-1990. If it is assumed, as above, that

approximately 90 per cent of these are aged 18 and above, this reduces the figure to approximately 1.6 million. Assuming that the laborforce participation rate again is 70 percent, this implies that approximately 1.1 million are in the labor force. It is known that educational attainment of typical Mexican immigrants is very low, with over three-fourths having less than a high-school education (Borjas et al., 1992). If those with a high-school education are included among the unskilled, then this will provide a figure of approximately 1 million additional unskilled workers. If this is summed to the contribution of legal immigration, a figure is arrived at which indicates that South-North migration to the United States from 1970-1990 raised the labor force of the unskilled by approximately 4.4 million workers. This estimate should be considered very rough.

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