

Factor market linkages in a global economy

Paul Oslington*

School of Economics and Management, University of New South Wales/ADFA, Northcott Drive, Canberra ACT 2600, Australia

Received 22 September 2000; received in revised form 5 September 2001; accepted 12 December 2001

Abstract

This paper considers linkages between national labour markets in a global economy, extending the existing analyses to the empirically important case where factor price equalization does not hold. Removing the assumption of factor price equalization allows the divergent wage experience as well as unemployment experience of Europe and America to be explained. Europe's minimum wage forces it out of the labour intensive industry, leaving it specialised in the skill intensive industry and with a lower return to skill than America. Under these conditions, the entry of labour intensive NICs into world markets pushes down American wages and alters its economic structure (which were unchanged under factor price equalization), and reduces European unemployment (which increased under factor price equalization). © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Integrated equilibrium; Factor price equalization; Inequality; Unemployment

JEL classification: F11; E24

1. Introduction

Our understanding of the adverse developments in European labour markets has been enhanced by the recent use of the trade theoretic technique of integrated equilibrium analysis. This technique builds on the parable of the angel in Samuelson (1949), and was developed by Dixit and Norman (1980) and Helpman and Krugman (1985). Integrated equilibrium analysis has highlighted the importance of linkages between national factor markets in explaining patterns of wage inequality and unemployment across countries. Krugman (1995) suggested how changes elsewhere in the world might affect European unemployment, even if goods prices remained the same. Davis (1998a,b) took this further, considering what type of changes in factor supplies and technology might generate the cross country

*Tel.: +61-262-688-720; fax: +61-262-688-450.

E-mail address: p.oslington@adfa.edu.au (P. Oslington).

patterns of wage inequality and unemployment. Perhaps the most striking of the implications is the way a European minimum wage supports American wages, so that Europe bears the unemployment burden of changes in factor endowments elsewhere in the world.

A significant limitation on this and some other related results is the assumption that all countries produce all goods and factor prices are equalised across the world. As Davis (1998a, p. 491) points out ‘The major analytics 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 . . . However, it also suggests an important respect in which additional inquiry is indicated. A key stylised fact we want to understand is the divergent relative wage experience of America and Europe’. Davis (1998b, p. 1616) comments that ‘using factor price equalization as a benchmark is justified by the great simplicity it yields to the analysis’ but notes ‘the value of pursuing extensions to the present study in which local factor supplies do matter’.

The present paper considers linkages between European, American and Newly Industrialised Country (NIC) labour markets in a framework where the integrated equilibrium is not replicated and factor price equalization breaks down. In this alternative framework factor, supplies and minimum wages can affect patterns of specialisation and wages in different countries.

The paper is organised as follows. Section 2 discusses what happens in the absence of factor price equalization. Having described the unemployment equilibrium in the absence of factor price equalization, Section 3 reconsiders the consequences of factor accumulation in America and Europe, while Section 4 reconsiders the consequences of the entry of labour abundant NICs.

2. Equilibrium in the absence of factor price equalization

The starting point for the analysis is the standard integrated equilibrium model of a trading world. In the model there are two factors, labour and skill, with endowments L and H , and prices w^L and w^H . There are two countries, America and Europe (later the NICs will be added) and subscripts ^A and ^E indicate values of the variables, so for instance w^{LE} is the price of labour in Europe. There are two goods X and Y , with p^X the relative price of good X , and good Y the numeraire so $p^Y = 1$. Production technology is constant returns to scale and the same across the world, and will be represented by unit cost functions $c^Y(w)$ and $c^X(w)$ for each of the goods. By Shephard’s Lemma, derivatives of these unit cost functions with respect to factor prices $c_w(w)$ are quantities of the factors needed to produce one unit of the product. Good X uses skill relatively intensively. Preferences are assumed to be identical and homothetic, represented by the demand function $D(p^X, p^Y)$.

Equilibrium conditions for this standard model are:

Zero profit conditions for each of the goods:

$$p^X = c^X(w^L, w^H) \quad (1)$$

$$p^Y = c^Y(w^L, w^H) \quad (2)$$

Full employment condition for each of the factors:

$$c_H^X(w^L, w^H)X + c_H^Y(w^L, w^H)Y = H \quad (3)$$

$$c_L^X(w^L, w^H)X + c_L^Y(w^L, w^H)Y = L \quad (4)$$

Demand

$$X/Y = D(p^X, p^Y) \quad (5)$$

These conditions yield equilibrium values of p^X , w^L , w^H , X and Y for the trading world.

An integrated equilibrium is a partition of the world factor endowment between the countries which replicates the world equilibrium, so that countries produce both goods and factor price equalisation holds. The set of endowment partitions which yield factor price equalisation is known as the factor price equalisation set.

Davis (1998a) pointed out that unemployment can be introduced into the standard integrated equilibrium model by fixing the price of labour in Europe w^{LE} at w^* , generating unemployment of labour in Europe. However, only endowment partitions where both countries continue to produce both goods and factor price equalisation holds were considered. This considerably simplifies the analysis as the American wage w^{LA} is tied to the fixed European wage w^* , but the empirical importance of the factor price equalisation case is debatable. What happens if factor price equalization does not hold? There are several ways factor price equalization could break down¹, and in the present analysis, the breakdown will come from the countries producing different goods because their factor endowments are sufficiently different².

When factor endowments are sufficiently different, the imposition of the European minimum wage shuts down the European labour intensive industry. This outcome is best understood by reconsidering the equilibrium conditions (1)–(5) above, which are represented by the unit cost (Figs. 1 and 2)³. Consider America in Fig. 1. With no minimum wage and endowments of labour and skill represented by E^A (which are within the shaded region where both goods continue to be produced⁴) American factor prices w^{HA} and w^{LA} are given by the intersection of the zero profit curves which represent conditions (1) and (2). Factor usage vectors X^A and Y^A sum to the endowment E^A indicating full employment, representing conditions (3) and (4) above. Although imposing a minimum wage in Europe equilibrium changes values of w^{HA} , w^{LA} , X^A and Y^A for the American economy, the nature of the equilibrium in the American economy remains the same.

In Europe, however, the imposition of the minimum wage shuts down its labour intensive industry Y , because firms in the labour intensive industry make less than zero profits when they have to pay the fixed minimum wage. Only the skill intensive good X can operate with at least zero profits. This specialisation in the skill intensive industry comes about even if we follow Davis' assumption that Europe is relatively well endowed with labour (see Davis, 1998a, p. 482) (Fig. 2).

Equilibrium conditions in Europe after the imposition of the minimum wage $w^{LE} = w^*$ become:

¹Breakdowns of factor price equalization due to divergent evolution of European and American technologies are considered by Davis (1998b), and Davis and Reeve (1999) consider divergent patterns of human capital accumulation.

²The set of partitions of the world endowment which yield factor price equalisation with a minimum wage is shown in Davis (1998a) (p. 482) (Fig. 2). Sufficiently different endowments in the present analysis means an endowment partition outside that set.

³Further details of the unit cost diagram utilised in Figs. 1 and 2 may be found in Dixit and Norman (1980) or Woodland (1982). Since we are dealing with a global economy model goods prices in Figs. 1 and 2 are endogenous.

⁴This shaded region in Figs. 1 and 2 corresponds to the factor price equalisation set in Davis (1998a) (p. 482) (Fig. 2).

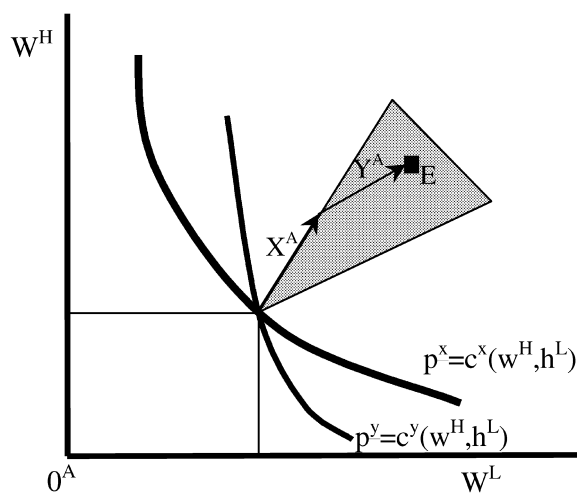


Fig. 1. American equilibrium.

Zero profits for good X :

$$p^X = c^X(w^*, w^{HE}) \quad (6)$$

Less than zero profits for the labour intensive good Y , which is therefore not produced:

$$p^Y < c^Y(w^*, w^{HE}) \text{ and } Y = 0 \quad (7)$$

Full employment of skill:

$$c_H^X(w^*, w^{HE})X^E = H^E \quad (8)$$

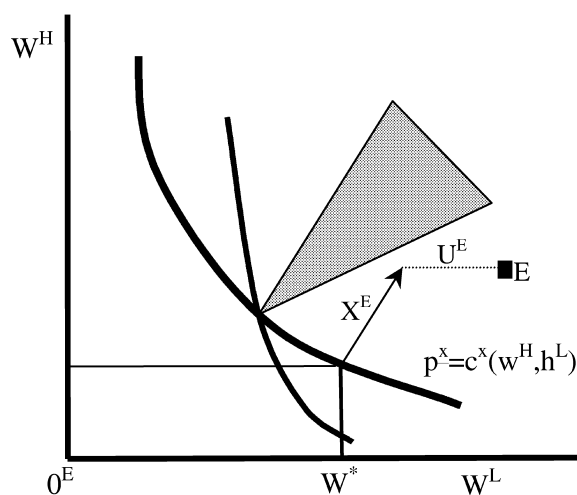


Fig. 2. European equilibrium.

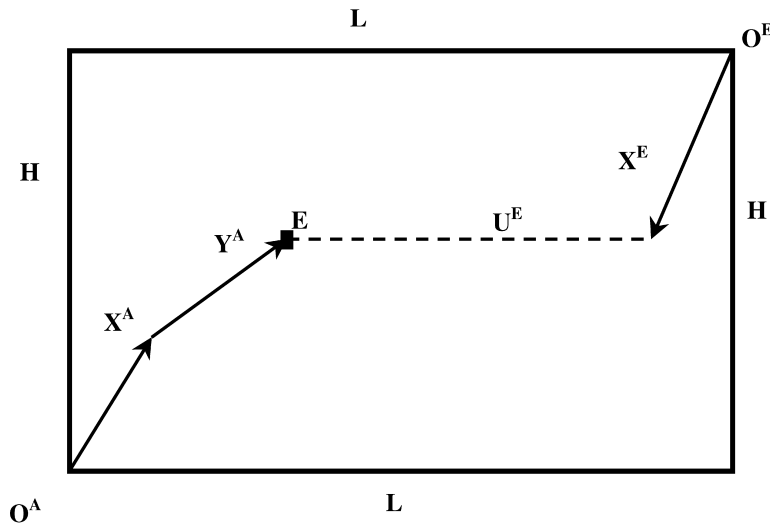


Fig. 3. World equilibrium with unemployment.

Unemployment of the labour subject to the wage floor

$$U^E = L^E - c_L^X(w^*, w^{HE})X^E \quad (9)$$

These conditions for Europe are illustrated in Fig. 2. Only good X is produced, and the equilibrium return to skill w^{HE} is set by the zero profit curve for X and the fixed return to labour $w^{HL} = w^*$. Note that the equilibrium factor price point is outside the zero profit frontier for good Y , illustrating the non-profitability of the Y industry with the minimum wage. The factor usage vector X^E drawn from the equilibrium factor price point falls short of the endowment E^E and unemployment is indicated by the dashed vector U^E .

This unemployment equilibrium without factor price equilibrium can be represented in a standard integrated equilibrium diagram in Fig. 3. Dimensions of the box are world endowments of L and H , and point E indicates the partition of world endowments between America and Europe. Factor usage vectors $X^A Y^A$ and X^E and the unemployment vector U^E in Fig. 3 correspond to those in Figs. 1 and 2. The important point about this equilibrium is that Europe, where the fixed wage induces specialisation and a breakdown of factor price equalisation, has a lower return to skill than America. This outcome of unemployment and a lower return to skill in Europe corresponds to what we observe, and answers Davis' call for investigation of non-factor price equalization cases that 'matter most empirically' (Davis, 1998a, p. 491).

3. Factor accumulation in America and Europe

Having described the equilibrium in the absence of factor price equalization, let us reconsider the consequences of factor accumulation in America and Europe. Davis showed that when factor price equalization holds 'cross country differences in the composition or growth rates of the labour force

Now consider the effects of labour accumulation in Europe without factor price equalization. As in the factor price equalization case, they are very simple—the additional labour increases European unemployment, leaving goods and factor prices unchanged, and having no impact on America. The contrast with the Davis result under factor price equalization (that where labour accumulates is irrelevant) is thus sharp. In the empirically important case where Europe's minimum wage wipes out its labour intensive industry, with consequently lower American wages and higher skill returns than Europe, we have seen that labour accumulation in America reduces European unemployment whereas labour accumulation in Europe increases it. Davis' irrelevance result does not generalize.

4. Entry of newly industrialised countries

An important result of Davis' paper was that, with unchanged wages, Europe bears the full burden of the entry of the NICs in the form of higher unemployment. As he points out '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' (p. 485).

The entry of the NICs must have similar effect to increases in the endowment of labour considered in the previous section. It is assumed that the NICs have no minimum wage. For instance a (perhaps unlikely) case where the NICs entering world markets are relatively well endowed with labour, but produce both goods and factor price equalization applies to the NICs/America subset of the world, would be formally identical to the case of labour accumulation in America considered by Davis.

A more empirically important case than either factor price equalization within the NICs/America subset or worldwide factor price equalization is where the NICs endowments are such that they are specialised in the labour intensive good Y , and have a lower wage than America, both of which have a lower wage than Europe's fixed wage⁵. Such a case is depicted in Fig. 5, which builds on the earlier Fig. 3, adding the NICs endowments of H and L to the world endowment box at the American origin O^A . The endowments of America and the NICs are too dissimilar to support factor price equalization, and the NICs devote their entire endowment to producing good Y . The factor usage vector for the NICs is thus Y^{NIC} in Fig. 5. Their entry into world markets increases the world supply of good Y , driving up the price of good X . In America the return to skill rises, the return to labour falls, firms use more labour intensive techniques, and to maintain full employment in America the output of good X must rise and the output of good Y must fall. In Europe the rise in the price of good X increases the return to skill, as well as the output of good X , and reduces unemployment. The new factor usage vectors are shown as $X'^A Y'^A$ and X'^E in Fig. 5. Again we have a sharp contrast to the Davis results for the factor price equalisation case—without factor price equalisation entry of the NICs raises returns to skill in both Europe and America.

It is worth noting that the consequences of entry of the labour endowed NICs are very similar to the consequences of labour accumulation in America, reinforcing the point that the effects of opening up trade with NICs depends on the underlying factor endowments they bring to the global economy.

⁵The importance of the labour abundant new entrants into world markets producing a different set of goods to America and Europe, and using different factor proportions, has been emphasised by Wood (1994) and others in relation to the adverse factor market developments.

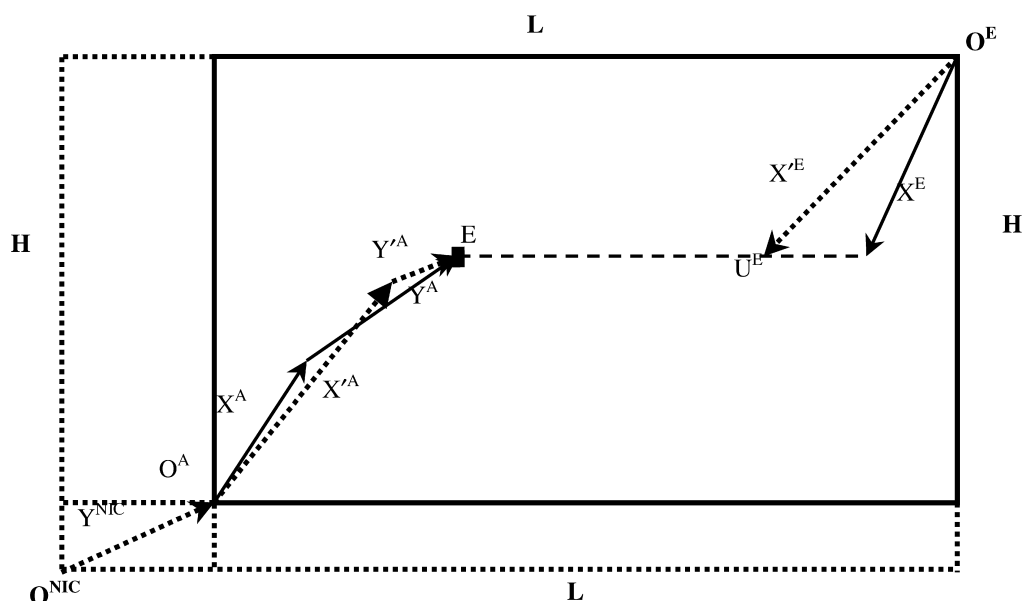


Fig. 5. Opening trade with labour abundant NICs.

5. Conclusion

The present analysis supports the overarching message of the recent work on European factor markets. As Davis (1998a, p. 490) says ‘even when factor markets are strictly national, with idiosyncratic national features, they can not be considered in isolation when goods markets are global’. However, some specific results about the effects of factor accumulation and the entry of the NICs on American and European labour markets do not survive the relaxation of the assumption of worldwide factor price equalization. Although both the model assuming factor price equalization and the alternative model presented here are highly abstract, the case considered here of Europe’s minimum wage shutting down its labour intensive industry and Europe having a lower skill premium than America would seem to be more relevant empirically, and thus of considerable interest to those seeking to understand the adverse developments in OECD factor markets within the global economy.

Acknowledgements

I thank Donald Davis for helpful correspondence on the issue, Twan Huybers and participants at the International Economics Seminar at University of Oxford for comments on an earlier version.

References

- Davis, D.R., 1998a. Does European unemployment prop up American wages? *American Economic Review* 88 (3), 478–494.
- Davis, D.R., 1998b. Technology, unemployment and relative wages in a global economy. *European Economic Review* 42 (9), 1613–1633.

- Davis, D.R., Reeve, T.A., 1999. Human capital, unemployment and relative wages in a global economy. *Journal of International Economics*, Unpublished manuscript.
- Dixit, A.K., Norman, V., 1980. *The Theory of International Trade—A Dual General Equilibrium Approach*. CUP, Cambridge.
- Helpman, E., Krugman, P., 1985. *Market Structure and Foreign Trade*. MIT Press, Massachusetts.
- Krugman, P., 1995. Growing world trade: causes and consequences. *Brookings Papers on Economic Activity* 1, 327–377.
- Samuelson, P.A., 1949. International factor price equalization once again. *Economic Journal* 59, 181–197.
- Wood, A., 1994. *North–South Trade, Employment and Inequality*. Clarendon Press, Oxford.
- Woodland, A.D., 1982. *International Trade and Resource Allocation*, Amsterdam, North Holland.