

Trade integration with emerging countries with substantial resources in skilled labour: What effects are to be expected for European countries?

(Patrick ARTUS)

SUMMARY

We show that, at the periphery of the European Union, or in the Central European accession countries, resources in skilled labour are abundant. This changes significantly the lessons drawn from the conventional model of international specialisation because of factor endowment.

We build a model of this type (with two countries, two products and three factors of production), and we study the effects of large resources in skilled labour in the emerging country on the nature of specialisation, relative prices, wage inequalities, capital flows, the brain drain, and so forth. We show that trade openness can, in this case, be very detrimental for advanced countries.

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INTRODUCTION

1 – Review of the literature

The economic integration between the 15 present countries of the European Union and the ten accession countries can have many effects:

- according to most studies¹, trade openness stimulates growth in emerging countries (here accession countries) via several mechanisms: an increase in competition allegedly makes the markets of Central European countries more competitive, increase in productivity, transfers of technologies via direct investment² or trade itself, etc. The intensity of the effect on growth depends on the level of development of emerging countries, of the institutions of these countries, the capacity of their banks to finance growth, etc.³;
- however, the positive effect of trade openness on well-being in the emerging country is not totally certain, for various reasons:
 - imperfections in the credit market, reducing the possibility for the unskilled to gain access to education⁴;
 - short-term international specialisation in sectors that, in a rationale of endogenous growth, do not help increase long-run growth⁵;
 - fall in the relative wage of skilled labour in the emerging country leading to a lesser incentive to accumulate human capital (Findlay-Kierzkowski (1983)).
- in the most developed countries, the effect of trade openness on wages and inequalities has been thoroughly analysed. The normal mechanism (Stolper-Samuelson (1941), Heckscher-Ohlin) operates via the variation in the relative price of tradable goods (Krugman (1995a and B); Leamer (1987 and 1996)). It leads to a productive specialisation linked to factor endowment. As one expects advanced countries to have a lot of skilled labour, and emerging countries abundant unskilled labour, one must also have in advanced countries, a rise in the types of production that primarily use skilled labour, a rise in the wage of skilled labour, a fall in the wage of unskilled labour, and therefore an increase in wage inequalities⁶, and this poses the problem of the redistribution of gains achieved via trade;
- one needs to bear in mind that another theory explains the widening in inequality: the one that accounts for it by technical progress skewed in favour of the utilisation of skilled labour⁷. However, the changeover to technologies that are unfavourable for unskilled labour can be a way to react to competition from emerging countries in advanced countries;
- this is because the normal reaction of advanced countries is to step up their Research & Development to differentiate their output from products manufactured in emerging countries⁸, which must normally also increase their R&D expenditure to copy the products made in the North. Advanced countries therefore use defensive innovation, i.e. change over to biased techniques that draw on more skilled labour to prevent the incentive provided by the products made in emerging countries⁹;

¹ Greenaway-Morgan-Wright (2002); Irwin-Tervio (2002); Frankel-Romer (1999); Levine-Renelt (1992); Dollar (1992); Sachs-Warner (1995); Harrison (1996); World Bank (2002); Edwards (1993 – 1998); Wacziarg-Welch (2002) highlight this effect on growth.

² Coe-Helpman (1995-1997); Wacziarg (1998); Coe-Helpman-Hoffmaister (1997); Cartiglia (1997), Glass-Saggi (2002).

³ Hallak-Levinsohn (2004); Tornell-Westermann (2003); Tornell-Westermann-Martinez (2004).

⁴ Agenor-Aizenman (1991); Kim-Kim (2000).

⁵ Matsuyama (1992); Dinopoulos-Segerstrom (1999); Eicher (1996); Kahn-Lim (1998); Katz-Krueger (1997); Levy-Murnane (1996); Katz-Autor (1999); Katz-Murphy (1992).

⁶ Berman-Ground-Griliches (1994); Krugman (1995 a); Davis (1998); Freeman (1995); Lawrence-Slaughter (1993); Cortes-Jean (1997); Murphy-Welch (1992); Krugman (1993); Topel (1997); Sachs-Shatz (1994, 1996); Baldwin (1995); Nickell-Bell (1995); Bhagwati-Dehejia (1994); Burtless (1995); Guesnerie (1998); Levy-Murnane (1992); Wood (1995); Borjas-Ramey (1994).

⁷ Acemoglu (1998); Aghion (1998); Autor-Katz-Krueger (1998); Berndt-Morrison-Rosenblum (1992); Bound-Johnson (1992); Bresnahan-Brynjolfsson-Hitt (1999); Doms-Dunne-Troske (1997).

⁸ Dinopoulos-Segerstrom (2003).

⁹ Thoenig-Verdier (2000 and 2003), Wood (1994), Acemoglu (1999).

- it is accordingly difficult, when looking at trends in wage inequalities, to distinguish what results from trade and what results from technological progress¹⁰; the situation can also be made more complex if there is wage rigidity in the advanced country, for example in the form of a minimum wage for low skilled labour. There is then a loss in income in the advanced country and an increase in capital outflows¹¹;
- the reaction of the supply of labour is also important¹²; if the supply of skilled labour grows rapidly after trade openness is introduced, with inequalities hardly increasing, the bias of technical progress tilted in favour of the utilisation of skilled labour is increased.

We are interested here in the important following point: whereas the literature considers that emerging countries have an abundant factor endowment with respect to unskilled labour, **in reality many emerging countries have plentiful skilled labour**¹³.

This important divergence between theory and reality can change the effects of trade integration on international specialisation, transfers of capital and inequalities, and this is what we would like to study. We can see that it could imply, for instance, less specialisation in advanced countries in the types of production using skilled labour, and a rise in income inequalities in emerging countries instead of the normal effect of a relative pay rise for the poorest categories of the labour force¹⁴.

If emerging countries boast a large endowment in skilled labour, and if this leads to an increase in capital flows from advanced countries into emerging countries, the brain drain from emerging countries should be reduced¹⁵.

We are going to:

- start by showing that **effectively many emerging countries have substantial resources in skilled labour**;
- then develop a conventional **theoretical model** with two countries, two goods and three factors of production (skilled labour, unskilled labour and capital) to find the **usual results concerning the effects of trade openness**: specialisation, relative prices, relative wages, capital flows, brain drain, effects of the minimum wage in the advanced country, reactions of economic policy in the advanced country; and the role of intermediate types of consumption;
- we then examine **how these results are modified if the emerging country boasts substantial resources in skilled labour**.

2 - Education in emerging countries

We must here **document**:

- **the fact that in some emerging countries, the level of schooling is high**;
- **the fact that this leads to different effects from those usually expected from international specialisation**.

We are going to concentrate on European Union enlargement countries and on neighbouring countries of the EU, possible candidates for a further widening (North Africa, Turkey and Balkans).

¹⁰ Markusen-Venables (1998); Ekholm-Midelfart-Knarvik (2001); Feenstra-Hanson (1999); Leamer (1994); Maurin-Thesmar-Thoenig (2002).

¹¹ Brecher (1974); Fagnart-Fleurbaey (2002).

¹² Katz-Murphy (1992); Goldin-Katz (1999).

¹³ This has been observed by Baldwin-François-Portes (1997), Boeri and Alii (2002), Breuss (2001); Doyle-Fidrmuc (2004)

¹⁴ Dollar-Kraay (2001), Harrison-Hanson (1999), Beyer-Rohas-Vergara (1999).

¹⁵ Carrington-Detrage (1998); Haque-Kim (1994), Hatton-Williamson (1998); OECD (2002); Solimano-Pollack (2004).

Education and labour costs

Table 1 shows the proportion of the labour force having enjoyed higher education (i.e. attended university). We see a **high level of schooling**:

- **in North African countries;**
- **in many Central European countries:** Poland, Croatia, Bulgaria and Serbia; as is well known, this is also the case in the Czech Republic, Slovenia and Hungary, but there are no comparable data.

Table 1
Labour force having graduated from university

As % of total	1994	1998	1999	2000	2001	2002
Tunisia					16	
Morocco					10	
Turkey	6.7	6				
Poland		11	13.4	13.9		
Romania			8.4	8.7		
Croatia				13.7	11.2	11.3
Bulgaria			22.3	23.9		21.8
Serbia			17.7	17.2		
European Union						
Ukraine					8.0	

Sources: Eurostat, national sources

The level of schooling of the labour force is low, on the other hand, in Turkey, Romania and Ukraine.

Table 2 shows hourly labour costs in these countries. As is well known, they range between USD 16 and USD 22 in EU-15 countries; **we can see in the countries we are studying wages that are 5 to 20 times lower**, even in the countries where the level of schooling is high.

Table 2
Hourly wage in dollars (2000)

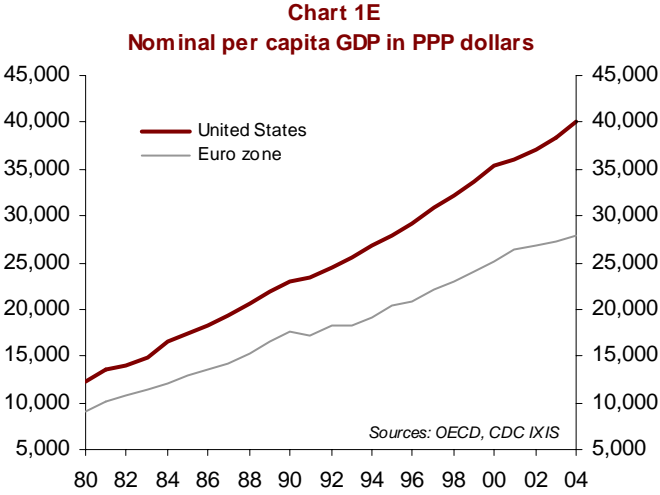
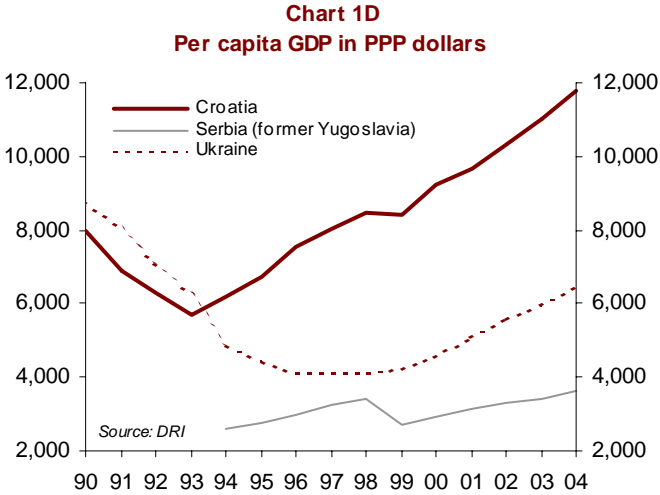
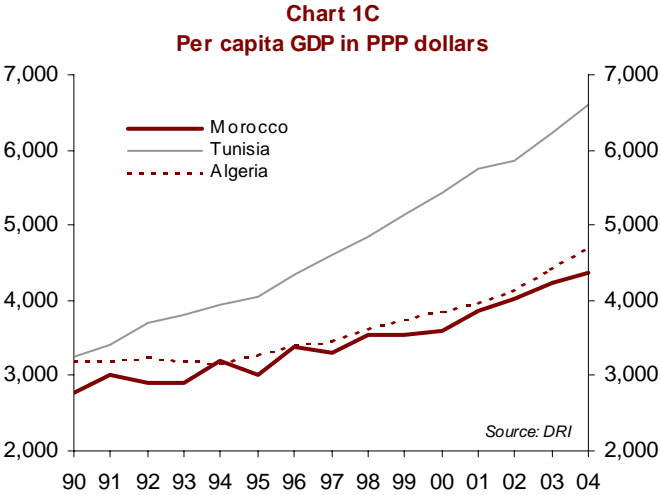
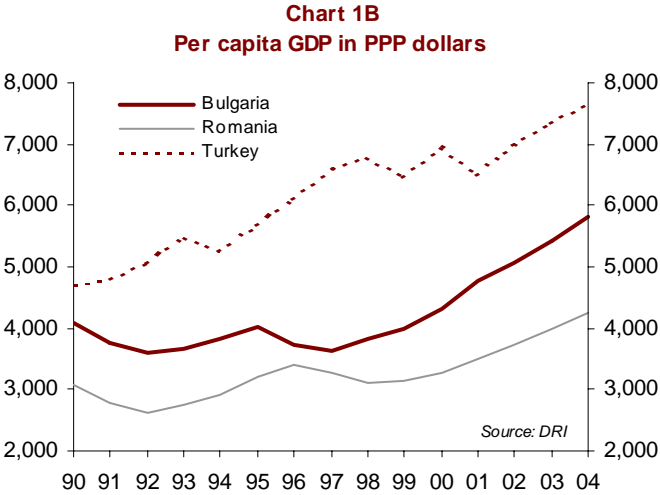
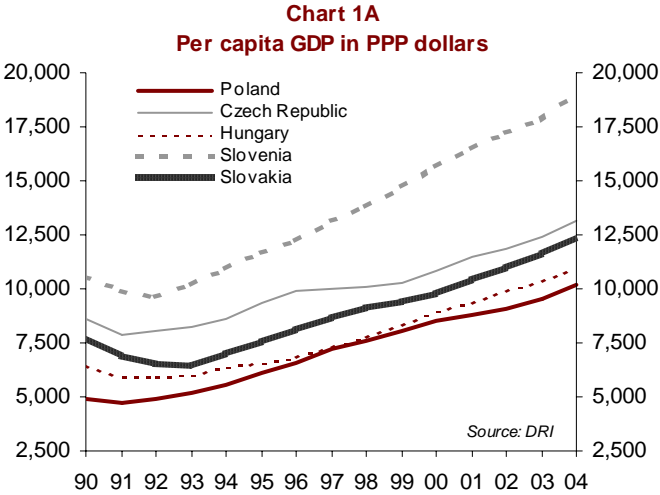
Poland	4.13
Czech Republic	3.04
Hungary	3.41
Slovenia	3.74
Slovak Republic	2.76
Bulgaria	1.29
Romania	1.18
Turkey	1.55
Croatia	2.58
Serbia	1.38
Ukraine	0.76
Morocco	0.64
Tunisia	0.71
Algeria	0.97

Sources: World Bank, Eurostat

We therefore do have the configuration, in many of these countries, of **a skilled labour force and low wage costs**.

Nominal wage differentials are obviously amplified by **differentials in price levels** (the prices of similar goods have not yet converged between the EU-15 and these countries).

To correct this effect, **we can look at per capita income in Purchasing Power Parity dollars (Charts 1A to 1E)**. For the euro zone as a whole, it stands at USD 28,000. Let us take the countries where the labour force is skilled; per capita incomes in PPP dollars range from USD 10,000 in Poland, USD 12,000 in the Czech Republic, USD 6,000 in Bulgaria, USD 4,500 in Morocco to USD 6,500 in Tunisia... The gap with EU-15 countries remains considerable.



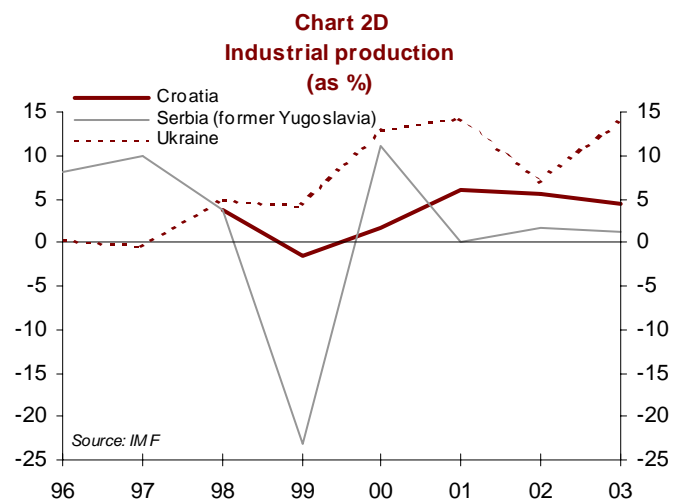
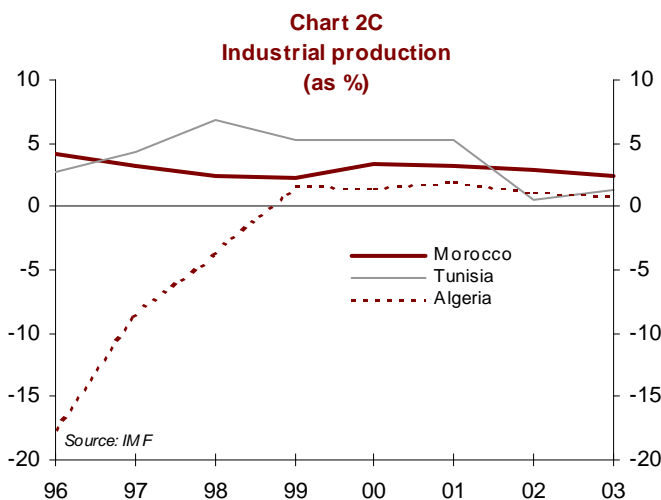
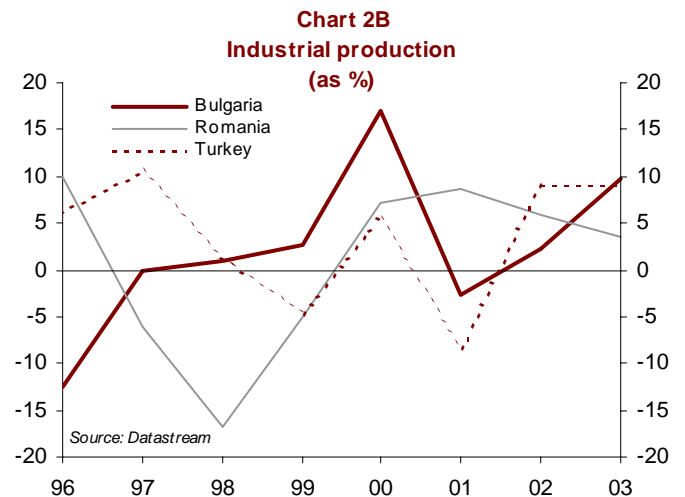
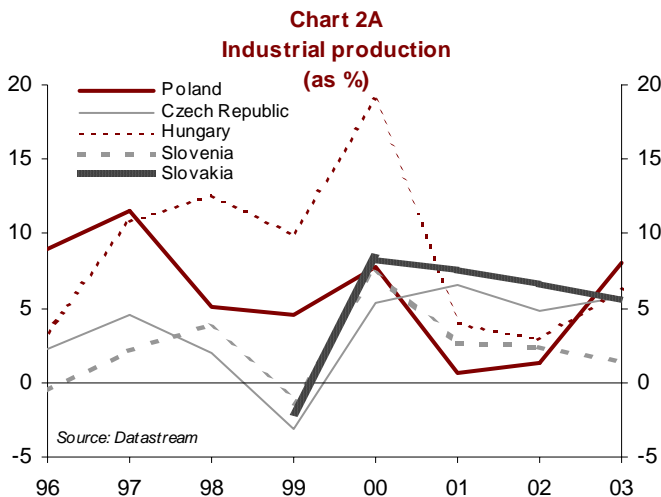
Effects on international specialisation

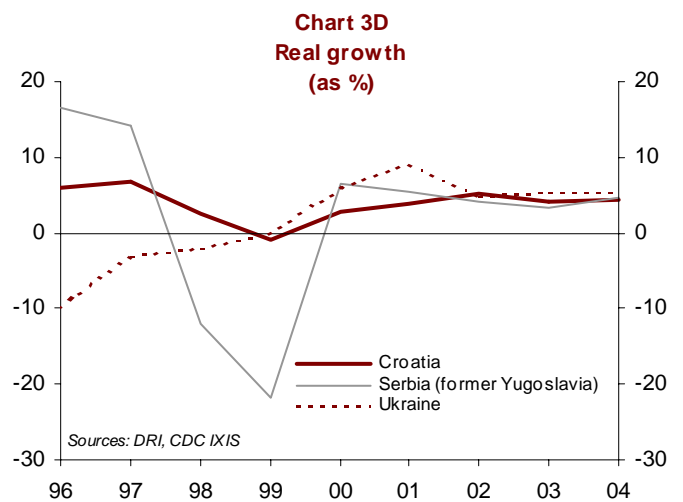
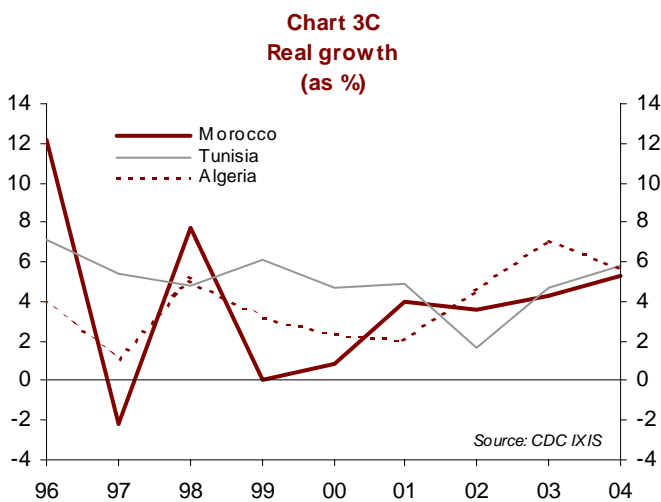
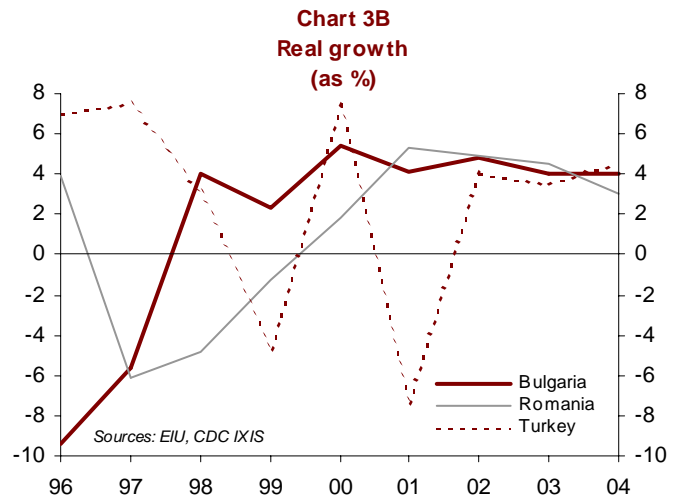
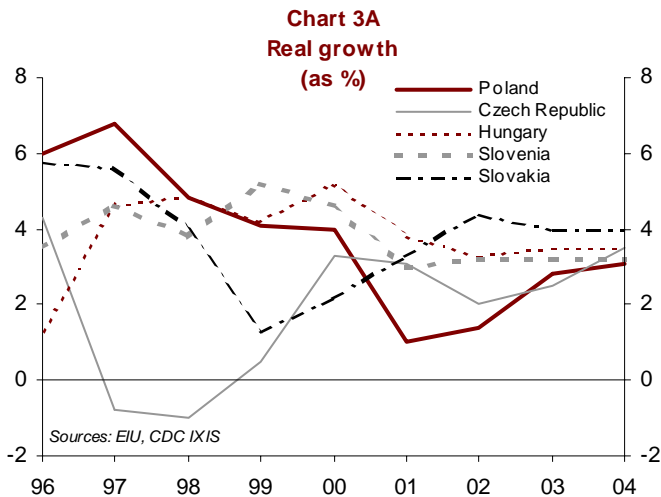
The analyses carried out above show that we expect, for the countries with a high level of schooling:

- **a possible inversed international specialisation**, with specialisation in these countries in the sectors using a lot of skilled labour; and, consequently, a rise, and not a fall, in wages of skilled labour;
- **large transfers of capital to these countries;**
- **little or no brain drain**, since the prospect with the transfers of capital is the equalisation of wages of skilled labour in these countries with those of skilled labour in EU-15 countries.

What can we see in the facts?

- **industrial growth (Charts 2A to 2D) is higher than overall growth (Charts 3A to 3D)** in Hungary, Slovakia, Bulgaria (except in 2001), and Ukraine, but clearly not in Poland, the Czech Republic, Slovenia, Romania, or Turkey (except in 2002-2003), and not in the three North African countries, Serbia or Croatia.





Yet, Poland, the North African countries, the Czech Republic, Croatia and Serbia have well schooled labour forces. The utilisation of this factor endowment should lead to stronger industrial growth, in countries where, notably, farm employment is still substantial (Table 3). But these countries also suffer from the **disappearance of traditional industries**, which use a lot of unskilled labour, and this also explains the **high level of unemployment** in all these countries except in Hungary (Charts 4A to 4D).

Table 3
Structure of employment (as %)

	Agriculture	Industry	Services
Poland	27	35	38
Czech Republic	6	40	54
Hungary	7	35	58
Slovenia	11	38	51
Slovak Republic	7	39	54
Bulgaria	48	35	17
Romania	42	28	30
Turkey	60	10	30
Croatia	16	33	51
Serbia	30	32	38
Ukraine	20	40	40
Morocco	44	23	33
Tunisia	32	33	35
Algeria	26	31	43

Source: World Bank

We can thus see that employment is contracting in manufacturing in countries where the labour force is skilled and where specialisation should occur in sophisticated industries: Poland, Slovakia and the Czech Republic (**Chart 4E**). This confirms the decline of traditional industries in these countries. Moreover, some services (banks, telecoms, etc.) also use skilled labour.

Chart 4A
Unemployment rate

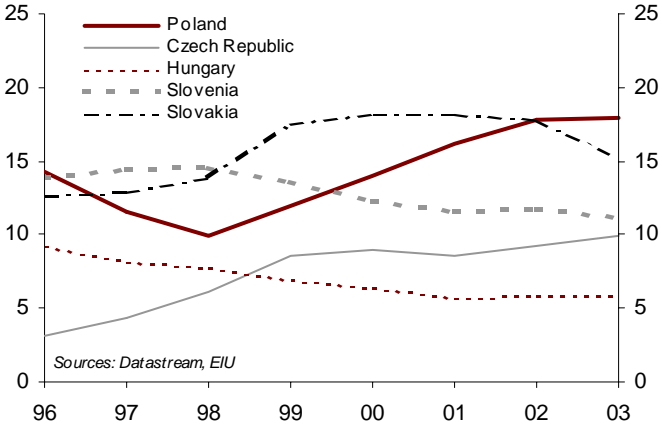


Chart 4B
Unemployment rate

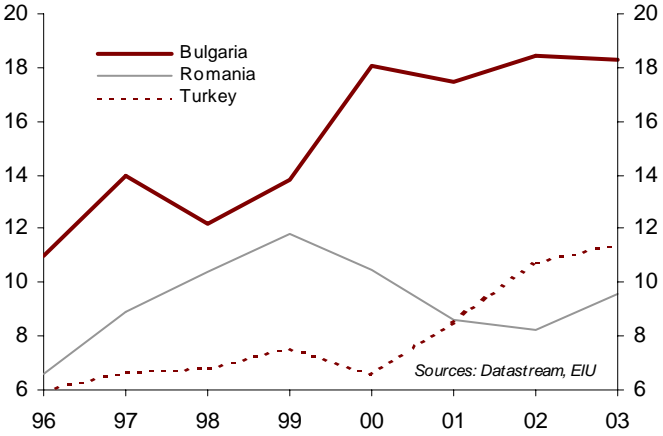


Chart 4C
Unemployment rate

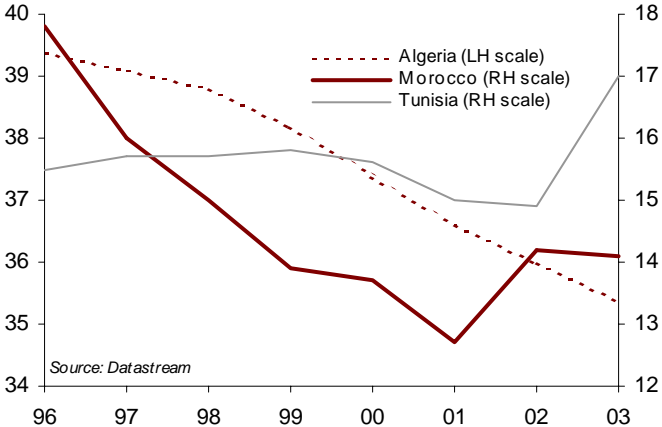


Chart 4D
Unemployment rate

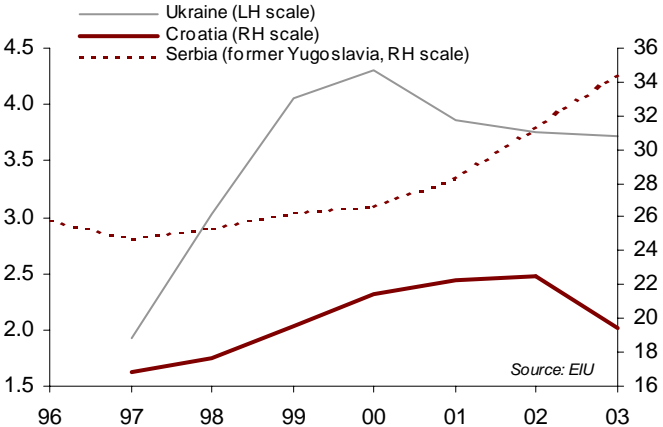
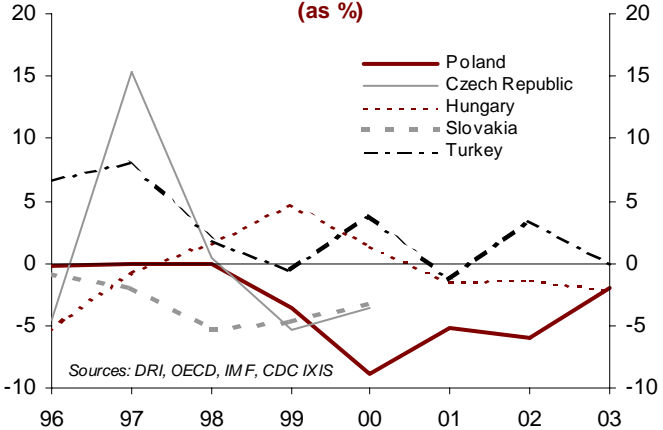


Chart 4E
Employment in the manufacturing sector (as %)



- **Direct investment (Charts 5A to 5D)**, relative to GDP in these countries, is noticeably high in the Czech Republic, Slovakia, Poland, Bulgaria, Croatia, and Serbia (since 2001). But it is quite low in the North African countries, Turkey, Romania and Ukraine.

With the important exception of North African countries, countries where the labour force is skilled are the ones that receive a lot of direct investment.

However, in comparison with the level observed in the EU-15 (19% to 20%, **Chart 6**), the investment rates in these countries are not high (**Charts 7A to 7D**), i.e. in Poland, the Czech Republic, Bulgaria, Romania, Turkey, and Serbia. We can see quite high investment rates in Hungary, Slovenia, the North African countries, Croatia and Ukraine, but it is very high only in Slovakia. **There are few links between the level of schooling of the labour force and the total investment rate.**

A noteworthy point is that in many of these countries (in particular the Czech Republic, Slovakia, Romania, Turkey, North African countries and Ukraine) the **tax burden is low** in comparison with what prevails in the EU-15 (**Charts 6 and Charts 8A to 8D**). The exceptions are Hungary, Poland, Slovenia, Bulgaria, Serbia and Croatia, and this has helped attract investments, but has also led to nearly all these countries (with the exceptions of Bulgaria and Ukraine, **Charts 9A to 9D**) face problems in terms of the fiscal deficit.

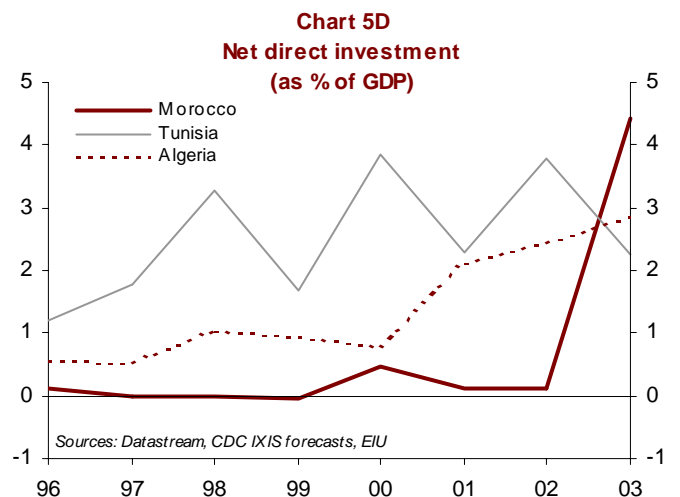
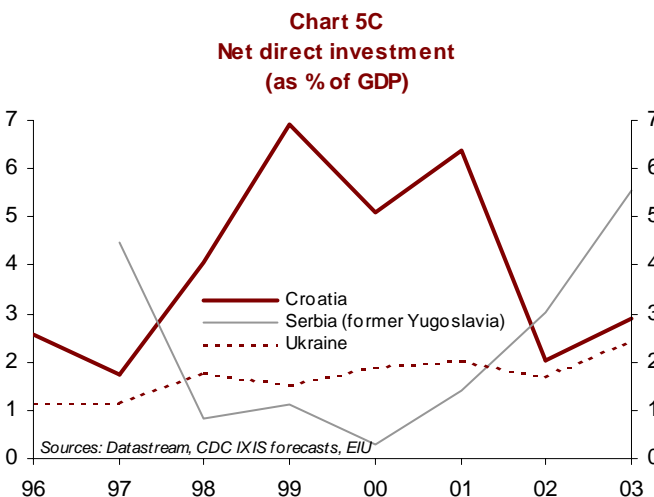
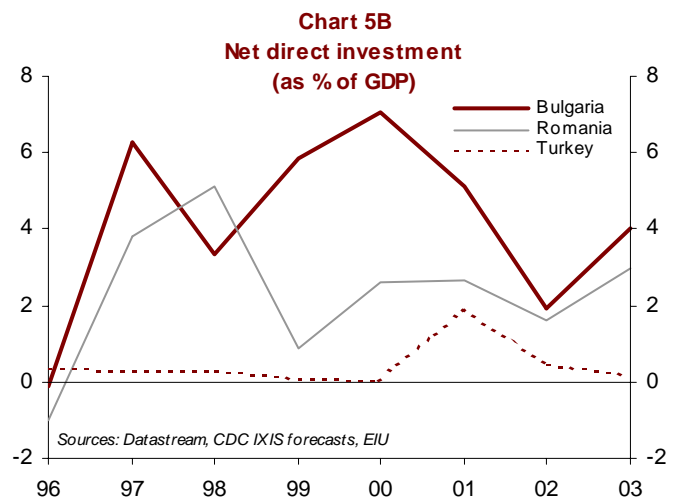
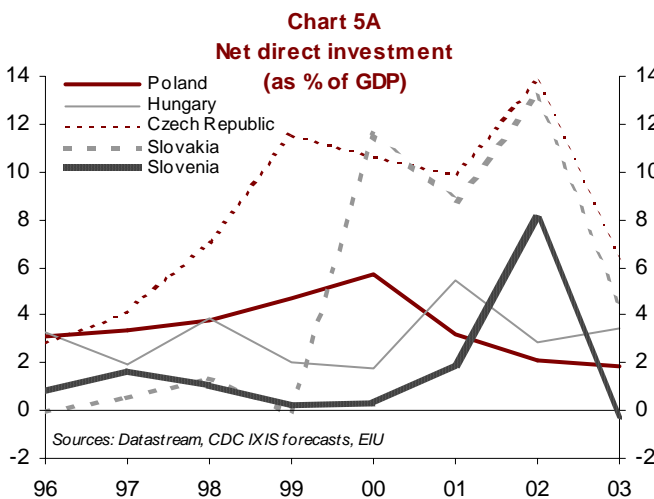


Chart 6
EU-15: Total investment and tax burden
(as % of GDP)

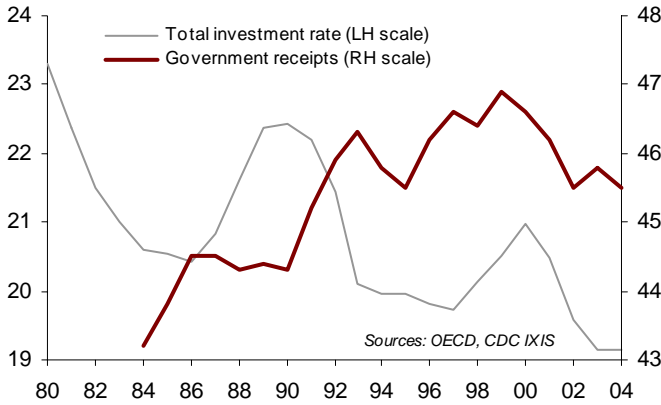


Chart 7A
Investment rate
(as % of GDP)

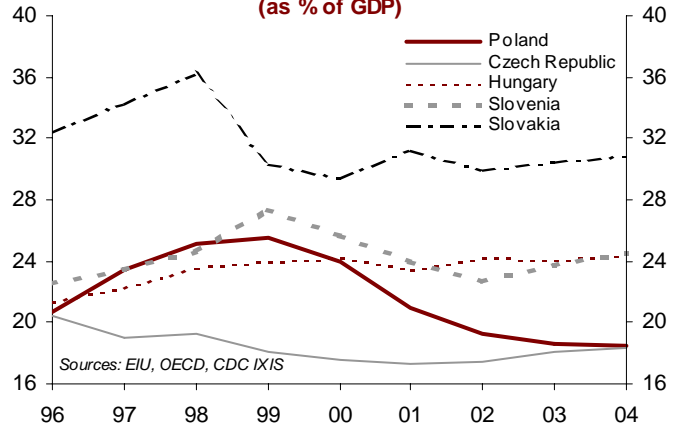


Chart 7B
Investment rate
(as % of GDP)

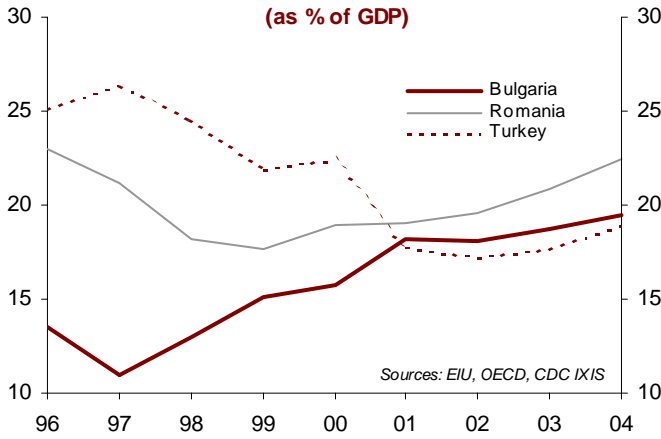


Chart 7C
Investment rate
(as % of GDP)

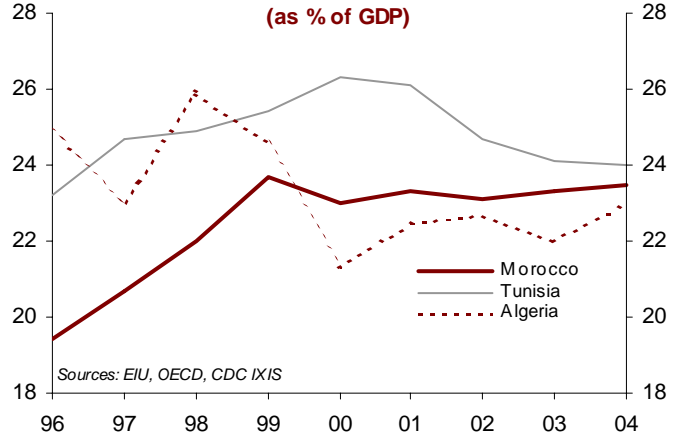


Chart 7D
Investment rate
(as % of GDP)

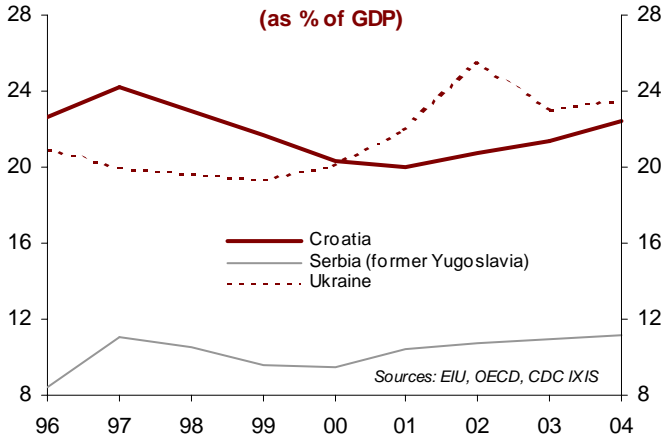
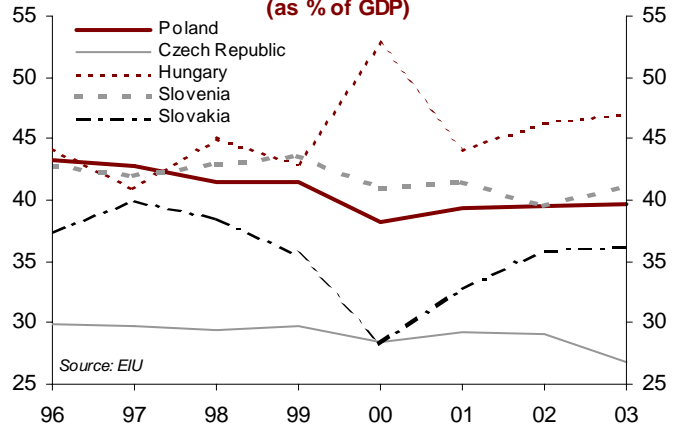
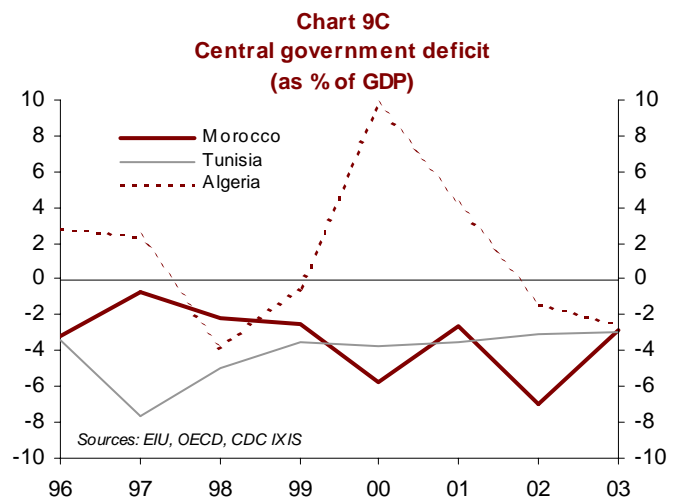
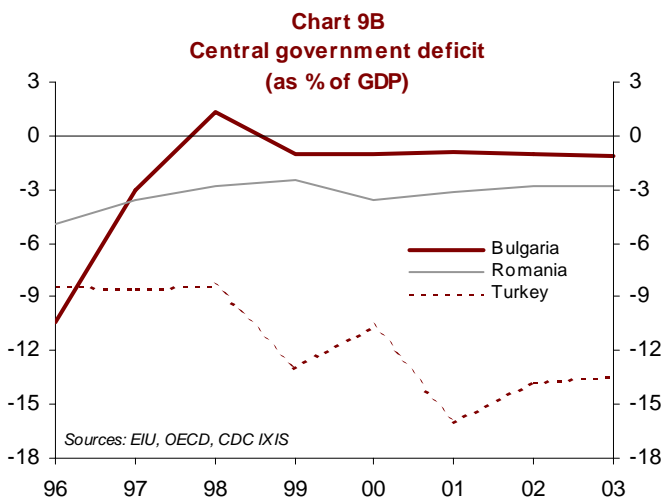
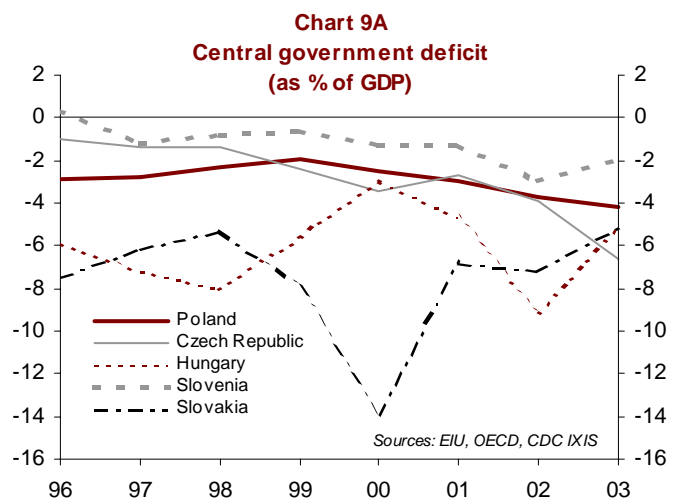
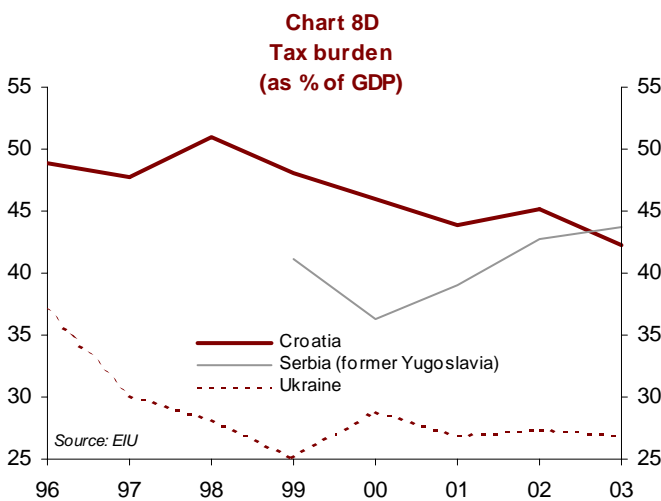
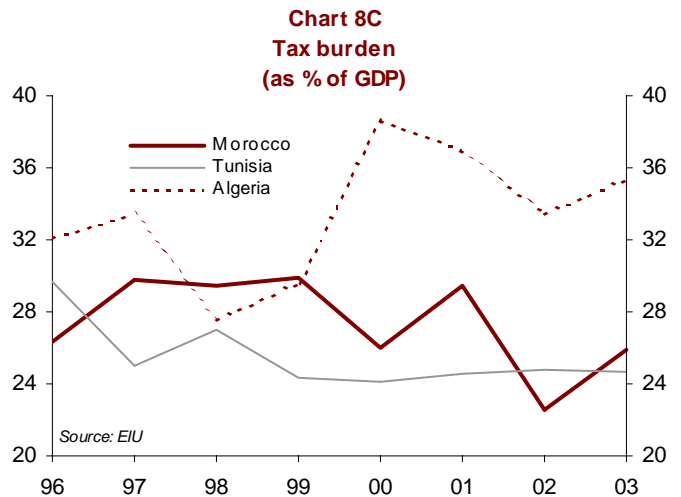
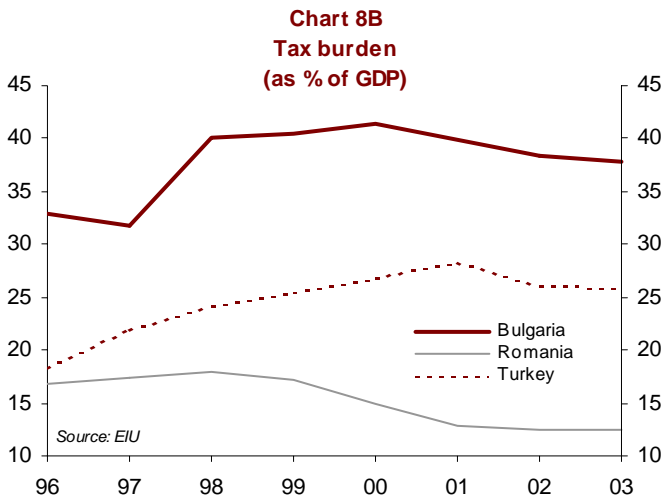
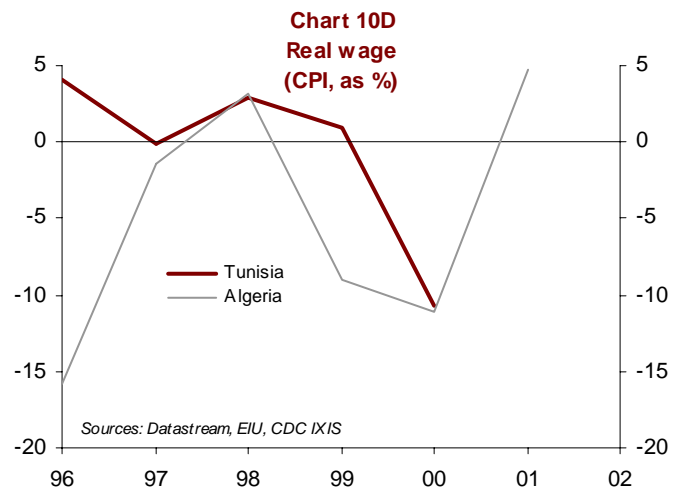
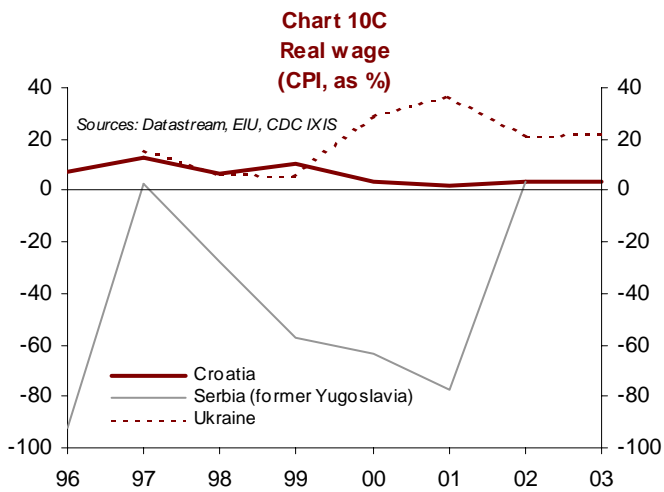
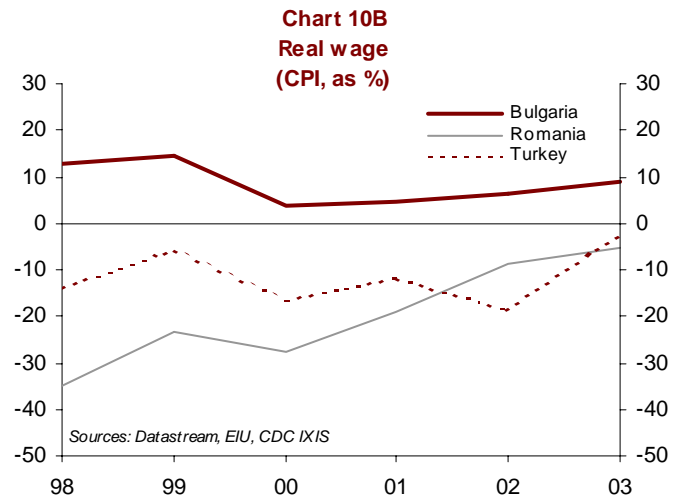
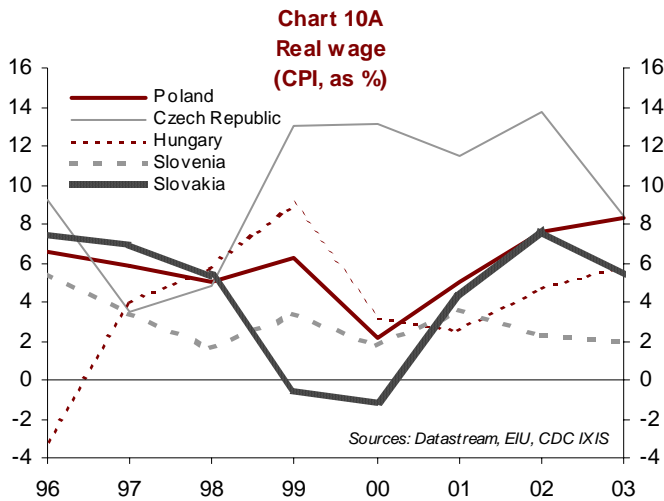


Chart 8A
Tax burden
(as % of GDP)





- real wages (Charts 10A to 10D)** have increased rapidly in the Czech Republic, Poland, Slovakia, and Hungary, and to a smaller degree in Slovenia, Bulgaria, Croatia, Ukraine and Morocco; but not in Romania, Turkey, Serbia, Algeria or Tunisia. **With the exception of Ukraine, the countries where the labour force's skills are poor have not benefited from rapid pay rises;**



- **emigration (Table 4)** is high in some countries where the skills of the labour force are good: Morocco, Bulgaria and Serbia; it is low in other countries where skills are also satisfactory: Tunisia, Poland and Croatia.

**Table 4
Emigration**

Country	Annual average emigration (% _o) 1995 – 2000
Morocco	1.5
Tunisia	0.8
Turkey	0.8
Bulgaria	4.9
Poland	0.5
Romania	0.5
Ukraine	2.0
Croatia	0
Serbia	1.9

On its own, good schooling of the population fails to avoid emigration in countries that are “remote” from the EU; this is consistent with the theoretical model: investment flows into these countries play a crucial role in preventing the brain drain.

Table 5 shows that the proportion of skilled foreign wage earners, with a scientific specialisation, is high in European companies.

**Table 5
Proportion of highly skilled foreign employees
in the payroll of firms employing this type of wage earner (%)**

Germany	9.1
France	10.9
United Kingdom	10.9
Netherlands	16.7
EU	11.1

Fields	
In which these employees work earners	Engineering sciences (41.5%)
	Mathematics (18.4%)
	IT (13.8%)
	Management (16.9%)

► **The empirical analysis we have carried out**

- **confirms there are** (North African countries, many CEEC) **emerging countries neighbouring the EU-15 that have a highly educated labour force and low wages;**
- **shows that the decline of traditional industries prevents these countries from enjoying noticeably rapid industrial growth or a particularly high investment rate;**
- **confirms the magnitude of direct investment into countries with a highly educated labour force, with the exception of North African countries. The brain drain** is significant in the countries where schooling levels are satisfactory but are still remote from the EU (Morocco, Bulgaria and Serbia); it is low in the other countries with a highly educated labour force (Tunisia, Poland and Croatia);
- **shows that, in most cases, real wages have hardly risen in the countries where the labour force’s schooling level is low.**

The process of trade openness and industrial specialisation is undoubtedly still too recent for these countries to benefit from robust industrial growth, because of the disappearance of traditional or obsolete industries.

Let us now move on to our theoretical model.

1 – The model

We consider:

- **two countries** (an advanced OECD country and an emerging country)
- **two goods** (a sophisticated good and a traditional good).

The **production technologies** of the two goods and **consumers' preferences** are the same in both countries, which differ only in terms of **endowment in factors of production**: capital, skilled labour and unskilled labour.

In the advanced OECD country:

- **the production function of the sophisticated good is:**

$$(1) Y = AK^a L_1^b N_1^{1-a-b}$$

Y is the production of the sophisticated good, K the capital in the sector that produces the sophisticated good, L_1 skilled employment, N_1 unskilled employment in the sophisticated sector. Production of the sophisticated good requires capital and both forms of labour.

- **The production function of the traditional good is:**

$$(2) Z = BN_2$$

Production of traditional good (Z) uses only unskilled labour; N_2 .

- **The equilibrium of the labour markets** (we suppose there is segmentation between the skilled labour market and the unskilled labour market), is written:

$$(3) \begin{cases} L_1 = L \\ N_1 + N_2 = N \end{cases}$$

L and N stand for the supply of skilled labour and of unskilled labour.

- **The consumers' utility function** U is written:

$$(4) U = \theta \ln(C) + (1-\theta) \ln(D)$$

C is consumption of the sophisticated product, D consumption of the traditional good, θ the relative preference of consumers for the sophisticated product.

In the emerging country, production technologies and consumers' preferences are the same as in the advanced country. The economy is therefore described by (a * refers to the emerging country):

$$(1') Y^* = A(K^*)^a (L_1^*)^b (N_1^*)^{1-a-b}$$

(production of sophisticated goods)

$$(2') Z^* = BN_2^*$$

(production of traditional goods)

$$(3') \begin{cases} L_1^* = L^* \\ N_1^* + N_2^* = N^* \end{cases}$$

(equilibrium of the labour market)

$$(4') U^* = \theta \ln(C^*) + (1-\theta) \ln(D^*)$$

(consumers' utility function).

The difference between the two countries results from their **endowments in factors of production**.

We suppose in this initial analysis that:

$$(3'') \begin{cases} K > K^* \text{ (there is more capital in the advanced country)} \\ L > L^* \text{ (larger resources in skilled labour in the advanced country)} \\ N^* > N \text{ (far greater resources in unskilled labour in the emerging country)} \end{cases}$$

Maximising U under the budgetary constraint:

$$(5) C + pD = Y + pZ$$

where p is the **relative price of the traditional good, we obtain**:

$$(6) \begin{cases} C = \theta(Y + pZ) \\ pD = (1-\theta)(Y + pZ) \end{cases}$$

- **The nominal wage** of skilled labour is W , the nominal wage of unskilled labour is S .

In the sector of sophisticated goods, for a given capital K , the maximisation of profit leads to:

$$(7) \begin{cases} L_1^a = b^{a+b} (1-a-b)^{1-a-b} AK^a W^{-(a+b)} S^{-(1-a-b)} \\ N_1^a = b^b (1-a-b)^{1-b} AK^a W^{-b} S^{-(1-b)} \end{cases}$$

In the **sector of traditional goods**, we have:

$$(8) S = pB$$

This leads, **at equilibrium in the two labour markets**, to:

$$(9) \begin{cases} W^{a+b} = b^{a+b} (1-a-b)^{1-a-b} AK^a (pB)^{-(1-a-b)} L^{-a} \\ N_1 = \frac{W}{pB} L \frac{1-a-b}{b} = (1-a-b)_{a+b} \frac{1}{(AK^a)^{a+b}} \bullet (pB)_{a+b}^{-1} L^{\frac{b}{a+b}} \\ N_2 = N - N_1 \end{cases}$$

The wage S of unskilled labour grows in line with the relative price of the traditional good; the wage W of skilled labour grows in line with AK^a (the capital and technical progress in the sophisticated sector), and decreases in line with the wage of unskilled labour (because of the negative effect of a rise in the wage of unskilled labour on demand for skilled labour), and decreases in line with

the supply of skilled labour. Unskilled labour N_1 used by the sophisticated sector grows in line with supply L of skilled labour (a rise in L increases the output of sophisticated good) and naturally decreases in line with the wage ($S = pB$) of unskilled labour.

The equilibrium in the product markets implies, by writing the equilibrium of the market of sophisticated products ($C = \theta(Y + pZ) = Y$):

$$(10) \quad Y(1 - \theta) = \theta pZ$$

where:

$$(10') \quad \begin{cases} Y = \left(AK^a L^b \right)^{\frac{1}{a+b}} (1-a-b)^{\frac{1-a-b}{a+b}} (pB)^{\frac{-(1-a-b)}{a+b}} \\ Z = B \left(N - \left((1-a-b) \frac{AK^a L^b}{pB} \right)^{\frac{1}{a+b}} \right) \end{cases}$$

Hence:

$$(11) \quad pB = AK^a L^b (1-a-b) \left(\frac{(1-a-b)^{-1}(1-\theta) + \theta}{\theta N} \right)^{a+b}$$

Hence furthermore:

$$(12) \quad \begin{cases} Y = AK^a L^b \left[\frac{\theta N}{(1-a-b)^{-1}(1-\theta) + \theta} \right]^{1-a-b} \\ N_1 = \frac{\theta N}{(1-a-b)^{-1}(1-\theta) + \theta}; N - N_1 = \frac{(1-a-b)^{-1}(1-\theta)N}{(1-a-b)^{-1}(1-\theta) + \theta} \\ W = bAK^a L^{-(1-b)} \left(\frac{\theta N}{(1-a-b)^{-1}(1-\theta) + \theta} \right)^{1-a-b} \end{cases}$$

A rise in θ (consumers' preference for the sophisticated product) triggers an increase in demand for this product, which is balanced by a rise in production of the sophisticated product Y , made possible by a rise in unskilled employment N_1 used in the production of the sophisticated good, hence a decline in the output of the traditional good; also via a rise in the relative price p of the traditional good, which reduces demand for this product. The rise in Y implies an increase in the wage W of skilled labour.

An increase in capital K in the sector producing the sophisticated good raises its output Y ; to rebalance the market of the sophisticated good, there is a parallel rise in the relative price of the traditional good (and this enables the market to meet $(1-\theta)Y = \theta pZ$) without a change in unskilled employment or in the production of the traditional good. The increase in the output of the sophisticated good leads to a rise in the wage of skilled labour.

The relative wage of skilled and unskilled labour is $\frac{W}{pB}$, equal to:

$$(13) \quad \frac{W}{pB} = \frac{b}{1-a-b} \frac{\theta}{(1-a-b)^{-1}(1-\theta) + \theta} \frac{N}{L}$$

It increases in line with the relative supply of unskilled labour and skilled labour $\left(\frac{N}{L}\right)$ and in line with the consumers' preference for the sophisticated goods (θ) .

In the **emerging country**, since $N^* > N$ (more abundant unskilled labour) and $L^* < L$ (less abundant skilled labour), the relative wage of skilled labour is higher than in the advanced country.

2 – Trade openness with perfect wage flexibility but without capital or labour mobility

We suppose here that the **advanced country and the emerging country**:

- **are completely open to trade** (of the sophisticated good and of the traditional good);
- **without any mobility of factors of production** (capital, skilled labour and unskilled labour).

The equilibrium is then written:

$$(14) \begin{cases} L_1 = L \\ L_1^* = L^* \text{ (skilled labour markets)} \end{cases}$$

$$(15) \begin{cases} N_1 + N_2 = N \\ N_1^* + N_2^* = N^* \text{ (unskilled labour markets)} \end{cases}$$

$$(16) \begin{cases} Y + Y^* = C + C^* \text{ (equilibrium in the sophisticated product market)} \\ Z + Z^* = D + D^* \text{ (equilibrium in the traditional product market)} \end{cases}$$

Since there is free trade of both types of good, the **relative price p of the traditional good is common to the two countries** (there is a **single price** for the two goods insofar as they are traded).

$$(16') \begin{cases} Y + Y^* = \theta(Y + pZ) + \theta(Y^* + pZ^*) \\ Z + Z^* = (1-\theta)\left(\frac{Y}{p} + Z\right) + (1-\theta)\left(\frac{Y^*}{p} + Z^*\right) \end{cases}$$

(these two equalities are obviously equivalent).

Hence, **to ensure the equilibrium of the two product markets:**

$$(16'') (1-\theta)(Y + Y^*) = \theta p(Z + Z^*)$$

this leads to the equivalent of (11) (12) in the case of a single country, or, for the **relative price of the traditional good**:

$$(17) pB = \left((AK^a L^b)^{\frac{1}{a+b}} + (AK^{*a} L^{*b})^{\frac{1}{a+b}} \right)^{(a+b)} \cdot (1-a-b) \cdot \left(\frac{(1-\theta)(1-a-b)^{-1} + \theta}{\theta(N+N^*)} \right)^{(a+b)}$$

for the output and the wage of skilled labour:

$$(18) Y = (AK^a L^b)^{\frac{1}{a+b}} \left((AK^a L^b)^{\frac{1}{a+b}} + (AK^{*a} L^{*b})^{\frac{1}{a+b}} \right)^{a+b+1} \cdot \left(\frac{\theta(N+N^*)}{(1-a-b)^{-1}(1-\theta) + \theta} \right)^{1-(a+b)}$$

and the equivalent for Y^* .

$$(19) \begin{cases} N_1 = \frac{(AK^a L^b)^{\frac{1}{a+b}}}{(AK^a L^b)^{\frac{1}{a+b}} + (AK^{*a} L^{*b})^{\frac{1}{a+b}}} \cdot \frac{\theta(N + N^*)}{(1-a)(1-a-b)^{-1} + \theta} \\ Z = B(N - N_1) \end{cases}$$

and, for the wages:

$$(20A) \begin{cases} W = b(AK^a)^{\frac{1}{a+b}} L^{-\frac{a}{a+b}} \left((AK^a L^b)^{\frac{1}{a+b}} + (AK^{*a} L^{*b})^{\frac{1}{a+b}} \right)^{-(1-a-b)} \cdot \\ \left(\frac{\theta(N + N^*)}{(1-a-b)^{-1}(1-\theta) + \theta} \right)^{1-a-b} \\ W/pB = \frac{1-a-b}{b} (AK^a)^{\frac{1}{a+b}} L^{-\frac{a}{a+b}} \left((AK^a L^b)^{\frac{1}{a+b}} + (AK^{*a} L^{*b})^{\frac{1}{a+b}} \right)^{-1} \cdot \\ \left(\frac{\theta(N + N^*)}{(1-a-b)^{-1}(1-\theta) + \theta} \right) \end{cases}$$

Wages of unskilled labour are similar in both countries, $S = S^* = pB$.

Since $K > K^*, L > L^*, N^* > N$, without ambiguity:

$$(20B) \frac{(AK^a L^b)^{\frac{1}{a+b}} + (AK^{*a} L^{*b})^{\frac{1}{a+b}}}{(AK^a L^b)^{\frac{1}{a+b}}} < \frac{N + N^*}{N}$$

hence, by denoting: $\begin{cases} \text{with } * \text{ the emerging country's variables} \\ \text{with } \hat{\ } \text{ the variables before trade openness} \end{cases}$

We obtain:

$$\begin{aligned} & \hat{p}^* < p < \hat{p} \text{ (relative price of the traditional good)} \\ & \begin{cases} Y > \hat{Y} \text{ (production in both countries of the sophisticated good)} \\ Y^* < \hat{Y}^* \end{cases} \\ & \begin{cases} N_1 > \hat{N}_1 \text{ (unskilled labour in the sector producing the sophisticated good)} \\ N_1^* < \hat{N}_1^* \end{cases} \\ & \begin{cases} Z < \hat{Z} \text{ (production in both countries of the traditional good)} \\ Z^* > \hat{Z}^* \end{cases} \\ & \begin{cases} W > \hat{W} \text{ (wage of skilled labour)} \\ W^* < \hat{W}^* \end{cases} \end{aligned}$$

$$\begin{cases} \frac{W}{pB} > \left(\frac{\hat{W}}{pB} \right) \text{(relative wage of skilled labour)} \\ \frac{W^*}{p^*B} < \left(\frac{\hat{W}^*}{p^*B} \right) \end{cases}$$

These developments are perfectly normal. Trade openness leads to a specialisation linked to the country's factor endowment; the production of sophisticated good therefore grows in the advanced country and declines in the emerging country; while the reverse holds true for the production of the traditional good. The average of the two countries is less efficient than the emerging country and more efficient than the advanced country with respect to producing the traditional good; there is accordingly a rise in the relative price of the traditional good in the emerging country and a decline in the advanced country. Demand for skilled labour increases in the advanced country, due to the production of the sophisticated good, and decreases in the emerging country. There is therefore a fall in the relative wage of skilled labour in the emerging country, while it rises in the advanced country.

3 – Trade openness with capital mobility

In addition to the previous determinants of the equilibrium (equilibria in the product markets and the labour markets), we introduce here **international capital mobility** between the advanced country and the emerging country.

It implies that marginal productivity of capital for the production of the sophisticated good is the same in both countries, i.e.:

$$(21) \left(\frac{K}{K^*} \right)^{1-a} = \left(\frac{L}{L^*} \right)^b \left(\frac{N_1}{N_1^*} \right)^{1-a-b}$$

Identifying N_1 and N_1^* thanks to (19), this leads to:

$$(22) \frac{K}{K^*} = \frac{L}{L^*}$$

: proportionality of the two stocks of capital as well as the supply of skilled labour in the two countries (equality of capital intensity in the sophisticated sectors of the two countries).

If global capital $K + K^*$ is given (equal to global savings), and if, before trade openness, capital intensity was higher in the advanced country, then there is **transfer of capital to the emerging country**, thus, in the advanced country, a contraction in the output of the sophisticated good, a decline in the wage of skilled labour, and a rise in the output of the traditional good.

If (22) is verified, we can also see that there is equalisation of the wage of skilled labour in the two countries $\left(W = W^* \text{ si } \frac{K}{L} = \frac{K^*}{L^*} \right)$. However, $\frac{K}{L} > \frac{K^*}{L^*}$ is initially ambiguous, since $K > K^*$ and $L > L^*$.

4 – Effects on incomes and well-being in the advanced country of trade openness

We concentrate first on well-being in the advanced country, by drawing a distinction between skilled and unskilled labour.

The utility function is (4), and income is shared between:

- the payroll of skilled labour, WL ;
- the payroll of unskilled labour, $pB.N$
- company earnings, $Y + pZ - (WL + pBN)$. since $Z = BN_2, pZ = pBN_2$ and the profits are equal to $Y - (WL + pBN_1)$.

Since trade openness increases the per capita wage of skilled labour W and reduces, in the advanced country, the relative price of the traditional good, p , and therefore the per capita wage of unskilled labour, **it increases the income of skilled labour (WL), and reduces the income of unskilled labour (pBN)**, $WL + pB.N_1$ is equal to $\left[AK^a L^b (pB)^{-(1-a-b)}\right]^{\frac{1}{a+b}} \cdot \left(\frac{1-a}{1-a-b}\right)$ and thus grows in line with trade openness since p declines in the advanced country.

$Y - (WL + pBN_1)$ is equal to $\left[AK^a L^b (pB)^{-(1-a-b)}\right]^{\frac{1}{a+b}} \frac{a}{1-a-b}$: profits are increased by trade openness.

Well-being lastly, is equal to:

$$(20 b) U = \ln(Y + pZ) + \theta \ln(\theta) + (1-\theta) \ln(1-\theta) - (1-\theta) \ln(p)$$

It is increased by the decline, in the advanced country, in the relative price of the traditional good, which increases consumption in volume terms of this good.

U varies in line with:

$$(20 c) \theta \ln(pB) + \ln \left(N + (a+b)(1-a-b)^{\frac{1-a-b}{a+b}} (AK^a L^b)^{\frac{1}{a+b}} (pB)^{\frac{-1}{a+b}} \right)$$

We will see in the **Appendix that well-being in the two countries is enhanced by trade openness.**

Trade openness with the emerging country in the advanced country:

- increases the income of skilled labour;
- reduces the income of unskilled labour;
- enhances well-being.

5 – Rigid minimum wage for unskilled labour

We now suppose that, in the advanced country, the **wage of unskilled labour is constrained**, and cannot fall after trade openness: $S = \bar{S} = \hat{p}B$, where \hat{p} is the relative price of the traditional good in the advanced country before trade openness.

In the emerging country, the wage of unskilled labour is set at the level $S^* = pB$, where p is the relative price of the traditional good after trade openness. We will suppose, in order to restrict the number of cases, that **when only the emerging country produces the traditional good, the**

equilibrium price of the traditional good is lower than \hat{p} (the equilibrium price in the advanced country before trade openness).

Consequently, after trade openness:

- the advanced country no longer produces the traditional good;
- the relative equilibrium price of the traditional good comes from $(1-\theta)(Y+Y^*) = \theta p Z^*$.

If, in the advanced country, the wage of unskilled labour remains blocked at $\hat{S} = \hat{p}B$, then:

- demand for unskilled labour to produce the sophisticated good is:

$$(23 \text{ a}) \quad N_1 = (1-a-b) \frac{1}{a-b} Q \frac{1}{a+b} \bar{S}^{-\frac{1}{a+b}}$$

by denoting $Q = AK^a L^b$;

- and production of the sophisticated good is:

$$(23 \text{ b}) \quad Y = Q \frac{1}{a+b} (1-a-b) \frac{1-a-b}{a+b} \bar{S}^{-\frac{1-a-b}{a+b}}$$

In the emerging country, the wage of unskilled labour is pB , where p is the relative equilibrium price of the traditional good. We therefore have:

$$(24) \quad \begin{cases} N_1^* = (1-a-b) \frac{1}{a+b} Q^* \frac{1}{a+b} (pB)^{-\frac{1}{a+b}} \\ Y^* = Q^* \frac{1}{a+b} (1-a-b) \frac{1-a-b}{a+b} (pB)^{-\frac{1-a-b}{a+b}} \end{cases}$$

where $Q^* = A(K^*)^a (L^*)^b$.

The equilibrium in the product market without production of the traditional good in the advanced country ($Z = 0$) implies (to obtain $(1-\theta)(Y+Y^*) = \theta p Z^*$).

$$(25) \quad \begin{aligned} & (1-a-b) \frac{1}{a+b} Q^* \frac{1}{a+b} (pB)^{-\frac{1-a-b}{a+b}} \left((1-\theta)(1-a-b)^{-1} + \theta \right) \\ & = \theta p B N_1^* - (1-\theta)(1-a-b) \frac{1-a-b}{a+b} (\hat{p}B)^{-\frac{1-a-b}{a+b}} Q^* \frac{1}{a+b} \end{aligned}$$

whereas, before trade openness, we had:

$$(26 \text{ a}) \quad (\text{advanced country}) \quad (1-a-b) \frac{1}{a+b} Q \frac{1}{a+b} (\hat{p}B)^{-\frac{1-a-b}{a+b}} \left((1-\theta)(1-a-b)^{-1} + \theta \right) = \theta \hat{p} B N$$

and:

$$(26 \text{ b}) \quad (\text{emerging country}) \quad (1-a-b) \frac{1}{a+b} Q^* \frac{1}{a+b} (\hat{p}B^*)^{-\frac{1-a-b}{a+b}} \left((1-\theta)(1-a-b)^{-1} + \theta \right) = \theta \hat{p} B^* N^*$$

Without ambiguity, p (relative price of the traditional good after trade openness) $> \hat{p}^*$ (price of the traditional good in the emerging country before trade openness), since the emerging country now produces to meet demand for goods in both countries.

If:

$$(27) (1-a-b) \left(\frac{Q^*}{Q} \right)^{\frac{1}{a+b}} + \frac{1-\theta}{(1-a-b)^{-1}(1-\theta)+\theta} < \theta \left(\frac{N^*}{N} \right)$$

then price p is $< \hat{p}$ (the price in the advanced country before trade openness), since the resources in unskilled labour in the emerging country are then very abundant ($N^* \gg N$).

We consider this case. We can obviously see that **this situation of rigidity in the wage of unskilled labour is highly detrimental for the advanced country.**

- the relative price of the traditional good is less low than when the wage of unskilled labour is flexible, and this hurts the advanced country's terms of trade;
- unemployment appears among unskilled labour ($N - N_1$), equal to employment in the traditional sector before trade openness;
- income $Y + pZ$ is substantially reduced, both by the decline in production of sophisticated goods Y and by the disappearance of the production of traditional goods Z ;
- if there is **capital mobility** (equalisation of marginal productivity of capital in the sophisticated sectors in both countries), we obtain:

$$(28) \frac{K}{K^*} = \frac{L}{L^*} \left(\frac{\hat{p}}{p} \right)^{\frac{-(1-a-b)}{a+b}}$$

which substitutes for $\frac{K}{K^*} = \frac{L}{L^*}$ in the case of wage flexibility, with $\hat{p} > p$: there is an increased transfer of capital from the advanced country into the emerging country, since the fact that the wage of unskilled labour is higher in the advanced country reduces the marginal productivity of capital in said country.

6 – Well-being in emerging country

- Trends in the emerging country are symmetrical to those seen in the advanced country. The relative price of the traditional good increases in the emerging country and this increases well-being (see Appendix). The wage of unskilled labour increases, and the wage of skilled labour decreases;
- if there is capital mobility, and if, before trade openness $\frac{K}{L} > \frac{K^*}{L^*}$ (greater capital intensity in the advanced country), then the rise in K^* increases well-being and the wage of skilled labour. The effect on the relative price of the traditional good, therefore on the wage of unskilled labour, is ambiguous. If initially K^* is very small, there is a rise in the relative price because income in the emerging country rises significantly;
- if the minimum wage of unskilled labour is rigid in the advanced country, the relative price of the traditional good is increased and this is favourable for the emerging country (which

produces more of the traditional good, and loses less in terms of the output of the sophisticated product since it is reduced in the advanced country).

7 – Reaction of the advanced country

Let us consider the case where the advanced country faces a minimum wage for unskilled labour. How can it react?

- **lower the minimum wage and offset this cut by a transfer between skilled and unskilled labour** that does not affect demand for labour;
- **favour retraining unskilled labour.**

A rise in L (supply of skilled labour) corresponding to a fall in N (supply of unskilled labour) in the advanced country would have the following effects:

- increase output Y of the sophisticated good (see (23 b)), and increase demand for unskilled labour (see (23 a)), therefore reduce unemployment;
- but, conversely, increase the relative price p of the traditional good (see (25)), by increasing income, therefore demand for the traditional good, in the advanced country. If production Z^* of the traditional good is substantial in comparison with the additional demand $\left((1-\theta) \frac{b}{a+b} Y \frac{dL}{L} \right)$ thus generated, the first effect outweighs the latter, and well-being in the advanced country is increased.

- **Taking advantage of demand for sophisticated goods related to their production**

We now introduce a new characteristic of our model that can be favourable for the advanced country: the fact that the production of sophisticated goods requires intermediate consumption of sophisticated goods. This can be seen, for example, in the relations between China and Japan: production of electronics, of automobiles, etc. in China generates demand for components, spare parts, etc., provided by Japan; it can also be a continuous flow of investments in productivity.

Let us suppose therefore that a fraction λ of the production of sophisticated goods is necessary in the form of intermediate consumption of sophisticated goods. The income distributed in the advanced country then declines to $Y(1-\lambda)$ (in the case of the minimum wage we are considering, $Z = 0$), and in the emerging country it stands at $Y^*(1-\lambda) + Z^*$. The equilibrium in the product markets is then written:

$$(28) \quad (Y + Y^*) (1 - \lambda) (1 - \theta) = \theta p Z^*$$

as demand for traditional goods is reduced by the contraction in income.

This leads, with respect to the determination of the relative price of the traditional good, to:

$$(29A) \quad (1-a-b)^{\frac{1}{a+b}} Q^* \frac{1}{a+b} (pB)^{\frac{-(1-a-b)}{a+b}} \left(\frac{(1-\lambda)(1-\theta)}{1-a-b} + \theta \right) + (1-a-b)^{\frac{1-a-b}{a+b}} Q \frac{1}{a+b} (\hat{p}B)^{\frac{-(1-a-b)}{a+b}} \left(\frac{(1-\lambda)(1-\theta)}{1-a-b} + \theta \right) = \theta \hat{p} B N$$

Before trade openness, we had, in the advanced country, in this same case:

$$(29B) \quad (1-a-b)^{\frac{1}{a+b}} Q^{\frac{1}{a+b}} (\hat{p}B)^{\frac{-(1-a-b)}{a+b}} \left(\frac{(1-\lambda)(1-\theta)}{1-a-b} + \theta \right) = \theta \hat{p}BN$$

In the former case (after openness) we have:

$$(30A) \quad \frac{d(pB)}{pB} \left(\theta N^* pB + \frac{1-a-b}{a+b} (1-a-b)^{\frac{1}{a+b}} Q^{\frac{1}{a+b}} (pB)^{\frac{-(1-a-b)}{a+b}} \left(\frac{(1-\theta)(1-\lambda)}{1-a-b} + \theta \right) \right) \\ = -(1-\theta)d\lambda(Y^* + Y)$$

In the latter case (before trade openness in the advanced country):

$$(30B) \quad \frac{d(pB)}{pB} \left(\theta N \hat{p}B + \frac{1-a-b}{a+b} (1-a-b)^{\frac{1}{a+b}} Q^{\frac{1}{a+b}} (\hat{p}B)^{\frac{-(1-a-b)}{a+b}} \left(\frac{(1-\lambda)(1-\theta)}{1-a-b} + \theta \right) \right) = -(1-\theta)d\lambda \bullet Y$$

This shows that if:

$$(31) \quad \frac{Y + Y^*}{\theta N^* pB + \frac{(1-a-b)^2}{a+b} Y^* \left(\frac{(1-\theta)(1-\lambda)}{1-a-b} + \theta \right)} > \frac{Y}{\theta N \hat{p}B + \frac{(1-a-b)^2}{a+b} Y \bullet \left(\frac{(1-\theta)(1-\lambda)}{1-a-b} + \theta \right)}$$

then the increase in λ (need for intermediate consumption of sophisticated goods) reduces the relative price of traditional goods to a greater extent after trade openness than before, this reduction was favourable for the advanced country. (31) is verified if θ (preference for the sophisticated good) is not too great, and for all the values of θ if:

$$(31') \quad \hat{p}BN \left(1 + \frac{Y^*}{Y} \right) + \frac{(1-a-b)^2}{a+b} Y > N^* pB$$

And this is probably true (pB is low, Y is high).

8 – Emerging country boasting plentiful skilled labour

As we have analysed it above, the model corresponds to the conventional analysis of the effects of trade openness between an advanced country and an emerging country: the emerging country has a larger endowment in unskilled labour and specialises in the production of the traditional good that uses unskilled labour.

But **there are emerging countries** (Central Europe, India for example) **where skilled labour is abundant**. We are therefore going to look now at how the previous results are modified when we suppose that the **endowment in skilled labour** (L^*) **in the emerging country is significant**.

We look at the various cases anew.

8 - 1 Trade openness without capital mobility and without minimum wage in the advanced country

The effects of trade openness are given in equations (17) to (20). The relative price of the traditional good and the wage of unskilled labour vary in line with:

$$\frac{\frac{1}{Q^{\frac{1}{a+b}}} + Q^* \frac{1}{a+b}}{N + N^*}$$

Production of sophisticated goods and unskilled employment in the sectors producing sophisticated goods in the two countries vary in line with the inverses of this ratio.

We still have:

$$Q^* = AK^{*a}L^{*b}$$

Before trade openness, all these variables vary in line with:

$$\frac{\frac{1}{Q^{\frac{1}{a+b}}}}{N} \text{ in the advanced country, } \frac{\frac{1}{Q^* \frac{1}{a+b}}}{N^*} \text{ in the emerging country.}$$

If:

$$(32) \quad NQ^* \frac{1}{a+b} < N^* Q^{\frac{1}{a+b}}$$

then we obtain the usual results seen above: trade openness reduces the relative price of the traditional good and the wage of unskilled labour in the advanced country, increases them in the emerging country, increases production of the sophisticated good and the wage of skilled labour in the advanced country, reduces them in emerging countries; increases production of the traditional good in the emerging country and reduces it in the advanced country; well-being is increased in both countries.

The more abundant skilled labour is in the emerging country (the more L^* and Q^* are increased), the more these effects are reduced. If L^* is so high that the inverse inequality of (32) holds, then there could actually be **specialisation in the emerging country in production of the sophisticated good.**

8 - 2 Trade openness with capital mobility

Capital mobility equalises the marginal productivity of capital between the sectors producing sophisticated goods. It is equal to (for example, in the emerging country):

$$(33) \quad \frac{\partial Y^*}{\partial K^*} = aA \frac{1}{a+b} \left(\frac{L^*}{K^*} \right)^{\frac{b}{a+b}} \left[\frac{\theta(N + N^*)}{((1-a)(1-a-b)^{-1} + \theta)} \cdot \frac{1}{Q^{\frac{1}{a+b}} + Q^* \frac{1}{a+b}} \right]^{1-a-b}$$

In the emerging country, capital K^* is low; if skilled employment L^* is high, there will be a **very large transfer of capital from the advanced country into the emerging country**, until the point is reached where $\frac{K^*}{L^*} = \frac{L}{L^*}$

This transfer of capital:

- increases overall output of sophisticated good in the two countries;
- increases the relative price of the traditional good and the wage of unskilled labour (there is a rise in overall income and in demand for the traditional good);

- reduces the production of sophisticated good and the wage of skilled labour in the traditional country and increases them in the emerging country;
- has the opposite effect on the output of the traditional good;
- reduces well-being in the advanced country and improves it in the emerging country.

8 - 3 Trade openness with a minimum wage in the advanced country

The equilibrium is given by (23 a) (23 b) (24) and (25). Trade openness in this case does not change the production of the sophisticated good in the advanced country. It leads to the disappearance of the production of the traditional good. The fact that skilled labour is so plentiful in the emerging country, without capital mobility, therefore exerts few effects.

9 – Brain drain

We are going to look at the possibility that skilled workers in the emerging country might migrate to the advanced country.

Before trade openness, wages of skilled labour are given by (12). We therefore have, before openness:

$$(34 a) \frac{W}{W^*} = \frac{K^a L^{-(1-b)} N^{1-a-b}}{K^{*a} L^{*-(1-b)} N^{*1-a-b}}$$

After trade openness, wages of skilled labour are given by (20). We therefore have, after trade openness:

$$(34 b) \frac{W}{W^*} = \frac{K^{\frac{a}{a+b}} L^{\frac{-a}{a+b}}}{K^{*\frac{a}{a+b}} L^{*\frac{-a}{a+b}}}$$

The relative wage for skilled labour in the advanced country in comparison with the emerging country is higher after trade openness if:

$$(35) K^a L^b N^{-(a+b)} > K^{*a} L^{*b} N^{*-(a+b)}$$

With the usual hypotheses ($K > K^*$, $L > L^*$, $N < N^*$), (35) is still verified, and trade openness increases the risk of a brain drain. This is obvious since, in this usual case, it leads to a rise in the wage of skilled labour in the advanced country, while reducing it in the emerging country.

(34a) (34b) and (35) show two interesting results:

- if the number of skilled workers is very high in the emerging country, it may well be that (35) is no longer verified, and therefore the risk of a brain drain is reduced by trade openness. In this case, as seen above, ((32)), the emerging country would specialise in the production of the sophisticated good.
- Capital mobility obviously lowers the risk of a brain drain, since it reduces K (therefore cuts the wage of skilled labour in the advanced country) and increases K^* (and thus increases the wage of skilled labour in the emerging country). The equalisation of the marginal productivity of capital leads, as seen above, to $\frac{K}{L} = \frac{K^*}{L^*}$.

If there is equalisation of the marginal productivity of capital (34 b) shows that, naturally, $W = W^*$ **there is equalisation of the wages of skilled labour in the two countries and disappearance of the risk of a brain drain.**

Summary

We started off with a quite standard model with two countries (an advanced country and an emerging country) and two goods — one sophisticated requiring capital, skilled labour and unskilled labour — and a traditional good, which requires exclusively unskilled labour. The advanced country enjoys an advantage in terms of factor endowment with respect to capital and skilled labour, while the emerging country enjoys one for unskilled labour.

Trade openness between the two countries then leads, as is well known, to:

- specialisation linked to factor endowment;
- a rise in the relative price of the traditional good in the emerging country, and a fall in said price in the advanced country;
- a decline in the relative wage of skilled labour in the emerging country, and a rise in this wage in the advanced country;
- if capital is mobile, a transfer of capital to the emerging country;
- a rise in well-being in the two countries;
- a brain drain, i.e. the departure of skilled labour from emerging countries.

If moreover, in the advanced country, the wage of unskilled labour cannot fall, then:

- after trade openness, the advanced country no longer produces the traditional good and there is, in this country, unemployment among unskilled labour;
- the advanced country benefits from a smaller fall in the relative price of the traditional good, and well-being is reduced in this country,
- there is an increased transfer of capital to the emerging country;
- the emerging country experiences a smaller decline in the relative price of the traditional good and a sharp rise in its production.

How can the advanced country then react?

- by replacing the minimum wage by transfer payments;
- by retraining unskilled labour.

Possibly, the situation will not be as adverse with respect to the **production of sophisticated goods requiring intermediate consumption of sophisticated goods**: trade openness that increases production of the sophisticated good is then more favourable for the advanced country.

But we have focused our study on the **analysis of the effects of trade openness in the case where the emerging country has abundant labour**. We have seen above at the beginning of this article that this was often the case, and this is a different situation from that usually described when studying the effects of trade openness.

The effects of trade openness are then changed in the following manner:

- reduction in the extent to which the advanced country is specialised in the production of the sophisticated good, or even an inversion in the direction of its specialisation;
- substantial transfer of capital from the advanced country into the emerging country, since the marginal productivity of capital is very high in the emerging country;
- partial and even total reduction in the medium term (after transfer of capital) in the brain drain.

The fact that emerging countries boast abundant skilled labour thus reduces substantially the advantages from trade openness for advanced countries: smaller rise in the production of sophisticated good, capital outflows, and lower emigration of skilled labour from emerging countries.

APPENDIX

Well-being

$$(A1) \quad \frac{\partial U}{\partial pB} = \frac{1}{pB} \left[\theta - \frac{(1-a-b)^{\frac{1-a-b}{a+b}} Q^{\frac{1}{a+b}} pB^{-\frac{1}{a+b}}}{N + (a+b)(1-a-b)^{\frac{1-a-b}{a-b}} Q pB^{-\frac{1}{a+b}}} \right]$$

$$(A2) \quad \frac{\partial^2 U}{\partial (pB)^2} = \frac{1}{(pB)^2} \left[-\theta + \frac{1+a+b}{a+b} (1-a-b)^{\frac{1-a-b}{a+b}} Q^{\frac{1}{a+b}} pB^{-\frac{1}{a+b}} \frac{N}{\Delta^2} \right] \\ + (a+b) \left[\frac{(1-a-b)^{\frac{1-a-b}{a+b}} Q^{\frac{1}{a+b}} pB^{-\frac{1}{a+b}}}{\Delta} \right]^2$$

Where $\Delta = N + (a+b)(1-a-b)^{\frac{1-a-b}{a+b}} Q^{\frac{1}{a+b}} (pB)^{\frac{1}{a+b}}$

Before trade openness:

$$(pB)^{\frac{-1}{a+b}} = (1-a-b)^{\frac{-1}{a+b}} Q^{\frac{-1}{a+b}} \frac{\theta N}{((1-a-b)^{-1}(1-\theta) + \theta)} = \hat{pB}^{\frac{-1}{a+b}}$$

$$\text{by } pB = \hat{pB}: \begin{cases} \frac{\partial U}{\partial pB} = 0 \\ \Delta = N + \frac{(a+b)(1-a-b)^{-1} \theta N}{(1-a-b)^{-1}(1-\theta) + \theta} \end{cases}$$

$\frac{\partial^2 U}{\partial (pB)^2}$ has the sign of:

$$(A3) \quad -\left((1-a-b)^{-1}(1-\theta) + \theta + (a+b)(1-a-b)^{-1} \right)^2 \\ + \frac{1+a+b}{a+b} (1-a-b)^{-1} \left((1-a-b)^{-1}(1-\theta) + \theta \right) \\ + \theta (a+b)(1-a-b)^2$$

$\frac{\partial^2 U}{\partial (pB)^2}$ is positive for all the values of θ if $1 - (a+b) - (a+b)^2 > 0$,

or $a+b < \frac{-1+\sqrt{5}}{2} = 0,62$; as we will suppose.

We have:

$$(A4) \quad U(pB) - U(\hat{p}B) = (pB - \hat{p}B) U'(\hat{p}B) + \frac{1}{2} (pB - \hat{p}B)^2 U''(\hat{p}B)$$

For the advanced country:

$$pB < \hat{p}B, \text{ thus } U(pB) - U(\hat{p}B) > 0$$

$$\text{For the emerging country, } pB > pB^*, U(pB) - U(pB^*) > 0$$

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