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The effects of globalisation on the supply of factors of production

This study was prepared under the authority of the Treasury and Economic Policy General Directorate and does not necessarily reflect the position of the Ministry for the Economy, Industry and Employment.

- The emergence of new economic giants like India and China combined with very rapid growth in trade have profoundly altered the supply of factors of production on a global level. The supply of labour weighted by the share of exports in global GDP has more than doubled since 1980, as has the stock of capital.

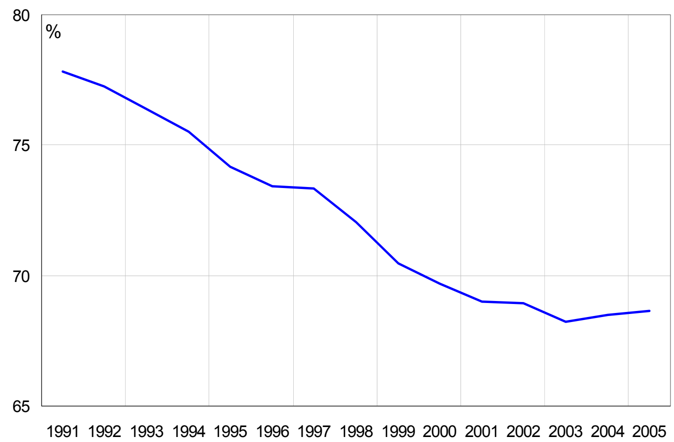
- Despite efforts to raise educational standards, low skilled workers continue to dominate global labour supply, even if their share of the world's total working population fell by 8 percentage points in the 1990s to 69%, where it has remained since 2000. This trend stems mainly from the opening up of emerging countries. In advanced countries, on the other hand, the share of highly skilled labour rose from one quarter to nearly one third between 1991 and 2005, while that of the low skilled fell sharply.

- Where wages are concerned, in theory trade opening is accompanied by a relative fall in the wages of unskilled workers in developed countries, especially given that the skill structure of the working population in the developed countries differs from that of emerging countries.

- The higher proportion of skilled workers in advanced countries goes hand in hand with a larger stock of capital relative to the labour factor. Trade opening therefore leads to a rise in the relative remuneration of skilled labour and capital. In addition, the capital intensity of exported merchandise grows faster in advanced countries than in the world as a whole, thereby leading to greater specialisation and widening pay differentials.

- The expansion of trade between emerging and developed countries is thus accompanied by increasing differences in the use of factors of production and greater specialisation, which is increasingly beneficial to the various parties.

Change in the share of low skilled workers worldwide (%)



Source: ILO, OECD, CEPII, DGTPE calculations.

DGTPE
DIRECTION GÉNÉRALE DU TRÉSOR ET DE LA POLITIQUE ÉCONOMIQUE

1. The emergence of new economic powerhouses is shaping trends in factors of production, including in the so-called "industrialised" countries

The international division of labour at the worldwide level has been conducive to the rapid integration of China and India into the international trade system, resulting in a shock to the supply of goods and services. These two countries' share of world trade has grown sharply in the past two decades. China's share of global exports of merchandise has more than quadrupled since 1990, reaching 8% in 2006, while India's share of global exports of services has grown fivefold, to nearly 3% in 2006.

Among the large emerging countries, China and India are demographic giants, but their average living standards are distinctly below those of Brazil or Russia. In addition, both countries diverge sharply from developed countries in terms of factor endowments (the use of skilled labour, unskilled labour, and capital). Simplifying somewhat, the impact of their integration into the global economy boils down to a very sharp increase in labour supply, in particular low skilled labour, which represents more than two thirds of their respective populations.

The growing fragmentation of the productive process has led to deep-seated changes in the labour market. In an open world, the movement of goods and services substitutes for that of people, which means that trade opening leads to increased competition between workers the world over. The spectacular expansion of the global supply of labour in the past two decades is expected to continue over the coming years. The United Nations[1] forecasts a 40% increase in the working-age population by 2050, and trade opening is expected to continue, especially in the services sector.

These trends have important consequences for the structure and remuneration of labour, including in advanced countries. According to international trade theory, the integration of new countries into the international trade system is thought (see Box 2) to exert downward pressure on advanced country workers' wages (corrected for productivity). In addition, trade opening, it is argued, creates greater instability for workers due to a shift from declining activities in the advanced countries towards growth sectors, where productivity is higher[2]. The OECD study also tends to show that employment at the sector level has become more sensitive to labour cost trends in recent decades, one of the forces driving this trend being delocalisation.

Here we consider two issues pertaining to this question:

- How is the rapid integration of the main emerging countries into the global economy (together with ongoing demographic trends) affecting global labour supply?
- Does the rapid integration of the emerging economies go hand in hand with a shift in the use of factors of production to the benefit of capital?

To answer these questions, we present here the impact of economic opening on the global supply of labour by skill level and on the capital intensity of exports. Overall, our estimates show that globalisation has probably had a greater impact on the relative remuneration of factors of production in developed countries since 2001. Before that date, there is reason to think that the combined efforts of the global economy to raise the average skill level of the population curbed the pressure on low wages resulting from the opening up of emerging countries.

Similarly, the rapid accumulation of capital in the global economy before 2001 limited the rise in the relative remuneration of capital that ought to have followed from the opening up of emerging countries. This was no longer the case after 2001. This inflexion stems from the faster trade integration of the major emerging countries together with the rapid growth in exports by China (rising at an annual rate of 18% before 2001 versus 23% after 2001) and India (+10% before 2001 and 18% after 2001) in particular.

2. Faster globalisation and integration of the emerging economies into the world trade system have affected the global supply of labour

2.1 Globalisation has sharply increased the global supply of labour

The opening up of the major emerging economies has affected the global supply of labour via population growth and the skill structure of the working population in these countries. The clarification we propose to provide here comes from a simple approach involving weighting countries' labour forces by the share of exports in their GDP, in order to obtain an indicator of trends in the global working population participating in the trade globalisation process. A precise description of the index used is presented in Box 1.

(1) UN Population Division (2005): "World Population Prospects", ESA/P/WP.202.

(2) See OECD (2007): "OECD Workers in the Global Economy: Increasingly Vulnerable?", OECD Employment Outlook.

Box 1: **Methodology used to build the index**

Based on an index proposed by the IMF ("The globalization of labor", World Economic Outlook, Chapter 5, April 2007), we have estimated a representative indicator of labour supply by skill capable of being mobilised for trade for the period 1991-2005. This is estimated as follows:

$$L_{monde,q} = \sum_k \frac{X_k}{Y_k} * L_{k,q}$$

Where X_k and Y_k respectively represent exports of merchandise and GDP (in current dollars) of country k, and $L_{k,q}$ the working age population (aged 15-64, in thousands) of country k by skill level q (three skill levels are used here). A similar index is calculated for the stock of capital.

We then assume that this indicator is a good proxy for the expected effects of the deepening of trade between countries with different factor endowments (for example through the growth in Chinese exports) or of trends in global factor endowments (e.g. the rise in average skill levels worldwide).

We distinguish two geographical regions, namely:

- Developed countries, comprising France, United States, Canada, Germany, Belgium, Luxemburg, Italy, Spain, Greece, Portugal, Scandinavia, Austria, Switzerland, Netherlands, United Kingdom, Ireland, Israel, Australia, New Zealand and Japan;
- Emerging countries, comprising Mexico, Turkey, South Korea, India, China, Brazil, Russia, Czech Republic, Slovakia, Hungary, Poland and Indonesia.

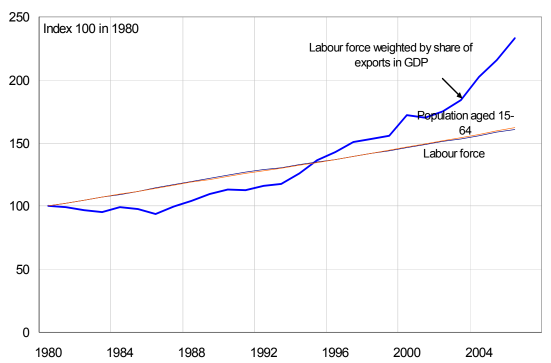
The construction of an index like this calls for strong assumptions, however, adopting a highly macroeconomic approach and leaving aside the approach by sectors:

- All skill levels are assumed to contribute homogeneously to opening regardless of sector of activity, which is a highly simplified assumption.
- The estimation of countries' economic opening is based exclusively on trade in goods[a], which ignores the rising power of India in services, for example. Trade in services accounted for 19% of global exports in 2005, rising to 37% for India (versus 9% for China).

a. Only data concerning workers readily capable of being mobilised are taken into account.

The change in this index (see Chart 1) shows that accelerated globalisation over the past decade has led to a sharp growth in the supply of available labour: the global labour supply adjusted for the share of exports in GDP more than doubled between 1980 and 2006. In addition, there has been a pronounced acceleration in the labour force involved in international trade since 2001. This growth is largely due to a rise of around 93% in global exports of merchandise between 2001 and 2006 (due in particular to the rapid integration of China, (which accounted for 9% of global exports of goods in 2006), with a growth rate on the order of 226%).

Chart 1: Global labour supply trends between 1980 and 2006



Source: ILO, OECD, CEPII-CHELEM, DGTPE calculations.

In particular, the number of workers in China and India capable of being mobilised for the global economy has more than doubled, from 147 million to 340 million people between 1991 and 2005. This increase has led to a radical shift in the balance of power between capital and labour, as more workers are now competing with each other at the global level, which can put downward pressure on wages. China and India represent 40% of the world's working population, and more than two thirds are low skilled (low skilled workers in India and China respectively represented 61% and 81% of the working population in 2005[3]).

Against this background, the growing globalisation of labour poses substantial challenges in the advanced countries due to the adjustment costs it entails in the labour market. Globalisation consequently makes it all the more urgent to adapt labour market institutions in order to reconcile the need for a high degree of flexibility and capacity to adjust with income security.

2.2 The accelerating pace of globalisation has been accompanied by growing inequalities between high and low skilled workers

Globalisation is taking place against a background of widening wage inequality in most OECD countries (see Chart 3). The principle of specialisation of economies that underpins international trade suggests that the growth in

(3) Sources: DGTPE Economic Missions. For China, a proxy is estimated on the basis of the Chinese population's skill level in 2003.

trade with the developing countries may have helped to widen wage inequalities in the OECD countries by depressing the pay of low skilled workers (see Box 2 on the theoretical impacts of North-South trade on the labour market).

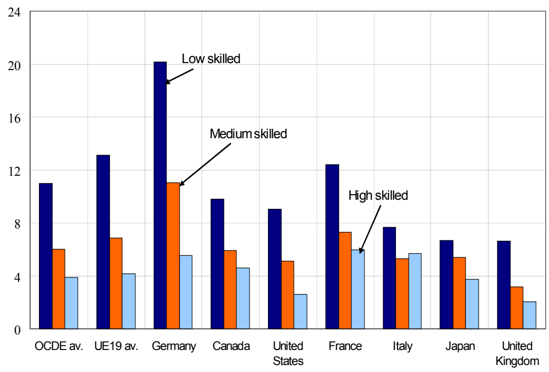
Two mechanisms are tending to increase pay inequality in developing countries as economies open up to world trade:

- **the actual opening up of trade to countries less well endowed with skilled labour:** differences in the structure of the labour force between countries reinforces the process of specialisation of economies, leading to a deterioration of the relative situation of low skilled workers in developed countries as the latter's demand for low skilled labour declines;
- **trends in the structure of the equilibrium global supply of labour after opening:** the integration of the emerging countries has increased the supply of low skilled labour on the global market, which ought to lead to a relative deterioration in the wages of low skilled workers.

Consequently, faster globalisation, with the opening up of the Chinese and Indian economies in particular, could be one possible explanation for the deteriorating relative situation of low skilled workers and the rising remuneration of capital witnessed in the developed countries since the beginning of the 1990s. This would be a result of very different labour market structure and capital intensity between developed and emerging countries.

Indeed, the industrialised countries have witnessed a pronounced increase in inequality between skilled and low skilled labour over the past twenty years. In continental Europe, this has led to far higher rates of unemployment for the low skilled (see Chart 2), and to widening wage inequality in the English speaking countries (see Chart 3).

Chart 2: Unemployment rates by skill level in 2005



Sources: OECD.

Box 2: **The theoretical impact of North-South trade on the labour market**

The rapid integration of the leading emerging economies into the global economy has, it is claimed, intensified competition among low skilled workers the world over. This principle flows from the comparative advantages of different countries, whereby the developed countries specialise in highly skilled labour-intensive tasks while the emerging countries specialise in low skilled labour-intensive tasks. In the developed countries, expanding skilled labour-intensive sectors raise demand for skilled labour, whereas declining sectors release low skilled labour. In the developed countries this gives rise to an imbalance in the labour market.

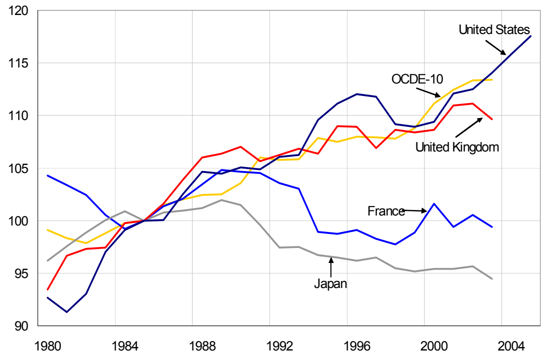
In the Heckscher-Ohlin model, technology and demand are identical between countries, the latter differing solely in terms of their distinctive factor endowments. In this case, trade and wages are linked solely to variations in the price of goods. Thus only two external forces are capable of affecting producer prices, namely:

- **a reduction in transaction costs** brought about by the lowering of tariff and non-tariff barriers and of transport costs. This intensifies trade between the developed countries and the emerging countries and so pushes down the price of low skilled-labour intensive goods in the developed countries;
- **trends in the supply of labour**: the demographic growth of the working population in the emerging countries boosts the supply of low skilled labour, thereby increasing output and exports of low skilled-labour intensive goods. This process of specialisation pushes down the relative price of low skilled-labour intensive goods in the global market and, a fortiori, in the developed countries.

According to Wood[a], the impact of these external forces on wages varies depending on the country's situation in terms of trade opening and factor endowments. In a closed economy, wages are determined by the intersection between the supply and demand curves for labour, whose level depends on the country's endowment in terms of skilled and low skilled labour. After opening, Wood considers an economy whose factor endowment allows it to produce both types of good and so diversify its trade. In that case, demand for labour is infinitely elastic and is unaffected by the domestic supply of labour (the country is assumed to be small in relation to the rest of the world). On the other hand, relative wages are determined by relative world prices of goods: for a given level of labour supply, relative wages are determined by relative world prices of goods. Thus if the global supply of low skilled labour grows, import prices of low skilled labour-intensive goods ought to decline, thereby pushing down the relative wages of low skilled labour.

a. Wood A. (1995) : «How Trade Hurt Unskilled Workers», *The Journal of Economic Perspectives, Vol. 29, N° 3, pp. 57-80.*

Chart 3: Wage inequalities in ten OECD countries



Source : OECD.

NB: The curves represent the distribution of wages, P90/P10 indicating the 90th and 10th percentiles of the distribution of wages for full-time salaried workers (rebased 100 in 1986).

However, other factors have probably played an important role. In particular, the spread of information technology and other technological advancements, which go hand in hand with skilled labour. The fact that wage inequalities have tended to widen in the developing countries also, particularly in the BRICs (Brazil, Russia, India and China), is consistent with the technological bias that has greatly contributed to raising the requisite skill level.

2.3 Despite efforts to improve the initial level of educational skills, the global labour supply remains heavily dominated by low skilled workers

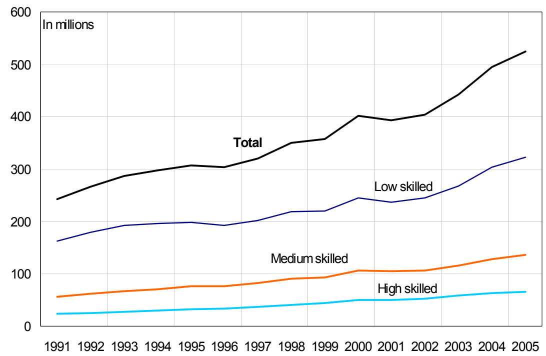
In addition to the impact of the economic integration of the leading emerging countries on the quantity of labour that could potentially enter into competition, here we consider its impact on trends in the nature of the global labour supply.

The structure adopted here for labour supply is based on the level of individuals' educational attainments. According to the ISCED 1997[4] nomenclature, three categories are used to evaluate the level of training of the working population: in France, for instance, low skilled people are those with no qualification or who have achieved the BEPC or CAP-BEP certificate (completion of lower secondary education); medium skilled workers have completed upper secondary education; while the high skilled have a higher education degree. Given the available data, only a few countries can be taken into consideration, namely the OECD countries, plus the leading emerging countries.

The data suggest that economic opening has led to a sharp increase in the "globalised" section of the working population, especially in the number of low skilled workers, which has grown from 162 million to nearly 322 million between 1991 and 2005 (see Chart 4).

However, the trend in the structure of labour supply shows only a very slight change in the supply of labour capable of being mobilised through trade (as defined in Box 1) to the benefit of the supply of low skilled labour (see Chart 4), coming after a decline in the share of low skilled labour in the global labour supply, from 66.8% to 60.3%, between 1991 and 2001. The results suggest that, despite efforts to improve the initial skill levels of the population of all countries, the share of the low skilled rose again after 2002, reaching 61.4% in 2005 (as a result of strong demographic pressure in the emerging countries). On the other hand, the share of high skilled workers has risen steadily, from 23.4% in 1991 to 26% in 2005, while that of the medium skilled has declined slightly since 2001.

Chart 4: Supply of labour by level of education



Source: ILO, OECD, CEPII, DGTPE calculations.

2.4 Following the acceleration of the process of economic integration, differences in factor endowments between developed and emerging countries have widened since the beginning of the 2000s

The supply of labour expanded especially rapidly between 1992 and 2005 as the emerging countries opened up their economies, rising 111%, versus 44% for the developed countries, with the BRICs registering the strongest growth (230%).

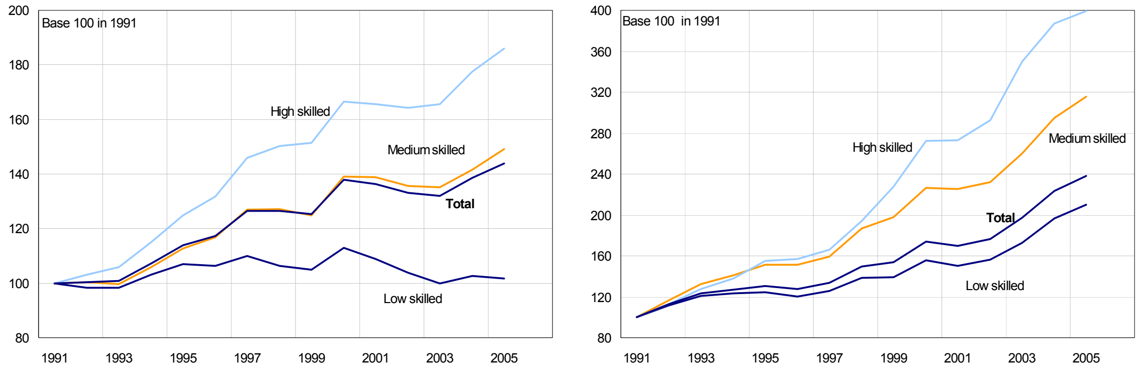
In the developed countries, the structure of the labour force weighted for economic opening is dominated by medium skilled workers, who accounted for 47.7% of the working population in 2005. However, in the developed countries, economic opening has brought a shift in the working population towards the high skilled, with their share rising from 24.2% to 31.3% between 1991 and 2005, while the share of low skilled has declined sharply, from 29.7% in 1991 to 21% in 2005.

(4) International Standard Classification of Education (ISCED 1997), devised by UNESCO in the early 1970s to serve "as an instrument suitable for assembling, compiling and presenting statistics of education both within individual countries and internationally". The nomenclature was revised in November 1997.

Chart 5: Labour force trends associated with global economic opening by skill level

DEVELOPED COUNTRIES

DEVELOPING COUNTRIES



Source: ILO, OECD, CEPII, DGTPE calculations (see Box 1).

Source: ILO, OECD, CEPII, DGTPE calculations (see Box1).

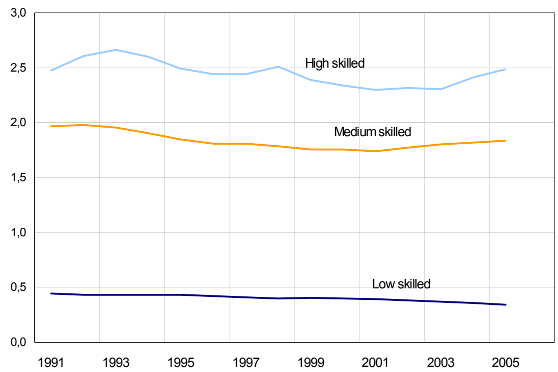
In the major emerging countries, particularly China, the number of low skilled workers continues to grow, but their share of the total working population fell by 10 percentage points between 1991 and 2005; a hefty rise in the number of scientists, engineers and researchers could challenge the traditional view of trade between the advanced countries, i.e. the North and the less developed countries, i.e. the South. However, low skilled workers still accounted for 68.7% of the "globalised" working population in 2005.

The emerging countries are witnessing a shift in the supply of labour mobilised for trade in favour of high skilled workers - with the share high skilled workers rising from 5.5% (10 million) to 9.2% (41 million) between 1991 and 2005 - and of medium skilled workers - with the share of medium skilled workers rising from 16.7% (31 million) to 22.1% (98 million) between 1991 and 2005 (see Chart 5).

In addition to the pressures being placed on labour demand in the developed countries by trends affecting the supply of labour elsewhere in the world and by growing trade opening, the domestic supply of labour is also changing. Once economies have opened up, rising average skill levels in the supply of labour do not narrow the wage inequalities brought about by trade opening. In this case, the expected impacts of opening on wage distribution are accentuated by the different countries' divergent endowment factors.

One possible indicator of this potential pressure could be the gap between the factor endowments of a given country and those of the global economy. Our estimates show that, after a phase of relative stability, the differences in the structure of labour supply in the developed countries vis-à-vis the world have widened since 2001 (see Chart 6). This ought therefore to strengthen the process of specialisation and intensify the pressures on wage inequalities between low and high skilled workers in the developed countries.

Chart 6: Differences in factor endowments by skill level



Source: ILO, OECD, CEPII, DGTPE calculations.

Interpretation: relationship between shares in the supply of labour by skill level in the developed countries vis-à-vis the world.

3. The integration of the emerging economies into the global trade system has led to a shift in the utilisation of factors to the benefit of capital

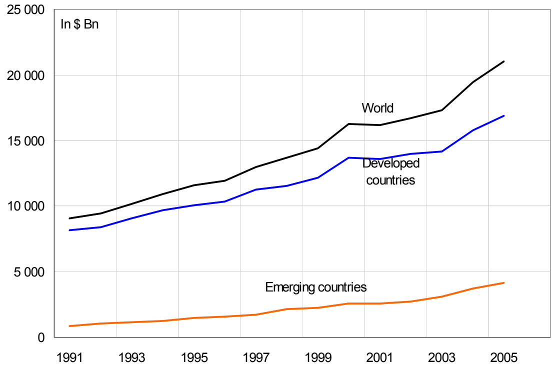
3.1 The developed countries' exports are increasingly capital-intensive relative to the world as a whole

The growth in the global supply of labour is putting downward pressure on import prices of labour intensive goods, thereby reducing the relative remuneration of labour and boosting that of capital. Conversely, the global accumulation of physical capital could lead to a progressive rise in the production of capital-intensive goods and to a fall in the price of these same goods; this would lower the return on capital and raise the remuneration of labour in the developed countries. Altogether, trends in the relative remuneration of factors depend on capital intensity, i.e. the ratio of the stock of capital to labour supply.

To study trends in the capital intensity of exported goods, we extend to capital the approach used in studying the labour supply, by estimating an index[5] that weights geographical regions' stock of physical capital[6] by the ratio of their exports to GDP.

The results suggest that economic opening has been accompanied by a steep growth in the capital mobilised via exports (progression de 133% entre 1991 et 2005), speeding up significantly from 2002 onwards (see Chart 7). Although the stock of capital mobilised for the emerging countries' exports has grown very quickly (rising 376%), its level is still distinctly below that of the developed countries.

Chart 7: Change in the stock of physical capital due to trade opening



Source: ILO, OECD, CEPII CHELEM, DGTPE calculations.

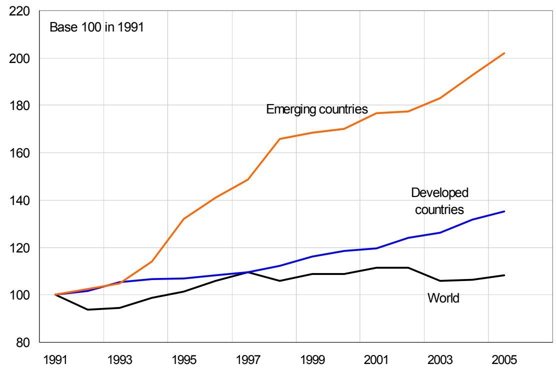
From this calculation of the capital mobilised via exports we obtain the capital intensity of exports, which is the ratio of capital and labour mobilised for exports.

The capital intensity of emerging countries' exports has grown far more rapidly than that of the developed countries since the early 1990s (see Chart 8). Despite this, this rate of growth has not eliminated the gap in factor endowments between the two zones, which remains particularly wide, **the developed countries being 19 times more capital intensive than the emerging countries.**

On the other hand, the capital intensity of exports at the global level has grown only slightly since the early 1990s. Between 1991 and 2005, the global supply of labour and the global stock of physical capital resulting from economic opening grew by 97% and 132% respectively. This seeming paradox stems from the fact that the **rapid opening up of the emerging economies, with their very low capital intensity, has contributed to a lowering of the global capital intensity of exports, even though it is in these emerging countries that capital intensity has grown fastest.**

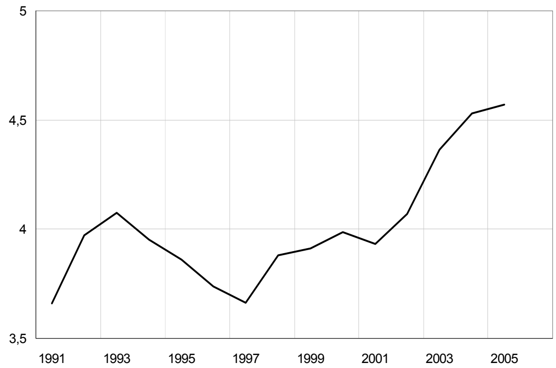
Owing to the low rate of growth in the capital intensity of exports at the global level, the capital intensity of the developed countries' exports relative to the world as a whole has risen (see Chart 9). This widening gap is leading to increased specialisation and boosting the remuneration of capital relative to that of labour in the developed countries.

Chart 8: Capital intensity of exports by zone



Source: ILO, OECD, CEPII CHELEM, DGTPE calculations.

Chart 9: Major stock market indices



Source: ILO, OECD, CEPII CHELEM, DGTPE calculations.

3.2 In the process of globalisation, the factor endowments mobilised by the developed countries are increasingly differing from those mobilised by the world as a whole

In the developed countries, globalisation has resulted in a growing mobilisation of capital and of the high skilled section of the working population. These two outcomes appear to confirm traditional trade theory, according to which a country with a relative abundance of a particular factor specialises in goods that are intensive in that factor. Moreover, these results are internally consistent, since

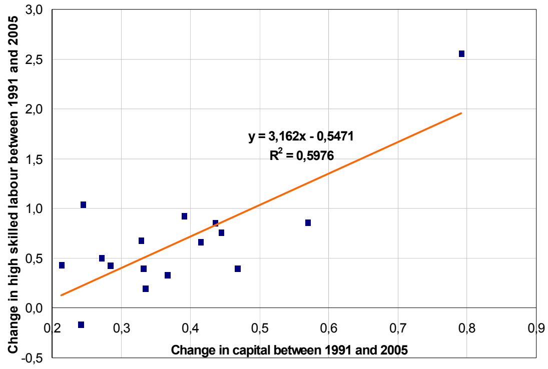
(5) This index is based on the IMF's work (see "The globalization of labor", Chapter 5 wing oof World Economic Outlook, April 2007), which is estimated as follows $K_{world} = \sum_k [(X_k/ \ Y_k) \times K_k]$, summed for all countries in the world k.

(6) Data for the stock of physical capital used here are estimations made by the CEPII based on the methodology of Benhabib and Spiegel (2005), see Poncet S. (2006): "The Long Term Growth Prospects of the World Economy: Horizon 2050", CEPII Working Paper CEPII No. 6, October 2006.

traditional trade theory also views skilled labour and capital factors as complementary.

The complementary nature of these factors in the developed countries seems to be observed empirically too: since 1991, the developed countries that have seen the greatest accumulation of capital are also those where the supply of skilled labour has grown the most (see Chart 10).

Chart 10: Correlation between supply of skilled labour and stock of physical capital in the developed countries



Source: DGTPE estimations.

Note: Stocks of capital and supply of labour are expressed logarithmically: we are therefore estimating the correlations between the growth rates of variables.

The fact that the capital intensity of developed countries' exports relative to the world as whole has grown and that the supply of skilled labour available for exports has risen faster in the developed countries than in the world as a whole ultimately signifies that the developed countries' factor endowments (available for mobilisation for international trade) are increasingly different from those of the world as a whole.

Consequently, since international trade between the developed countries and the rest of the world takes place more and more on the base of dissimilar factor endowments, it is increasingly benefiting all of the different participants, a priori. On the other hand, globalisation probably entails high adjustment costs, with growth in trade between two countries with different factor endowments triggering intense factor reallocations within each country in the short run. In the developed countries, these adjustment costs weigh essentially on the unskilled.

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