

Over the past two decades, labor markets around the world have become increasingly integrated. Political changes and economic reforms have transformed China, India, and the former Eastern bloc countries, effectively involving their large labor forces in open market economies. At the same time, the development of technology, combined with the progressive removal of restrictions on cross-border trade and capital flows, has made it possible for production processes to be unbundled and located farther from target markets for a growing universe of goods and services. The location of production has become much more responsive to relative labor costs across countries. There have also been increasing flows of migrants across borders, through both legal and informal routes.

This ongoing globalization of the labor market has drawn increasing attention from policymakers and the media, particularly in the advanced economies. The most asked question is whether the addition of this unprecedentedly large pool of labor from emerging market and developing countries is adversely affecting compensation and employment in the advanced economies.

This chapter addresses this important and emotive question. In contrast with most previous studies, which focus on one country or a single channel of transmission, it takes a broad approach, considering a large sample of advanced economies and a full range of transmission channels (competing imports of final products, offshoring of intermediate products, and immigration). The chapter focuses on the following issues:

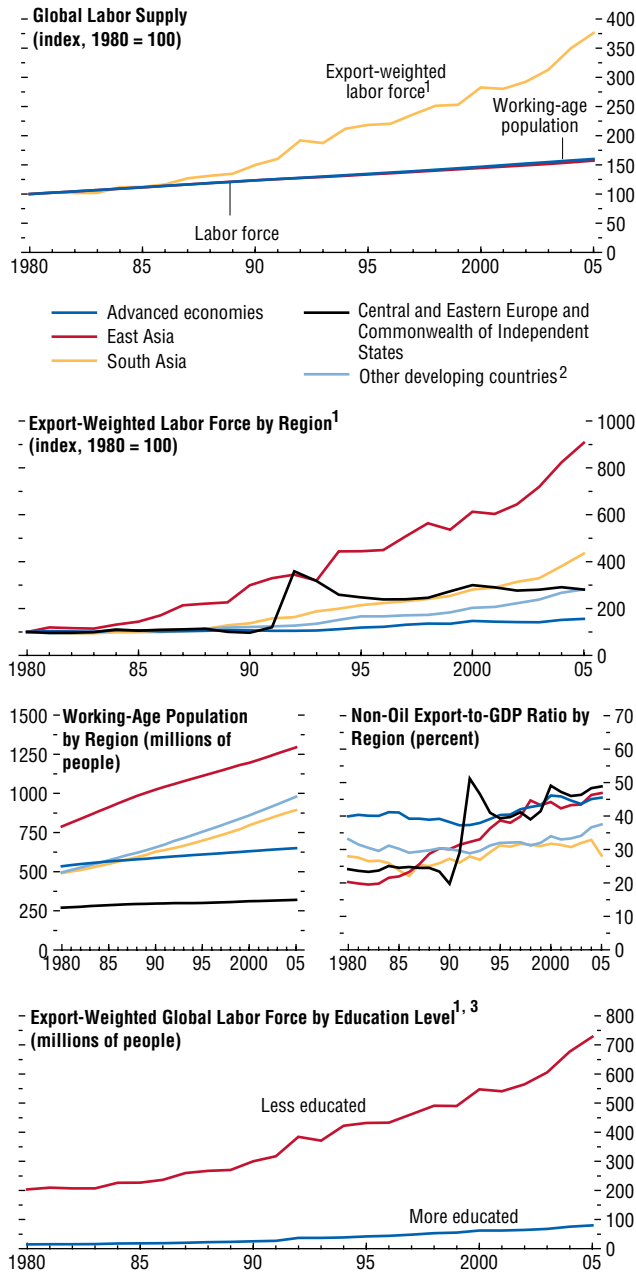
- How rapidly has the global labor supply grown, and which channels of labor globalization have been most important?
- To what extent can recent trends in labor shares and labor compensation in advanced economies be explained by the changing global labor supply relative to other factors such as technological change and labor market reform? Has the impact been different in skilled and unskilled sectors?
- What policies can help the advanced economies meet the challenges of further labor market globalization?

This chapter finds that the effective global labor force has risen fourfold over the past two decades. This growing pool of global labor is being accessed by advanced economies through various channels, including imports of final goods, offshoring of the production of intermediates, and immigration. The ongoing globalization of labor has contributed to rising labor compensation in advanced economies by boosting productivity and output, while emerging market countries have also benefited from rising wages. Nevertheless, globalization is one of several factors that have acted to reduce the share of income accruing to labor in advanced economies, although rapid technological change has had a bigger impact, especially on workers in unskilled sectors. The analysis finds that countries that have enacted reforms to lower the cost of labor to business and improve labor market flexibility have generally experienced a smaller decline in the labor income share. Looking ahead, it is important for countries to maximize the benefits from labor globalization and technological change, while also working to address the distributional impact. To this end, policies should seek to improve the functioning of labor markets; strengthen access to education and training; and ensure adequate social safety nets that cushion the impact on those adversely

Note: The main authors of this chapter are Florence Jaumotte and Irina Tytell, with support from Christian de Guzman and Stephanie Denis. Robert Feenstra provided consultancy support.

Figure 5.1. Alternative Measures of Global Labor Supply

East Asia's marked rise in working-age population and increasing trade openness have contributed to about half of the quadrupling of the effective global labor supply, while South Asia and the former Eastern bloc accounted for smaller increases.



Sources: United Nations, Population Prospects: The 2004 Revision Population database; World Bank, *World Development Indicators*; and IMF staff calculations.

¹National labor forces scaled by export-to-GDP ratios.

²Includes Western Hemisphere, Middle East and North Africa, and sub-Saharan Africa.

³More educated labor force is defined by persons with university-level education. Less educated is defined by labor force with primary and secondary education plus the uneducated.

affected, without obstructing the process of adjustment.

How Globalized Is Labor?

A first question to address is how the opening up of China, India, and the former Eastern bloc countries, together with ongoing demographic developments, has affected the global labor supply. This is not easy to answer because much depends on the assumptions made about how much of a country's labor force is in, or could potentially compete in, the global market. One simple approach is to weigh each country's labor force by its export-to-GDP ratio.¹ By this measure, the effective global labor supply quadrupled between 1980 and 2005, with most of the increase taking place after 1990 (Figure 5.1).² East Asia contributed about half of the increase, due to a marked rise in working-age population and rising trade openness, while South Asia and the former Eastern bloc countries accounted for smaller increases. While most of the absolute increase in the global labor supply consisted of less-educated workers (defined as those without higher education), the relative supply of workers with higher education increased by about 50 percent over the last 25 years, owing mostly to advanced economies, but also to China.

Advanced economies can access this increased pool of global labor both through imports of goods and services and through immigration. Trade has been the more important channel and has grown more rapidly, not least because

¹This approach, which follows Harrigan and Balaban (1999), is more accurate for developing countries specialized in labor-intensive activities than for advanced economies whose exports are relatively capital intensive. In order to capture the export of labor through emigration, emigration weights could be added to the trade weights. However, these weights are generally very small.

²This compares to estimates in Freeman (2006) that the integration of China, India, and the former Eastern bloc countries doubled the number of workers in the global economy. The difference is due to the weighing of national labor forces by export-to-GDP ratios in this chapter's estimates.

immigration remains highly restricted in most countries (Figure 5.2). A similar picture emerges for developing and emerging market countries, where the export-to-GDP ratio is in general much higher than the ratio of emigrants to the domestic labor force.³ Nevertheless, immigration has expanded significantly over the past two decades in some large European economies (Germany, Italy, and the United Kingdom) and in the United States. The share of immigrants in the U.S. labor force is now close to 15 percent and hence comparable to the share of imports in GDP. Elsewhere the share of immigrants is still substantially less than the share of imports in GDP, but it is not negligible.

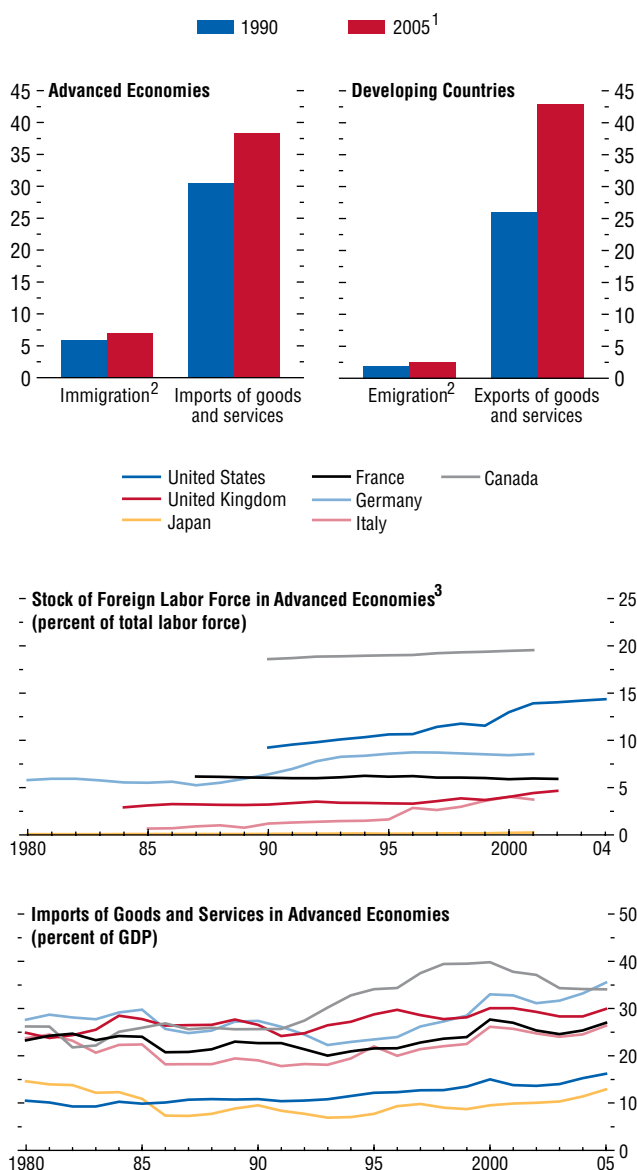
Focusing on trade, the share of developing country products in the manufacturing imports of advanced economies has doubled since the early 1990s (Figure 5.3). This owes much to China. Developing countries have also been capturing an increasing share of world markets. At the aggregate level, however, trade is a win-win game. As China, India, and the Eastern bloc countries have opened up, world markets and opportunities to export have expanded considerably for advanced economies and developing countries alike. Developing countries' imports have been growing faster than those of advanced economies and the share of advanced economies' exports going to developing countries has been rising (though not as rapidly as the share of developing countries in their own imports). Further, while both import and export prices have been on a declining trend relative to output prices, the terms of trade of advanced economies have improved by a cumulative 7 percent since 1980. Most notably, there was a substantial improvement in the terms of trade of Japan in the first half of the 1980s. However, the large fall in import prices at this time was mainly the result of the strong appreciation of the yen at a time when oil prices were falling, and was not directly related to globalization.

³The stock of emigrants is limited to those emigrating to OECD economies.

Figure 5.2. Immigration and Trade

(Percent of labor force and GDP, respectively)

Although immigration has expanded significantly over the past two decades in some large European countries and the United States, trade remains as the more important channel for accessing the large global labor force.



Sources: Docquier and Marfouk (2005); OECD, International Migration Data; U.S. Census Bureau; and IMF staff calculations.

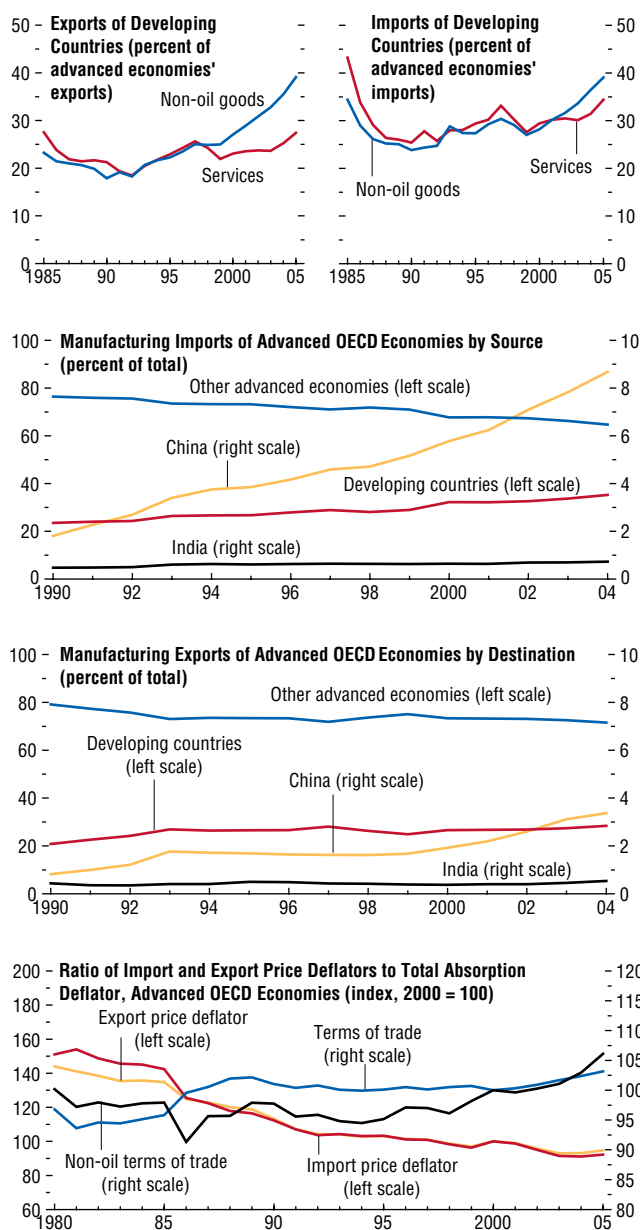
¹2000 data for immigration and emigration.

²Hong Kong SAR, Greece, Israel, New Zealand, Singapore, and Taiwan Province of China are not included in average immigration due to data limitations. Russia and Slovak Republic are not included in average emigration due to data limitations.

³Foreign-born labor force for Australia, Canada, and the United States. For Italy, the Netherlands, Norway, and the United Kingdom, the data refer to the share of foreign employment in total employment.

Figure 5.3. Share of Developing Countries in Trade

As China, India, and the Eastern bloc have opened up, world markets and opportunities to export have expanded considerably for advanced economies and developing countries alike.



Sources: OECD, STAN Bilateral Trade Database; and IMF staff calculations.

As can be seen in Figure 5.4, the strong export dynamism of emerging market and developing countries is in skilled as well as unskilled products: developing countries' share in world exports of skilled goods and services has been on the rise in recent years.⁴ China has led the way, reflecting its very strong growth and a move toward more skill-intensive goods in its export basket. India's export basket is also changing rapidly toward skill-intensive services, but the country's weight in world trade remains small.

One category of trade that has received much attention in recent years is trade in intermediates. The reduction of barriers to cross-border trade and capital flows, combined with technological progress in transport and communication, has made it easier for firms to move parts of their production to less costly foreign locations—a process referred to as offshore outsourcing or, more simply, offshoring. Nevertheless, and contrary to some popular perceptions, offshored inputs, which account for about half of total imports (the rest being imports of final products), have grown somewhat more slowly than total trade (see also OECD, 2006a). Moreover, the scale of offshoring is still quite limited in the overall economy (Figure 5.5). Imports of intermediate manufacturing and services inputs (excluding energy) accounted for about 5 percent of gross output and about 10 percent of total intermediate inputs in advanced economies in 2003, the latest year for which data are available.⁵ These shares have

⁴Skilled exports are measured as exports of goods and services produced in skilled sectors, that is, sectors with a higher share of skilled workers in their labor force. The results are generally robust to excluding medium-skill sectors and focusing instead on low-skill and high-skill sectors (see Appendix 5.1 for details). Using a more refined classification of products by skill intensity, Rodrik (2006) concludes that China's export basket is much more skill intensive than would be expected given China's level of development.

⁵It is common to scale imported intermediates by total intermediate inputs to estimate the intensity of offshoring. However, it seems more appropriate to scale imported intermediates by total inputs (including labor and capital), since imported intermediates can substitute not only for domestic intermediate inputs but also for in-house labor and capital.

increased only moderately since the early 1980s.⁶ The share of offshored inputs in gross output ranges from 12 percent in the Netherlands to about 2–3 percent in the United States and Japan. Offshoring is thus relatively limited in the United States and Japan, in the same way that trade openness is usually low in large economies.

The manufacturing sector has been most affected by offshoring because it is more tradable. For the countries for which long data series are available (G-7, Australia, and the Netherlands), the share of imported manufacturing inputs in gross manufacturing output increased from 6 percent in 1980 to 10 percent in 2003, with the rise being somewhat stronger in the latter years of the sample (Figure 5.6). In 2003, the offshoring intensity in manufacturing ranged from 4 percent in Japan to a high of about 25 percent in Canada. Imports of services inputs by the overall economy remain low at 1 percent of gross output, although the offshoring intensity in services has increased in recent years in a number of countries, including Canada, Germany, and the Netherlands.⁷

Interestingly, the rise in offshoring in advanced economies has been driven mostly by imports of skilled rather than unskilled inputs. Several factors may help explain this finding. First, in line with advanced economies' comparative advantage in skill-intensive production, goods traditionally produced in unskilled sectors (e.g., textiles) are more likely to be imported as final goods rather than intermediates.⁸ Sectors involved in the rise in the imports of intermediaries are electronic equipment; other machinery and equipment; and chemical, rubber, and plastic products. It should be noted, however,

⁶The flattening in 2001–02 is temporary and reflects the slowdown in world trade associated with the global recession.

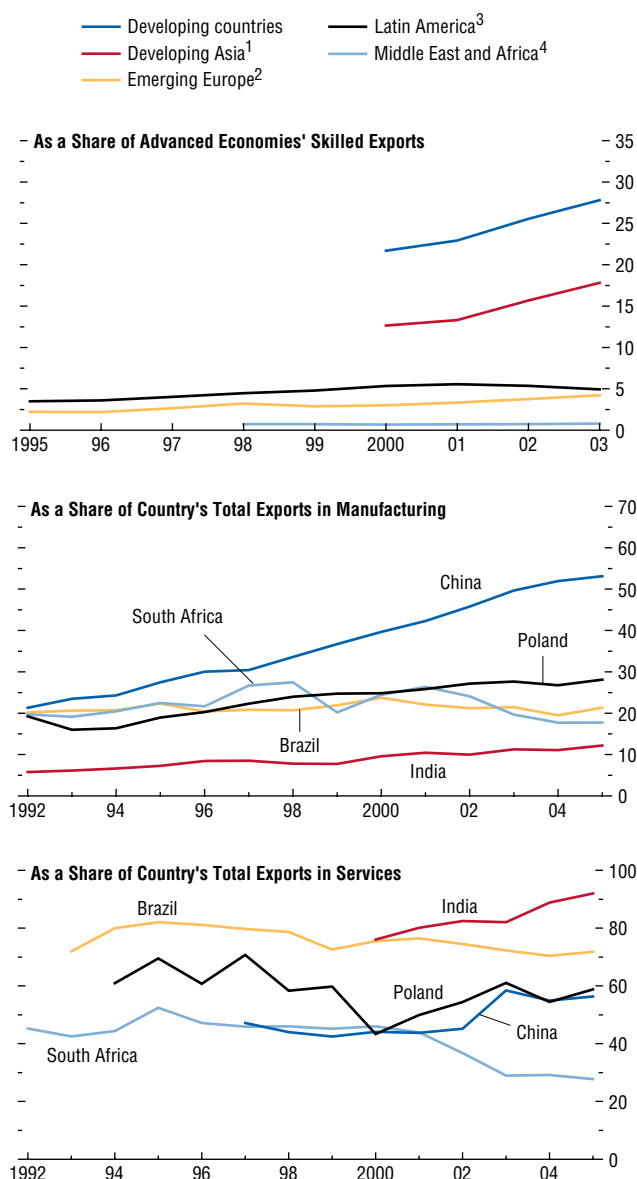
⁷See Jensen and Kletzer (2005) and Amiti and Wei (2005) for more details on offshoring of services. The latter also find that offshoring of services remains very limited, although it has grown in recent years.

⁸The share of imported intermediates in total imports of unskilled products is lower than the comparable share for skilled products, at 37 percent and 68 percent, respectively.

Figure 5.4. Developing Countries: Exports of Skilled Manufacturing Goods and Services

(Percent)

The recent robust growth in developing countries' share in world exports, particularly in skilled products, owes much to China.



Sources: OECD, International Trade in Services Database and STAN Industrial Database; World Bank, World Integrated Trade Solution database; and IMF, *Balance of Payments Statistics*.

¹Bangladesh, China, India, Malaysia, the Philippines, and Thailand.

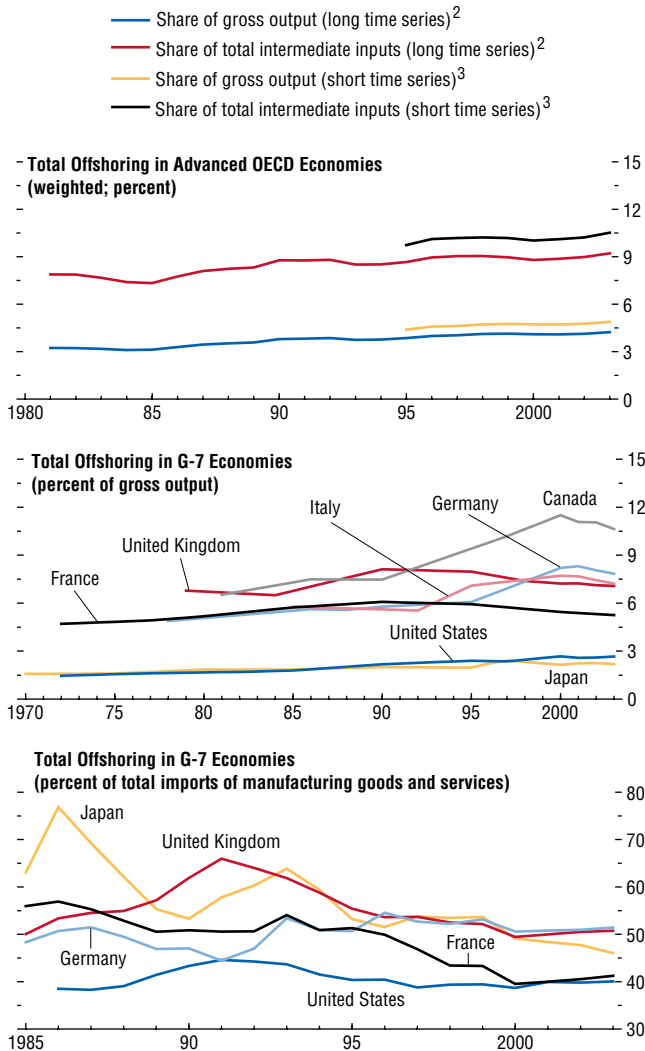
²Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Turkey.

³Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela.

⁴Egypt, Ethiopia, Morocco, South Africa, Sudan, and Tanzania.

Figure 5.5. Offshoring by Advanced Economies¹

The extent of offshoring is still quite limited in advanced economies. In 2003, the offshoring of nonenergy manufacturing and services inputs averaged about 5 percent of gross output and roughly 10 percent of total intermediate inputs. The low level of offshoring is particularly pronounced in the world's largest economies, the United States and Japan.



Sources: OECD, Input-Output Tables (1995, 2002, and 2006 editions), International Trade in Services Database, and STAN Industrial Database; Groningen Growth and Development Centre, 60-Industry Database (September 2006); and IMF staff calculations.

¹Offshoring measures calculated using Input-Output Tables from OECD; resulting series extended from 2001 to 2003 by estimating extent of offshoring using a combination of data from the OECD STAN Industrial Database and the Groningen 60-Industry Database; only offshoring of nonenergy manufacturing and services inputs considered.

²Advanced OECD economies used in calculations for long time series include Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States; weighted using series on GDP at current U.S. dollars from the World Economic Outlook database.

³Advanced OECD economies used in calculations for short time series include Australia, Austria, Canada, Finland, France, Germany, Greece, Italy, the Netherlands, Japan, Korea, Portugal, Spain, Sweden, the United Kingdom, and the United States; weighted using series on GDP at current U.S. dollars from the World Economic Outlook database.

that offshoring is likely to involve the least skill-intensive stages of production in these skilled sectors, although the available data do not allow confirmation of this. Second, the bulk of advanced economies' imports (of both final and intermediate products) still comes from other advanced economies and likely includes more skilled rather than unskilled products. Third, as mentioned earlier, the global supply of labor with higher education has increased relative to labor with lower education.

How Has the Globalization of Labor Affected Workers in Advanced Economies?

The rapid growth of the global labor supply and its manifestation through increasing exports of emerging market and developing countries leads to the question of how these trends have affected workers in advanced economies. With exports from emerging market and developing countries being intensive in labor, especially unskilled labor, traditional trade theory would predict that the integration of these countries into the world economy would exert downward pressure on the wages (corrected for productivity) of workers in advanced economies. Hence, the share of national income received by labor—the so-called labor share—would be expected to decline. To see this, it is worth noting that the labor share can be expressed as the ratio of labor compensation per worker to average worker productivity.

Nevertheless, workers in advanced economies could still be better off if the positive effects from enhanced trade and productivity on the economy's income (the size of the total "pie") are larger than the negative effect on the share of this income that accrues to labor. The vast literature documenting gains from trade (see, for example, Lewer and Van den Berg, 2003; Berg and Krueger, 2003) suggests that the increase in the economy's income may indeed be substantial. Recently, Grossman and Rossi-Hansberg (2006) have argued that the productivity-enhancing effect from trade in intermediates could be even larger than from trade in final

goods because, in addition to a competition effect for producing sectors, trade in intermediates also reduces the costs of production of using sectors. The empirical evidence on the productivity effects of offshoring is, however, mixed.⁹

What do the data show? Looking first at the labor share, there has been a clear decline since the early 1980s across the advanced economies (Figure 5.7).¹⁰ The decline is stronger for the labor share than for the share of employees' compensation, reflecting a reduction in the share of other categories of workers in the total workforce (other categories of workers include self-employed, employers, and family workers).¹¹ A part of this decline is a reversal of the rise in labor shares that took place in the 1970s, especially in Europe and Japan (Blanchard, 1998).¹²

⁹There is little empirical evidence on the productivity effects of offshoring to date (see Olsen, 2006). There are some indications that positive productivity effects of manufacturing offshoring depend on the degree to which firms are already globally engaged. However, their global engagement may be already close to optimal levels in advanced economies, suggesting that the potential for productivity gains from services offshoring may be larger. Positive productivity effects of services offshoring to date appear to be generally small in manufacturing plants, but somewhat bigger in service-sector firms. Amiti and Wei (2006) find a significant positive effect of services offshoring and a somewhat smaller positive effect of manufacturing offshoring on productivity in the United States.

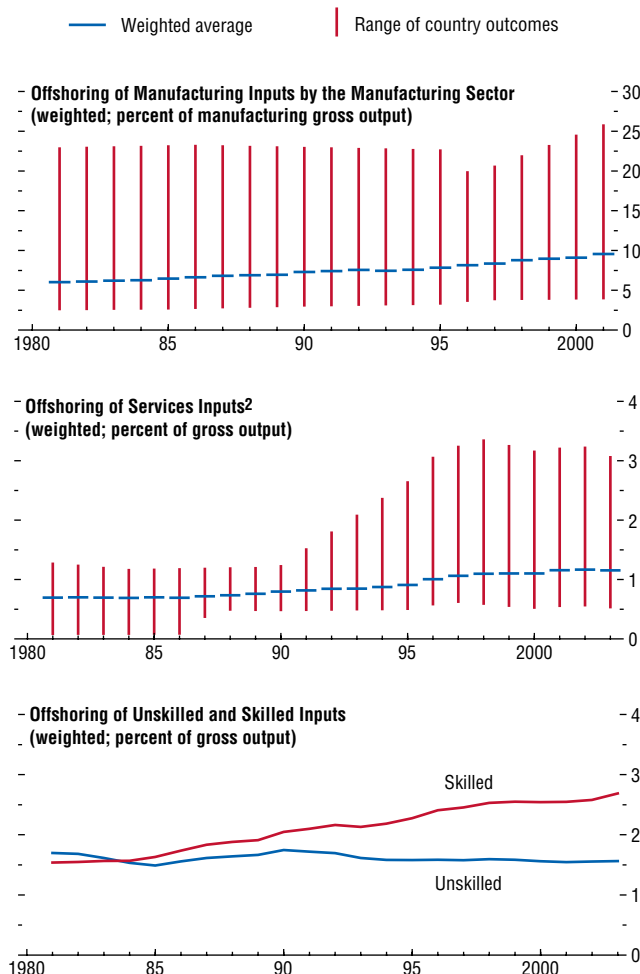
¹⁰National accounts provide the share of employees' compensation in total income but do not identify separately the labor income of other categories of workers (self-employed, employers, and family workers). Several correction procedures are available (Gollin, 2002) and, for data availability reasons, the employees' compensation was augmented with compensation of other categories of workers by assuming that the latter command similar wages per worker as employees. The results are robust if other procedures are used (see Appendix 5.1).

¹¹Focusing on the United States, for which data are available since 1930, the share of employees' compensation in national income does not appear to be at a historical low (though this may be partly related to the rise in the share of employees in the total workforce).

¹²Blanchard (1998) argues that the rise of the labor share in Europe in the 1970s was driven by a negative shift in labor supply as wages did not adjust fast enough to the slowdown in underlying factor productivity growth. Over time, though, employment adjusted downward, exerting downward pressure on wages and returning the labor share toward its previous level (though at a higher unemployment rate). The further decline that has taken

Figure 5.6. Advanced Economies: Offshoring by Category of Inputs¹

The manufacturing sector has been more affected by offshoring because it is more tradable, although there are considerable differences across countries (the vertical line shows the range of country outcomes). Skilled inputs have also played a more significant role in the growth of offshoring in advanced economies than unskilled inputs.



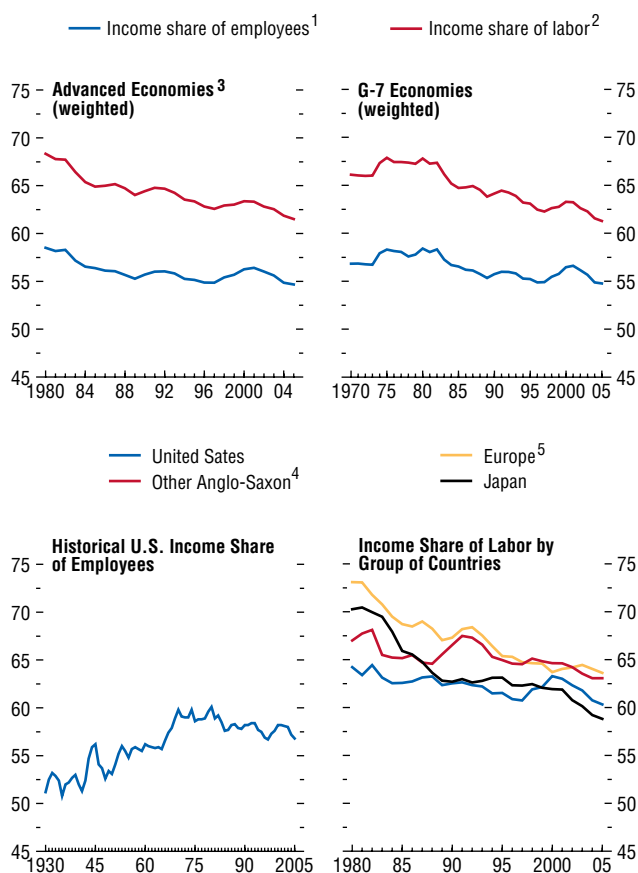
Sources: OECD, Input-Output Tables (1995, 2002, and 2006), International Trade in Services Database, and STAN Industrial Database; Groningen Growth and Development Centre, 60-Industry Database (September 2006); and IMF staff calculations.

¹Offshoring measures calculated using Input-Output Tables from OECD; resulting series extended from 2001 to 2003 by estimating extent of offshoring using a combination of data from the OECD's STAN Industrial Database and the Groningen 60-Industry Database; only offshoring of nonenergy manufacturing and services inputs considered. Advanced OECD economies used in calculations for long time series include Australia, Canada, France, Germany, Japan, the Netherlands, the United Kingdom, and the United States; weighted using series on GDP at current U.S. dollars from the World Economic Outlook database.

²Excludes the United States since import data are reported as inclusive of "cost, insurance, and freight"; thus, values that normally accrue to business services are included in associated goods sectors.

Figure 5.7. Advanced Economies: Labor Income Shares
(Percent of GDP unless otherwise noted)

Over the past two decades, there has been a continued decline in the share of income that accrues to labor, especially in Europe and Japan. The income share of workers in unskilled sectors has dropped strongly while that of workers in skilled sectors has generally made small gains.



The decline in the labor share since 1980 has been much more pronounced in Europe and Japan (about 10 percentage points) than in Anglo-Saxon countries, including the United States (about 3–4 percentage points).¹³ Within Europe, the strongest decline is observed in Austria, Ireland, and the Netherlands. Further, most of the decline in the labor share can be attributed to the fall in unskilled sectors, which was more pronounced in Europe and Japan than in the Anglo-Saxon countries. This decline reflects a combination of the reduction in the within-sector labor share and the shift of output from unskilled toward skilled sectors (see Figure 5.7). The income share of labor in skilled sectors, on the other hand, has been on the rise, especially in Anglo-Saxon countries where it has increased by about 5 percentage points. It is important to emphasize that due to the nature of the available data, these results relate to income shares of workers in skilled and unskilled sectors, rather than to income shares of skilled and unskilled workers themselves.

Despite the fall in the overall labor share, real labor compensation has expanded robustly in all advanced economies since 1980, with growth accelerating since the mid-1990s. This trend reflects both employment growth and increases in real compensation per worker, with a stronger weight on employment in the Anglo-Saxon countries and on real compensation per worker in Europe (Figure 5.8). Since the mid-1990s, however, employment growth has picked up in Europe, outpacing the growth in real compensation per worker. Growth in labor compensation of unskilled sectors, however, has been very sluggish (Figure 5.9). While unskilled employment has held steady in the United States, increases

place in the labor share since the mid-1980s is the result of an adverse labor demand shock: at a given wage and capital stock, firms have steadily decreased employment. Such a shift may have various sources: the adoption of technologies biased against labor and toward capital or a shift in the distribution of rents away from workers.

¹³For the purpose of this chapter, Europe includes the euro area countries, Denmark, and Norway, while Anglo-Saxon countries include Australia, Canada, the United Kingdom, and the United States.

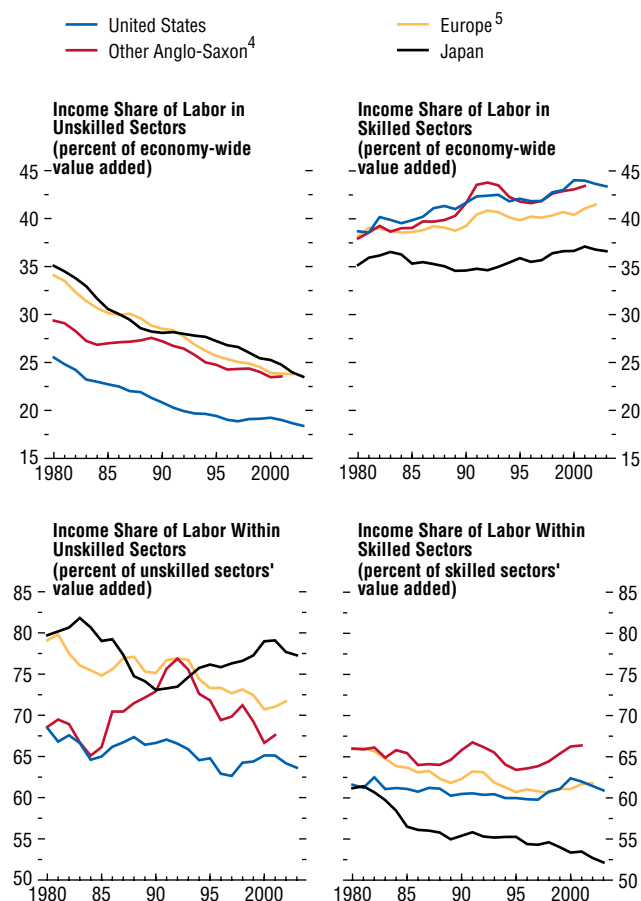
in real compensation per worker have been meager in unskilled sectors and the earnings gap between skilled and unskilled sectors has widened by 25 percent. In Europe, real compensation per worker in unskilled sectors grew broadly in line with that in skilled sectors, but employment in unskilled sectors lost ground to employment in skilled sectors (and actually contracted by a cumulative 15 percent).¹⁴

Turning to emerging market countries, theory would predict that the globalization of labor would bring large benefits for workers in the form of wage convergence toward the levels in advanced economies. Data from the manufacturing sector confirm that real wages in emerging market countries, particularly in Asia, have been catching up with those in the United States (Figure 5.10). Real wages (corrected for purchasing power) have been converging rapidly and are relatively high in Asian countries that started developing earlier (Hong Kong SAR, Korea, Singapore, and Taiwan Province of China). Wages in other Asian countries, including China, have been converging at a slower pace, though this has accelerated in recent years.¹⁵ Studies confirm that both trade and emigration have contributed to rising incomes of nationals of developing countries, although the evidence on their impact on inequality is mixed (see Box 5.1 for a discussion of the evidence on the implications of globalization for labor markets in developing countries).

Labor Compensation and the Globalization of Labor: An Empirical Examination

While striking, the globalization of labor is but one of the forces that has been affecting the labor markets of advanced economies over the past two decades. Rapid technological change is another central development with potentially important implications for labor market

Figure 5.7 (concluded)



Sources: Haver Analytics; International Labor Organization, Labor Statistics Database; OECD, Employment and Labor Market Statistics, National Accounts Statistics, and STAN Industrial Database; United Nations, *National Accounts Statistics* (2004); and IMF staff calculations.

¹ Income share of employees is the ratio of employees' labor compensation to value added.

² The income share of labor estimates the share of labor compensation of employees and "nonemployee" workers in value added.

³ Advanced economies include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States; weighted using series on GDP in U.S. dollars from the World Economic Outlook database.

⁴ Anglo-Saxon economies include Australia, Canada, and the United Kingdom. Australia is excluded from the analysis by skill level due to lack of data.

⁵ Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, and Sweden. Ireland, the Netherlands, and Spain are excluded from the analysis by skill level due to lack of data.

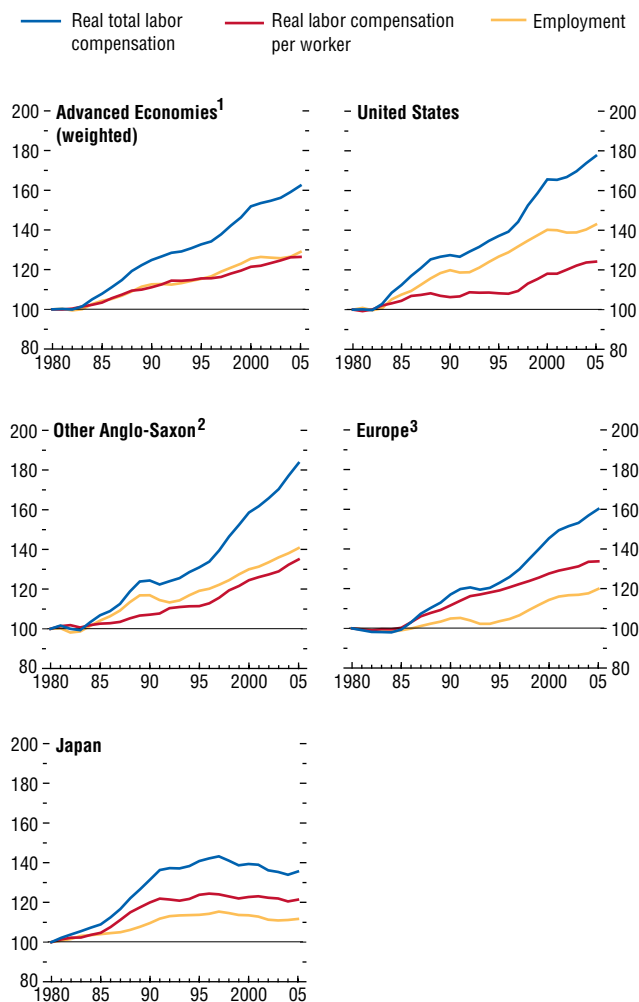
¹⁴Katz and Autor (1999) find similar changes in the gap between high- and low-income earners for the United States and European countries.

¹⁵Asia's labor productivity has also been converging toward the U.S. level (see the September 2006 *World Economic Outlook*).

Figure 5.8. Advanced Economies: Labor Compensation and Employment

(Index, 1980 = 100)

Despite the fall in the overall labor share, real labor compensation has grown robustly in advanced economies, with a stronger weight on employment in Anglo-Saxon economies.



Sources: Haver Analytics; International Labor Organization, Labor Statistics Database; OECD, Employment and Labor Market Statistics, National Accounts Statistics, and STAN Industrial Database; United Nations, *National Accounts Statistics* (2004); and IMF staff calculations.

¹Advanced economies include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom, and the United States; weighted using series on GDP in U.S. dollars from the World Economic Outlook database.

²Anglo-Saxon economies include Australia, Canada, and the United Kingdom.

³Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, and Sweden.

outcomes (Figure 5.11). The information and communications technology (ICT) revolution, an all-purpose technological revolution that Blinder (2006) has compared to the third industrial revolution, has stimulated capital accumulation (see the September 2001 *World Economic Outlook*) and favored skilled labor—with which it is more complementary—over unskilled labor. Technology has also progressed in other areas as reflected in the strong rise in patent applications in OECD economies, especially since the early 1990s.

There have also been changes in labor and product market policies. Reforms have proceeded in several areas, but generally in the direction of lowering the cost of labor to business and enhancing the flexibility of markets. Four main developments in labor market policies are particularly worth noting (see Figure 5.11): (1) a marked increase in the generosity of unemployment benefits in Europe (as measured by average replacement rate of income), in contrast with a slight decline in Anglo-Saxon countries; (2) a general decline in the tax wedge, especially in the United States where it has fallen by about 10 percentage points since 1995; (3) substantial declines in legislated employment protection and product market regulation, especially in Europe and Japan, both of which started with particularly restrictive stances; and (4) persisting large cross-country differences in the degree of employment protection, with low protection in the United States and other Anglo-Saxon countries and relatively high protection in Europe and Japan. Recent studies (Bassanini and Duval, 2006; and Annett, 2006) have highlighted reductions in the tax wedge, reductions in unemployment benefits, deregulation of product markets, and more limited employment protection as the main factors that have contributed to employment growth and declining unemployment.¹⁶ Disentangling

¹⁶Some of these variables may also affect the labor share in similar ways, especially if the elasticity of substitution between labor and capital is high. For instance, an increase in the unemployment benefit replacement rate increases the reservation wage of workers and leads in the very short run to a rise in the labor share. But as employment adjusts downward, the labor share declines and can

the influence of these variables is difficult, in particular because technological change and the globalization of labor may be expected to affect compensation and the labor share in similar ways. The influence of policy variables is complex, particularly because they may also affect the labor share indirectly by facilitating or obstructing the adjustment of the economy to labor globalization and technological progress.

This section uses an econometric model to analyze the relationship between labor compensation and labor globalization—measured in terms-of-trade prices, offshoring, and immigration—controlling for technological progress and changes in labor market policies. The basic model, which has solid microeconomic foundations and is widely used in the recent trade literature (see, for instance, Feenstra, 2004; Harrigan, 1998; and Kohli, 1991), relates the labor share to the capital-labor ratio and import and export prices (expressed relative to domestic prices).¹⁷ The two latter variables capture the effects of globalization of trade: declines in import prices are expected to decrease the labor share, as imports that come increasingly from developing countries are labor intensive; in contrast, declines in export prices should benefit labor relative to capital because of the high capital intensity of advanced economies' exports. The basic model is augmented to include the intensity of offshoring, the share of immigrants in the domestic labor force, the share of ICT capital in total capital, measures of labor market policies, and country fixed effects.¹⁸ The model

fall below its initial level if the elasticity of substitution between capital and labor is high enough (Blanchard, 1998). Other shocks that increase the cost of labor, such as an increase in the tax wedge or an increase in employment protection, can be expected to have similar effects. Although strict product market regulation creates rents, it is not clear that it should affect the distribution of these rents between labor and capital and hence the labor share.

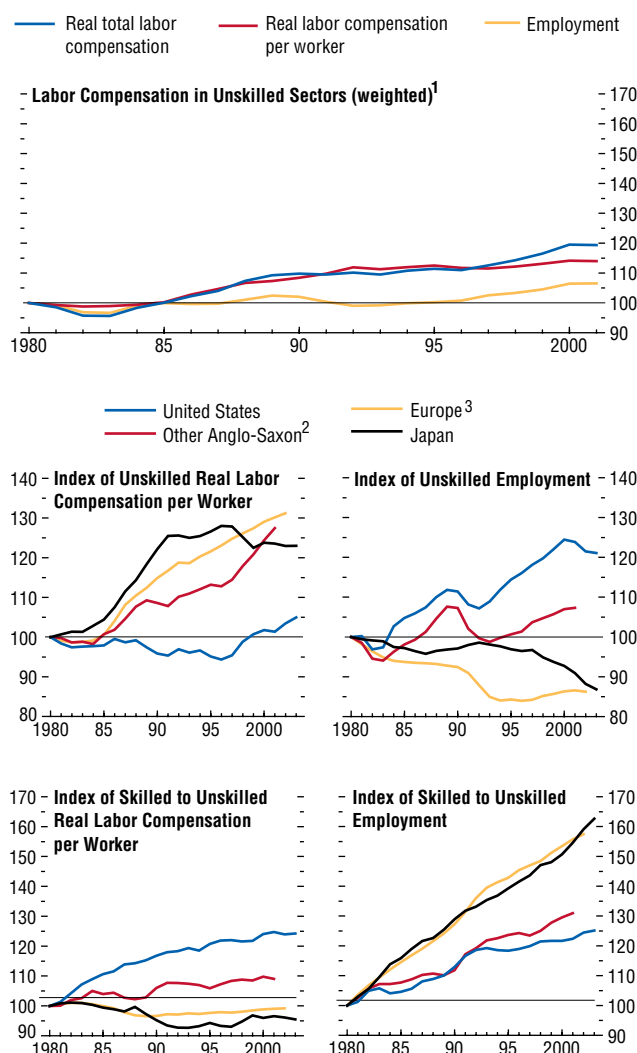
¹⁷The factor share equations are derived from the maximization of an (economy-wide) revenue function, taking as given the factor endowments and sectoral prices (import, export, and absorption). See Appendix 5.1 for more details.

¹⁸The theoretical rationale for including these variables is that they may act as shift factors in the revenue (GNP) function (Feenstra, 2004).

Figure 5.9. Advanced Economies: Labor Compensation and Employment in Skilled and Unskilled Sectors

(Index, 1980 = 100)

Despite strong growth of labor compensation overall, the growth in labor compensation of unskilled sectors has been very slow. In the United States, the earnings gap between skilled and unskilled workers has widened by about 25 percent since 1980, while in Europe, employment in unskilled sectors has contracted.



Sources: Haver Analytics; International Labor Organization, Labor Statistics Database; OECD, Employment and Labour Market Statistics, National Accounts Statistics, and STAN Industrial Database; United Nations, *National Accounts Statistics* (2004); and IMF staff calculations.

¹For analysis by skill level, advanced economies include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Norway, Portugal, Sweden, the United Kingdom, and the United States; weighted using series on GDP in U.S. dollars from the World Economic Outlook database.

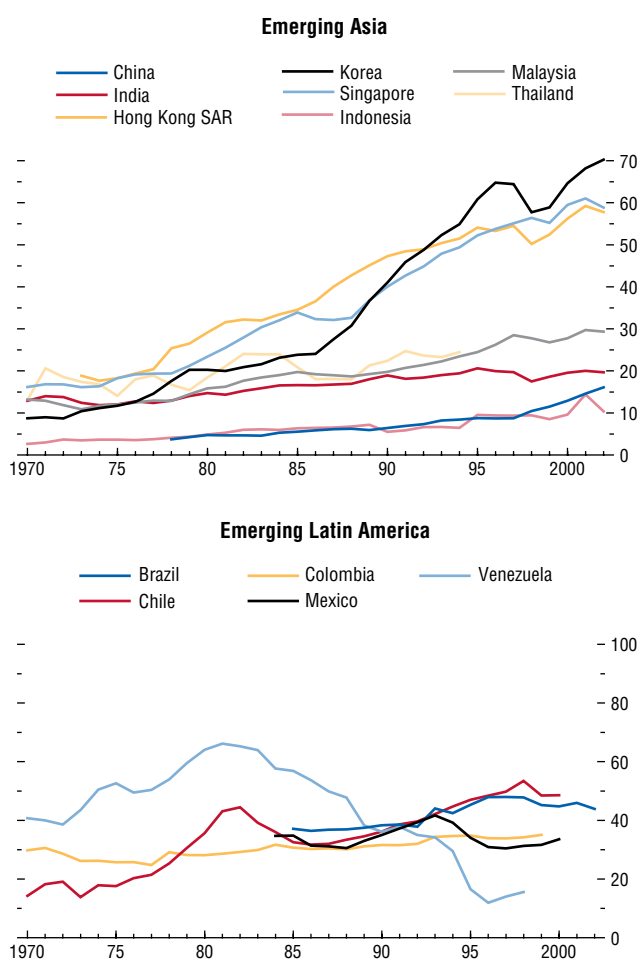
²For analysis by skill level, Anglo-Saxon economies include Canada and the United Kingdom.

³For analysis by skill level, Europe includes Austria, Belgium, Denmark, Finland, France, Germany, Italy, Norway, Portugal, and Sweden.

Figure 5.10. Catch-Up by Emerging Markets' Manufacturing Wages

(Percent of U.S. manufacturing wages in constant PPP dollars)

While relative manufacturing wages in emerging Asia are generally increasing, catch-up has been most evident in the newly industrializing economies, such as Korea, Singapore, and Hong Kong SAR. In contrast, Latin American economies have not experienced much convergence.



Sources: UNIDO, Industrial Statistics Database (2006); CEIC Asia Database; Instituto Brasileiro de Geografia e Estatística, *Pesquisa Industrial Mensal*; and IMF staff calculations.

was estimated on a panel of 18 advanced OECD economies over 1982–2002, for the overall labor share and for the income shares of labor in skilled and unskilled sectors (see Appendix 5.1 for more details). At the outset, it should be noted that the effects of globalization can only be imperfectly disentangled from those of technology, especially for technological progress in transport and communication, which vastly expands the opportunities for globalized production. Similarly, part of the decline in import (and, in some cases, export) prices may be attributable to productivity improvements in the production of information and communications technology.

The results from estimating this model suggest that labor globalization, technological change, and labor market policies have all affected labor shares over the past two decades (Figure 5.12).¹⁹ Both labor globalization and technological progress have acted to reduce the labor share, with the impact of technological progress being somewhat larger, while changes in labor market policies have generally had a smaller but positive impact on the labor share.²⁰

¹⁹The contribution of a factor to the average annual change in the labor share over the sample period is the product of its coefficient and of its own average annual change over the same period.

²⁰Most studies have focused on explaining the decline in the relative wage (or labor share) of unskilled workers in the United States (see Freeman, 1995; and Feenstra, 2004, for a survey). Studies that attempt to explain the evolution of the overall labor share are more scarce. Most studies conclude that skill-biased technological change is a more important cause of wage inequality than trade (e.g., Harrigan, 1998; and Harrigan and Balaban, 1999). Feenstra (2004 and 2007) finds that the role of trade and technological progress are equally important in explaining rising wage inequality. In a recent contribution, Guscina (2006) finds that labor shares across countries are equally affected by technological progress and openness. Harrison (2002) also finds that globalization tends to reduce the labor share. Another strand of the literature examines whether globalization increases the elasticity of labor demand to wages and finds mixed results (see, for instance, Slaughter, 2001; and OECD, 2006a). Studies of immigration tend to find that its effects on wages and employment of natives are small (Greenwood, Hunt, and Kohli, 1996; and OECD, 2006b).

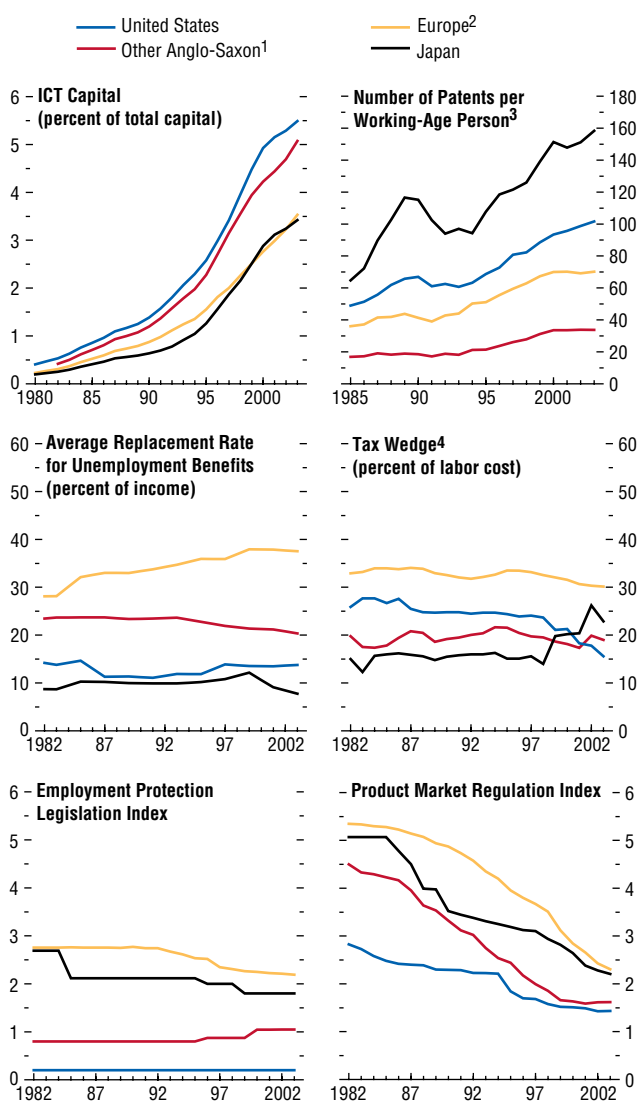
Each channel of labor globalization (trade prices, offshoring, and immigration) individually plays a relatively small role in explaining the decline in the labor share.

Labor globalization contributed to the decline in labor shares in most countries, with broadly similar effects in both Anglo-Saxon countries and Europe.²¹ Nevertheless, the labor globalization effect in the Anglo-Saxon countries and Europe is driven by different factors. Europe's labor share has been affected both by offshoring and immigration, while, in the Anglo-Saxon countries, offshoring was a somewhat less important factor. Similarly, within Europe, large economies were affected more by immigration than by offshoring, while the opposite holds for small economies. Another component of globalization—the change in trade prices—generally had only a small net effect on the labor share. Hence, while globalization exerted downward pressure on the labor share through declines in import prices, this effect has been broadly compensated by similar declines in export prices, which have boosted the labor share since exports of advanced economies are capital intensive. In large European countries and Japan, the net effect from changes in trade prices was actually to boost the labor share, likely reflecting a stronger concentration of exports in capital-intensive goods.

The reasons for the milder decline of the labor share in the Anglo-Saxon countries than in Europe are found in the role of technological change and labor market policies rather than in the differences in the impact of labor globalization. Technological change has contributed to the reduction of the labor share in both groups, but less so in the Anglo-Saxon countries. In particular, in the United States, ICT capital even contributed to raising the labor share, possibly reflecting the fact that the United States is most

Figure 5.11. Information and Communications Technology (ICT) Capital, Patents, and Labor Market Indicators

The globalization of labor is but one of the forces that have influenced labor markets in advanced economies over the past two decades. Rapid technological change and changes in labor and product market policies are other significant developments with potentially important implications for labor market outcomes.



Sources: Bassanini and Duval (2006); Jorgenson and Vu (2005); OECD, Science and Technology Statistics; and IMF staff calculations.

¹ Australia, Canada, New Zealand, and the United Kingdom.

² Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. Greece is not included due to data limitations.

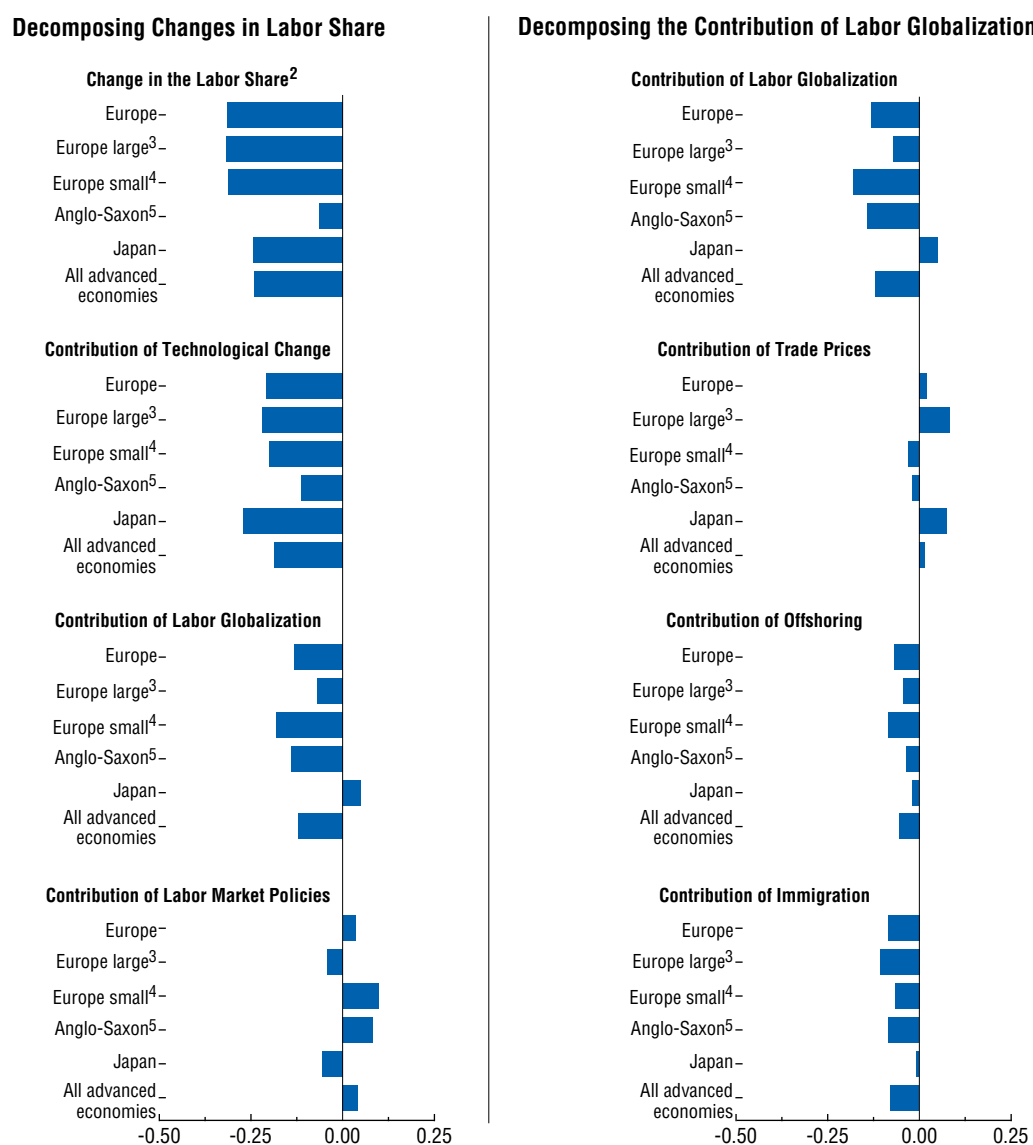
³ Patents that have been filed at the European Patent Office, Japanese Patent Office, and granted by the United States Patent and Trademark Office (measured by priority year, that is, year of first application).

⁴ Difference between the labor cost to the employer and the net take-home pay of the employee, in percent of the labor cost.

²¹ Some caution is needed when interpreting these results, since they are based on the regression coefficients that are the same for all the countries and average annual changes in variables that are country specific.

Figure 5.12. Contributions to the Annual Change in Labor Share¹
(Percentage points)

Labor globalization and technological progress have acted to reduce the labor share, with the impact of technological progress being somewhat larger, while changes in labor market policies have generally had a smaller but positive impact on the labor share. Trade prices, offshoring, and immigration individually play a relatively small role in explaining the decline in the labor share.



Source: IMF staff calculations.

¹1982–2002 or longest period available. 1986–2001 for Japan, as changes in the relative import price in earlier years reflected the yen's strong appreciation rather than globalization. The contributions are based on estimated regression coefficients and average annual changes in the respective variables by country (see Appendix 5.1).

²The annual change in the labor share in this figure corresponds to the sample period for which all the regression variables were available and may thus differ from the one shown in Figure 5.7.

³Europe large includes France, Germany, Italy, and Spain.

⁴Europe small covers Austria, Belgium, Denmark, Finland, Ireland, the Netherlands, Norway, Portugal, and Sweden.

⁵Anglo-Saxon countries include Australia, Canada, the United Kingdom, and the United States.

Box 5.1. Emigration and Trade: How Do They Affect Developing Countries?

This box reviews the evidence on the effects of emigration and trade on labor markets and incomes in developing countries.

Emigration

While a vast theoretical and empirical literature considers the impact of immigration on destination countries, little work has been done on emigration and its impact on source countries.¹ This is surprising because the shares of the labor force leaving many individual source countries as emigrants are considerably higher than the proportionate changes in the labor force of many receiving countries due to immigration. To cite a few examples, the labor force in Barbados, Belize, El Salvador, Guyana, and Jamaica has been reduced by 20 percent or more due to emigration to the OECD countries.² Meanwhile, immigrants constitute about 15 percent of the U.S. labor force, and the share is considerably lower in most other OECD countries.

In general, source countries do not record information on those who emigrate. However, Mexico and other Latin American countries—from where immigration is mostly to the United States—offer ideal case studies because U.S. data sources can be used to analyze the impact on the source countries. Along these lines, Cardarelli and Ueda (2004) assess the impact of migration to the United States on the welfare of source countries. Using as a yardstick the income produced by the nationals of the country irrespective of where they live, they estimate that the well-being of Mexican-born people was, on average, 20 percent higher than the country's GDP alone would suggest over 1994–2003. Cardarelli and Ueda also conclude that immi-

gration opportunities to the United States have raised the well-being of nationals born in several other developing countries, particularly in Latin America and the Caribbean (e.g., Jamaica, Haiti, Nicaragua, and El Salvador) and in the Philippines and Vietnam. One channel of income gains for developing country residents, included in these calculations, is the large flow of remittances back into the country from emigrants living abroad (see the April 2005 *World Economic Outlook*). While in Mexico annual remittances were about 3 percent of GDP over 1990–2003, they amounted to over 10 percent of GDP in El Salvador and Jamaica over the same period.

Focusing on workers who have stayed home, Mishra (2007) examines the effect of emigration to the United States on wages in Mexico, using data from the Mexican and U.S. censuses for 1970–2000. She finds a strong and positive effect of emigration on Mexican wages: a 10 percent decrease in the number of Mexican workers in a given skill group (defined by schooling and experience) increases the average wage in that skill group by about 4 percent (Aydemir and Borjas, 2006, find a similar result). The impact on wages differs dramatically across schooling groups, with the greatest increase being for the higher wage earners (those with 12–15 years of schooling) owing to the higher emigration rate of this group. Hence, while all categories of workers who stay home benefit in terms of higher wages, emigration could serve as a partial explanation for the increasing wage inequality in Mexico.³

The positive effect of emigration on wages in Mexico is confirmed by Hanson (forthcoming). He examines changes in the distribution of labor income across regions of Mexico during the 1990s, a period of rapid globalization of the Mexican economy. He finds that over the decade, average hourly earnings in high-

Note: The main author of this box is Prachi Mishra.

¹See Borjas (1994 and 1995) for surveys of the empirical literature on immigration.

²The outflow of workers is largely to the United States, and took place between 1970 and 2000. In 1965, the United States implemented the Immigration and Nationality Act, which changed the basis of entry into the United States from country quotas to family-based reunification. This brought about a drastic change in the composition of immigration, increasing the share of migrants from developing countries.

³Emigration accounts for approximately 37 percent of the increase in relative wages of high school graduates (12 years of schooling) and 14 percent of the increase in relative wages of those with some college education (13–15 years of schooling) between 1990 and 2000.

Box 5.1 (concluded)

migration states rose by 6–9 percent relative to low-migration states.

While workers benefit from higher wages and families from remittance inflows, capital owners who hire these workers lose. Overall, however, estimates suggest that there is a small aggregate annual welfare gain in the case of Mexico. Nevertheless, emigration can lead to loss of welfare if the fact that emigration of high-skilled workers leads to a decline in the productivity of those who have stayed behind is taken into account. For example, qualified doctors, researchers, and engineers confer a positive externality on the rest of the population, and this is lost when they emigrate. Mishra (2006) estimates substantial productivity losses for those who stay behind because of the very high rates of high-skilled emigration from the Caribbean countries. Gupta, Pattillo, and Wagh (2007) also report a high rate of migration of skilled workers from sub-Saharan African countries. One consequence of this is a human resource shortage in the health sector of these countries, as skilled health care professionals get hired in the high-demand OECD countries.

Trade

A large body of research shows that trade openness in developing countries has raised aggregate incomes and growth rates (see Berg and Krueger, 2003, for a survey). Using cross-country and panel regressions, many studies have found that openness to trade is a significant explanatory variable for the level or growth rate of real GDP per capita, with the weight of evidence suggesting that this result holds even when the endogeneity of trade openness is taken into account and after controlling for other important determinants, such as the quality of institutions and geography.

In contrast, the internal distributional consequences of trade reform in developing countries are still the subject of intense debate (see Goldberg and Pavcnik, forthcoming, for a survey). The workhorse model to analyze the labor market consequences of trade liberalization—the Stolper-Samuelson theorem—predicts that trade

liberalization will shift income toward a country's abundant factor.⁴ For developing countries, this suggests that liberalization will principally benefit the abundant unskilled labor. Yet many developing countries, including Argentina, Brazil, Colombia, China, India, and Mexico experienced a widening wage gap between skilled and unskilled labor during periods of trade reform during the 1980s and 1990s.⁵

Of course, rising wage inequality does not necessarily imply a causal impact of trade reforms (since typically trade reforms were accompanied by significant domestic reforms in most countries).⁶ Hence, the literature in the past decade has focused on trying to identify the causal link between trade liberalization and distributional outcomes. Two key methodologies used are the industry-level and the regional approaches that examine whether industries or regions that were more exposed to trade liberalization experienced larger changes in labor market outcomes. However, a drawback of both these approaches is that they can directly

⁴Davis and Mishra (2007) discuss a variety of reasons for why the assumptions underlying the Stolper-Samuelson model may be too simplistic to hold in the real world. One possible reason is that the pattern of trade depends on a country's "local" rather than global factor abundance: a country's factor abundance needs to be compared with that of others that produce the same set of goods. For example, Mexico is less skill abundant relative to the United States but more skill abundant relative to China. When Mexico joined the General Agreement on Tariffs and Trade in the mid-1980s, it opened its borders to the less-skill-abundant world, which could explain the rising wage inequality in the late 1980s.

⁵The definition of skill varies across specific country studies. Studies using household survey data define skill based on education of the household head, whereas studies using plant- or firm-level data typically differentiate between production and nonproduction, or blue-collar and white-collar, workers.

⁶Other explanations of the rising wage gaps include skill-biased technological change or increased offshoring of activities that are relatively skill intensive from the point of view of developing countries (though offshoring may itself be triggered by a free trade agreement with an advanced economy, leading to reduced tariffs) (Feenstra, 2007).

identify only relative differences across regions or industries and not identify the impact on the nation as a whole.⁷

The econometric evidence from different countries is mixed on how trade reforms affect relative labor market outcomes across regions or industries. Topalova (2005) and Edmonds, Pavcnik, and Topalova (2007) find that districts in India that were more exposed to import liberalization experienced a slower reduction in poverty, which was coupled with lower investment in human capital and a lower decline in child labor. On the other hand, using a broader measure of openness, Hanson (2007) finds that states in Mexico with high exposure to globalization (measured by the shares of foreign direct investment, imports, and exports assembly in state GDP) experienced a rise in labor incomes relative to low-exposure states in the 1990s.

The empirical evidence on the effect of trade liberalization on wages at the industry level is

⁷Porto (2006) is one study that uses a general equilibrium model of trade to answer the ambitious question of the overall effect of trade liberalization on inequality, in the context of Argentinean trade reforms. The model is used to *simulate* the effect of trade policy changes on the distribution of household welfare (household expenditure per capita). He finds evidence of a pro-poor bias caused by the reform. On average, poor households gained more from reforms than did middle-income households. However, the drawback of this approach is that predictions of the model depend crucially on parameter estimates that are typically not known (e.g., wage-price elasticities) and are difficult to estimate consistently with time-series data on wages and prices when many other policies changed along with trade (see Goldberg and Pavcnik, forthcoming, for a discussion of this paper).

also mixed.⁸ For example, studies find no significant relationship between trade policy and industry wages in Brazil and Mexico (Pavcnik and others, 2004; and Feliciano, 2001), while the reduction in tariffs within a sector is found to be associated with a significant reduction in wages in that sector in Colombia (Goldberg and Pavcnik, 2005) but with an increase in wages in Poland (Goh and Javorcik, 2007). The evidence from India on the effects of changes in tariffs on wages is mixed (see Topalova, 2005; Dutta, 2004; and Kumar and Mishra, forthcoming). Given that the sectors that experienced the largest tariff reductions were those with the largest share of unskilled workers, the industry-level studies thus suggest mixed effects of trade liberalization on the overall wage gap between skilled and unskilled workers: trade reforms were associated with a higher wage gap in Colombia, possibly with an unchanged wage gap in Brazil and Mexico, and with lower wage inequality in Poland.

In conclusion, on the one hand, emigration and trade both increase the aggregate incomes of developing countries (once the income of emigrants is included). On the other hand, the existing evidence on the impact of globalization on inequality is mixed, particularly in the case of trade. Further research efforts are needed to fully understand these important issues.

⁸These studies use a two-step methodology. First, they use household survey data to estimate “industry wage premia,” defined as the part of worker wages that is explained by a worker’s industry affiliation after controlling for observable worker characteristics (e.g., schooling, experience, and so on). Second, the estimated industry wage premia are regressed on measures of trade reform by industry.

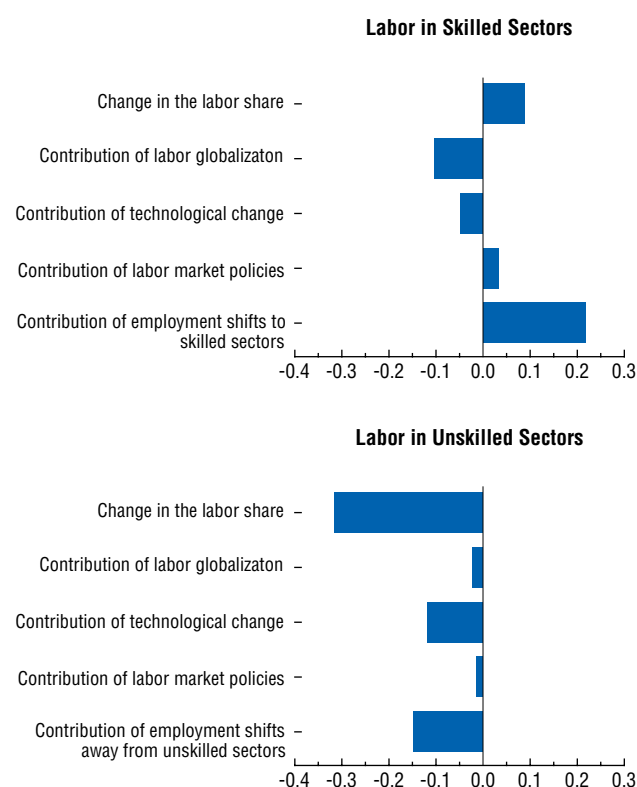
advanced in the use of ICT. The adverse labor demand effects of ICT appear to be stronger at the early stages of ICT adoption, before the needed adjustments in workers’ education have taken place.

Changes in labor market policies have had a positive effect on the labor share in Anglo-

Saxon countries, but a much more modest effect on average in Europe, particularly in large European economies where labor policies are estimated to have actually contributed to a decline in the labor share. The contribution of labor market policies is driven primarily by the changes in the tax wedge and unemployment

Figure 5.13. Advanced Economies: Contributions to the Annual Change in the Labor Share by Skill Level¹
(Percentage points)

While technological change affected mostly the income share of labor in unskilled sectors, the labor income share in skilled sectors was more affected by labor globalization.



Source: IMF staff calculations.

¹1982–2002 or longest period available. 1986–2001 for Japan, as changes in the relative import price in earlier years reflected the yen's strong appreciation rather than globalization. The contributions are based on estimated regression coefficients and average annual changes in the respective variables by country (see Appendix 5.1).

benefit replacement.²² The decline in the tax wedge in Anglo-Saxon countries, especially in the United States, benefited the labor share, while in Europe the labor share was hurt by a rise in unemployment benefit replacement rates.

Turning to look at the skilled and unskilled sectors separately, the main factor affecting the income share of labor in unskilled sectors over the sample period, beyond the shift of employment toward skilled sectors, is technological change (Figure 5.13). This result is consistent with the belief that computers and other ICT equipment act as a substitute for unskilled labor, but they tend to complement skilled labor. On the other hand, labor globalization contributed to a decline in the income share of labor in skilled sectors, much more so than in unskilled sectors. This is in line with earlier findings that the increase in offshoring was mostly driven by the offshoring of skilled inputs rather than unskilled inputs. However, this was more than offset by the shift of employment from unskilled sectors to skilled sectors and the income share of labor in skilled sectors actually increased moderately.²³

Of course, the effects on labor shares do not by themselves give the full picture of how workers' well-being is affected by forces of globalization and technological change. These factors also influence output and total labor compensa-

²²The other variables, namely, employment protection legislation, product market regulation, and union density, did not have significant effects. The analysis was expanded to investigate whether some labor market institutions tend to amplify or attenuate the impact of labor globalization and technological progress. Although strict employment protection legislation does not appear to have any effect on its own, there is some evidence that it tends to increase the adverse effects of labor globalization on labor shares. A more flexible labor market may thus contribute to limiting the decline in the overall labor share caused by globalization.

²³Workers in unskilled sectors have also benefited somewhat less from labor market policy changes. Although product market regulation has a negligible impact on the overall labor share, it seems to benefit the income share of labor in unskilled sectors. Hence, the reduction in product market regulation over the sample period had a negative effect on this income share.

tion. The model results imply that on average, in advanced economies, the decline in traded goods prices yielded about a 6 percent increase in both output and total labor compensation, in real terms, over 25 years.²⁴ Thus, although the labor share went down, globalization of labor as manifested in cheaper imports in advanced economies has increased the “size of the pie” to be shared among all citizens, resulting in a net gain in total workers’ compensation in real terms (Figure 5.14).²⁵

In sum, the econometric analysis suggests that both labor globalization and technological change have been important factors behind the observed decline in labor shares in advanced economies. The rapid progress in ICT has had a particularly strong effect on the unskilled sectors. The role of labor market policies has differed across countries, with positive effects largest in the United States and much more modest on average in Europe (and negative in some countries). Finally, global competition has brought down international trade prices. Cheaper imports have increased the size of real total labor compensation, implying that workers have participated in the benefits of the bigger economic “pie,” although their share of it has declined.

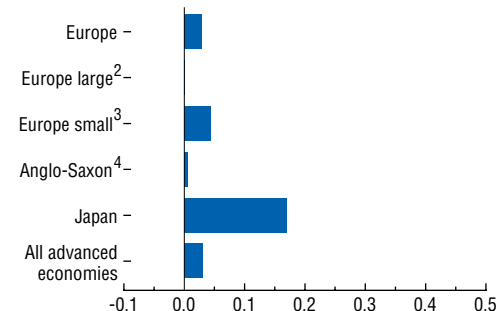
²⁴This result was calculated as follows. The model allows for deriving elasticities of labor compensation to trade prices: on average, a 1 percent decline in the relative price of imports raises real total labor compensation by 0.5 percent, while a 1 percent decline in the relative price of exports lowers it by a somewhat smaller 0.4 percent. Combining these elasticities with the actual average changes in relative export and import prices implies an average annual increase in labor compensation of about 0.2 percent on average in advanced economies (or about 6 percent if compounded over 25 years). The increase in output implied by the change in trade prices is just the difference between the percent change of total labor compensation and the percent change of the labor share (which is very small in this case).

²⁵It should also be noted that a comprehensive evaluation of the impact of globalization on workers’ financial means needs to go beyond labor compensation and to take into account an increase in direct and indirect asset ownership (see the September 2006 *World Economic Outlook*).

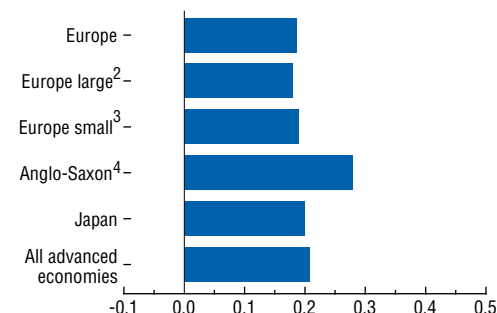
Figure 5.14. Effects of Changes in Trade Prices on Labor Share, Output, and Labor Compensation¹
(Percent)

Although on the whole the labor share went down, the globalization of labor increases the size of the pie to be shared among all citizens, resulting in a net gain in workers’ compensation in most countries.

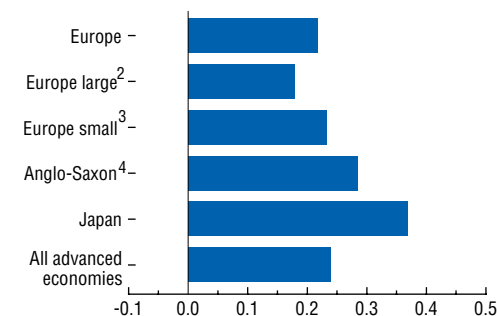
Impact of Change in Trade Prices on Annual Change in Labor Share



Impact of Change in Trade Prices on Annual Change in Output



Impact of Change in Trade Prices on Annual Change in Labor Compensation



Source: IMF staff calculations.

¹1980–2004 or longest period available. 1986–2004 for Japan, as changes in the relative import price in earlier years reflected the yen’s strong appreciation rather than globalization. The effects are based on estimated regression coefficients and average annual changes in the respective variables by country (see Appendix 5.1).

²Europe large includes France, Germany, Italy, and Spain.

³Europe small covers Austria, Belgium, Denmark, Finland, Ireland, the Netherlands, Norway, Portugal, and Sweden.

⁴Anglo-Saxon countries include Australia, Canada, the United Kingdom, and the United States.

Summary and Policy Implications

There has been a dramatic increase in the size of the effective global labor force over the past two decades, with one measure suggesting it has risen fourfold. This expansion is expected to continue in the coming years. The UN projects a 40 percent rise in the world's working-age population by 2050, and trade openness will continue to grow, especially in services. Indeed, tentative projections suggest that the effective global labor supply could more than double again by 2050.²⁶

The global pool of labor can be accessed by advanced economies through imports and immigration. Trade is the more important and faster-expanding channel, in large part because immigration remains very restricted in many countries. Contrary to popular perceptions, the intensity of offshoring of the production of intermediates is still small in the overall economy, although the manufacturing sector is more affected because of its greater tradability. Imports of offshored intermediates have also been growing somewhat more slowly than total trade.

The integration of workers from emerging market and developing countries into the global workforce has produced important benefits for advanced economies. Export opportunities have expanded considerably. It has provided access to cheaper imported goods and has enabled companies to operate more efficiently. This has boosted productivity and output, and contributed to rising real labor compensation. For emerging market economies, the ongoing integration of labor into the global marketplace has benefited workers, with manufacturing wages rising rapidly.

²⁶This projection is based on the medium variant of the UN projections of working-age population and on the assumption that the ratio of non-oil exports to GDP will continue expanding at the rate observed in recent years (see Appendix 5.1). World Bank (2006) also provides projections of the world's workforce until 2030 and projects that although the vast majority of the world's workforce will remain unskilled, the supply of skilled workers is likely to grow faster than that of unskilled workers.

Nevertheless, labor globalization has negatively affected the share of income accruing to labor in the advanced economies (the labor share). It is, however, only one of several factors that have affected the labor share over the past two decades. Rapid technological change—especially in the information and communications sectors—has had a bigger impact, particularly on the labor share in unskilled sectors. This is broadly consistent with findings highlighted in a recent joint study by the International Labor Office and the World Trade Organization (2007).

Against this background, the increasing globalization of labor and ongoing technological changes raise important challenges for policy-makers in the advanced economies. They must seek to harness the benefits that the growing pool of global labor is creating. This means continuing along the path of trade liberalization, while ensuring that domestic economies are sufficiently flexible to be able to adjust and respond to the pressures of globalization. At the same time, it is important to be fully cognizant of adjustment costs, and policies do need to support those people who are negatively affected by labor market globalization and technological changes. In broad terms, policies need to respond along three dimensions:

- *Improve the functioning of labor markets.* Steps to reduce tax wedges to enable workers to take home a larger proportion of their gross pay and to ensure that unemployment benefit replacement rates do not deter workers from seeking employment have helped a number of countries adjust to the pressures of globalization. The duration of unemployment benefits and the work availability requirements are also important (see Annett, 2006; and Bassanini and Duval, 2006). Moreover, policies that increase the flexibility of the economy and thereby enable workers to move more easily from declining to expanding areas of the economy help the process of adjustment. A variety of country-specific approaches are possible, as demonstrated by the range of experience of successful reformers in western Europe (see Box 2.2). Reform packages also

have to be designed with fiscal consequences in mind.

- *Improve access to education and training.* Developing workers' skills is necessary for keeping up with rapid technological change and for continuing innovation. Skilled sectors have been better able to adapt to changing conditions caused by the ICT revolution than unskilled sectors. Further, countries that started adopting ICT and training workers in this area earlier experienced less decline in their labor share. Workers must also be ready to compete with the growing pool of skilled workers in emerging markets, especially those in Asia. Beyond increases in spending on education and training, the quality of this spending is crucial. Experience shows that evaluation and targeting of training are important to maximize its impact.
- *Ensure adequate social protection for workers during the adjustment period.* This includes providing adequate income support to cushion, but not obstruct, the process of change, and also making health care less dependent on continued employment and increasing the portability of pension benefits in some countries. The latter would also enhance the flexibility of the economy by facilitating the move of workers from declining sectors to expanding sectors. Whether measures specifically targeted at workers who have been displaced by international trade are desirable is less clear (see, e.g., OECD, 2005). The fact that these workers may face special hurdles reintegrating into the labor market as they are often older and less educated, and their skills are specific to declining industries or occupations, argues in favor of such measures. Also, minimizing losses for such workers may increase support for the international economic integration process. However, it may be difficult (even conceptually) to differentiate between job losses caused by globalization and those caused by other factors, since most labor markets are characterized by high rates of turnover and year-to-year earnings vari-

ability. If trade-displaced workers are treated more generously, including, for instance, by being provided supplementary wage subsidies, such compensation should be structured to avoid dulling incentives to search actively for new jobs.

Appendix 5.1. Data Sources and Methods

The main authors of this appendix are Florence Jaumotte and Irina Tytell.

Variable Definitions and Data Sources

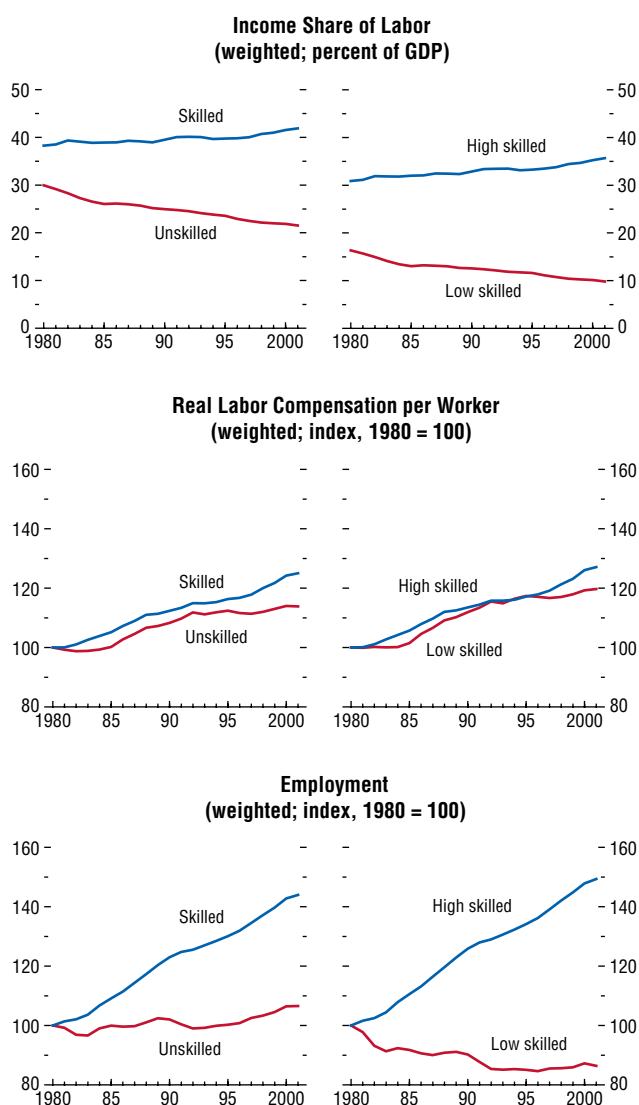
This section provides further details on the construction of the variables used in this chapter and the sources of the data.

Sectoral Classification

Throughout the chapter, the analysis is carried out both for the aggregate economy and for a disaggregation of the economy by skill category. The classification of trade and labor into skill categories is based on the skill intensity of the sector. Hence skilled exports are exports of goods and services typically produced by skill-intensive sectors. The skilled labor share is the share of national income that accrues to workers in skill-intensive sectors. One drawback of this approach is that it does not capture changes that occur between skilled and unskilled workers within sectors. A more refined approach was, however, not feasible because of the lack of cross-country data on the wages of production (unskilled) and nonproduction (skilled) workers, which would have been needed to calculate labor shares and labor compensation of skilled and unskilled workers.

The classification of sectors into skilled and unskilled is based on the share of skilled workers in the labor force of the sector, where a person is considered skilled if he or she has at least upper secondary education. Data on the average fraction of skilled labor in each sector (across 16 OECD economies from 1994 to 1998) are from Jean and Nicoletti (2002). The chapter classifies 18 sectors (from the International Standard

Figure 5.15. Advanced Economies' Labor Income Share, Labor Compensation, and Employment: Robustness to Alternative Skill Classification¹



Sources: Haver Analytics; International Labor Organization, Labor Statistics Database; OECD, Employment and Labour Market Statistics, National Accounts Statistics, and STAN Industrial Database; United Nations, *National Accounts Statistics* (2004); and IMF staff calculations.

¹For the analysis by skill level, advanced economies include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Norway, Portugal, Sweden, the United Kingdom, and the United States; weighted using series on GDP in U.S. dollars from the World Economic Outlook database.

Table 5.1. Classification of Sectors by Skill Intensity

Main Classification	Alternative Classification
Unskilled	Low skilled
Agriculture	Agriculture
Mining	Mining
Food and tobacco	Food and tobacco
Textiles, apparel, and leather	Textiles, apparel, and leather
Wood	Wood
Other nonmetal products	Other nonmetal products
Metals and metal products	Metals and metal products
Transport equipment	Construction
Other manufacturing	
Construction	Medium skilled
Trade, hotels, and restaurants	Paper and publishing
	Transport equipment
Skilled	Other manufacturing
Paper and publishing	Utilities
Fuel, chemicals, and rubber	Trade, hotels, and restaurants
Machinery and equipment	Transport and communications
Utilities	
Transport and communications	High skilled
Business services	Fuel, chemicals, and rubber
Social and personal services	Machinery and equipment
	Business services
	Social and personal services

Sources: OECD; and IMF staff estimates.

Industrial Classification, Revision 3) into two broad aggregates, namely, unskilled and skilled sectors, as reported in Table 5.1. In order to test the robustness of the results, an alternative three-category split was also used, which distinguishes between low-skill, medium-skill, and high-skill sectors. Figure 5.15 shows that the patterns of the labor shares (and real labor compensation per worker and employment) for the narrower high- and low-skilled aggregates are similar to those for the broader skilled and unskilled aggregates.

Labor Compensation and Labor Shares

Labor compensation was calculated by augmenting the compensation of employees for the income of other categories of workers (self-employed, employers, and family workers). Following Gollin (2002) and for data availability reasons, it was assumed that other categories of workers earn the same average wage as employees. Labor compensation is hence the product of the compensation of employees and the ratio of total employment

and employees.²⁷ Other correction procedures (see Gollin, 2002, for a review), for which the data are not widely available, yield similar patterns over the subset of the sample used in this chapter for which the data are available. This correction was applied at both the aggregate and the sectoral level of data. When sectoral data on employees or total employment were not available, the following procedure was used:

- the ratio of total employment to total employees was assumed to be the same as in previous years or, if it was not available for any year, it was assumed to be equal to the average for this sector across other OECD economies; and
- the sum of “nonemployee” workers across sectors was constrained to add up to the total for the aggregate economy by scaling the imputed number of nonemployee workers proportionately.

The variables are defined as follows. Real labor compensation is labor compensation deflated by the CPI index from the World Economic Outlook database. The labor share is calculated as the ratio of labor compensation and value added at basic prices.²⁸ The share of labor in skilled (unskilled) sectors is the ratio of labor compensation in skilled (unskilled) sectors to the economy-wide value added.

The main data source is the OECD’s Structural Analysis (STAN) Database. However, several other sources were used to fill in missing data and extend the series to the most recent year possible. For employees’ compensation and value added, these include the OECD’s National Accounts Statistics, the UN’s *National Accounts Statistics*, and Haver Analytics (for Japan). For data on total employment and employees, the additional sources were the OECD’s Employment and Labor Market Statistics Database and the ILO Labor Statistics Database. Due to data

availability reasons, the calculations were limited to advanced OECD economies.

Manufacturing Wages

Manufacturing wages for advanced and developing economies are from the UNIDO Industrial Statistics Database. They were converted into constant purchasing power parity (PPP) dollars using CPI indices and PPP exchange rates from the World Economic Outlook database. The data for China are from the CEIC Asia database.

Immigration

The data on foreign labor force are from the OECD’s *Trends in International Migration* (2003 edition for all countries except the United States). For the United States, the data are from the U.S. Census Bureau and the U.S. Bureau of Labor Statistics. Data for Italy, the Netherlands, Norway, and the United Kingdom are for foreign employment instead of labor force. Data for Australia, Canada, and the United States refer to foreign-born labor force instead of foreign labor force. The available series were extended backward using growth rates from the stock of foreign (or foreign-born, in the case of Australia, Canada, and the United States) population when available, and the missing years were interpolated.

Data on emigration for 1990 and 2000 are from Docquier and Marfouk (2005) and refer to the stock of emigrants to the OECD economies.

Trade and Offshoring

Data on trade used in the chapter are from a variety of sources. Aggregate data on trade quantities and prices are from the World Economic Outlook database, including for the non-oil goods and services aggregates. Sectoral trade data for advanced economies (used to construct skilled and unskilled trade) are from the OECD STAN Industrial Database (for manufacturing) and from the OECD International Trade in Services Database (for services). For developing countries, sectoral trade data were obtained from the World Integrated Trade Solution (for

²⁷Korea was excluded from the sample because some of the income of the self-employed is already in the employees’ compensation, making it impossible to apply the correction (see also Young, 1995 and 2003).

²⁸The exceptions are Japan, where value added is measured at producer prices, and the United States, where it is measured at market prices.

manufacturing) and from the IMF's *Balance of Payments Statistics* (for services). Data on manufacturing trade of advanced OECD economies by source country are from the OECD STAN Bilateral Trade Database. The services data for India were extended using the CEIC Asia database.

Offshore outsourcing is the outsourcing of intermediate production to companies in locations outside the country, which can be foreign affiliates or independent companies. It is measured by the imports of intermediate inputs, as provided in the OECD Input-Output Tables (1995, 2002, and 2006 editions). These tables assume that an industry uses an import of a particular product in proportion to its total use of that product ("the import proportionality assumption"), and this proportion is the economy-wide share of imports in domestic demand. The measure used in the chapter only includes nonfuel manufacturing and services inputs. Imported intermediate inputs of a sector are scaled by either the sector's gross output or its total use of intermediates. Sectoral offshoring intensities are then aggregated based on sectoral gross output weights. Finally, the data on the overall offshoring intensity are interpolated for missing years.

For years beyond 2000, the OECD data were extended using the latest input-output table available (2000 for most countries) and updating the data on the import proportions for each category of intermediate input. The latter was approximated by the share of imports in domestic absorption (consumption and investment) for that category of products (sector). Data on imports by sectors are from the OECD STAN Industrial Database for manufacturing and from the OECD International Trade in Services Database for services. Data on value added by sector (used to calculate absorption) are from a combination of the OECD STAN Industrial Database and the Groningen 60-Industry Database.²⁹

²⁹Sectoral offshoring intensities were aggregated using sectoral value-added weights, due to the lack of data on sectoral gross output for the later years. The historical and extended series were then spliced using growth rates.

Imports of final goods and services are constructed as a residual by subtracting imported intermediate inputs from total imports.

Global Labor Supply

Several measures of the global labor supply are calculated, including the world's working-age population, the world's labor force, and an export-weighted world's labor force. The latter attempts to measure the presence of the countries' labor supply in the international market and is calculated as the sum across countries of national labor forces, each weighted by the country's ratio of non-oil exports to GDP (Harrigan and Balaban, 1999). The export-to-GDP ratio is capped to one to limit the weight of countries specialized in re-export trade. Data on working-age population and labor force are from various sources, including the World Economic Outlook, the World Bank's World Development Indicators, the United Nations Population Projections, and the CEIC Asia databases. The global labor supply by education level is calculated using the Barro-Lee (2000) data set on educational attainment of the population aged 15 or more. It is assumed that the share of the labor force with higher education is about the same as the share of the population aged 15 or more with higher education. For the years 2001–05, this share was extrapolated linearly for each country.

The projections of the global labor supply for 2006–50 are based on the UN projections of the working-age population. The labor force participation rate in each country is assumed to converge by 2050 to the current rate of labor force participation in the United States. Assuming instead that labor force participation rates remain at their current levels does not have much effect on the global labor supply projections. Projections for the export-to-GDP ratio are based on country-specific *World Economic Outlook* projections until 2012, and on the trend increase observed in the world export-to-GDP ratio for later years. Under these assumptions, the cumulative growth in the export-weighted global labor force over 2005–50 could range

from a low of 120 percent (under the low variant of the population projections) to a high of 190 percent (under the high variant).

Capital Stock and ICT Capital

Fajnzylber and Lederman (1999) are the source of the capital stock series for the entire economy. This data set extends the capital stock series estimated by Nehru and Dhareshwar (1993) by adding the annual flow of gross fixed capital formation and assuming a 4 percent depreciation rate to the preexisting stock of capital.

Jorgenson and Vu (2005) provide series on IT investment using national expenditure data for computer hardware, software, and telecommunications equipment. A perpetual inventory method applies varying depreciation rates to estimate IT capital stock. This method assumes a geometric depreciation rate of 31.5 percent and a service life of 7 years for computer hardware, 31.5 percent and 5 years for software, and 11 percent and 11 years for telecommunications equipment.

Labor Market Policy Indicators

The indicators of labor and product market policies were provided by Bassanini and Duval (2006). The indicators are defined as follows:

- Average unemployment benefit replacement rate is the average of the unemployment benefit replacement rates corresponding to multiple income, family, and unemployment duration situations. These include two income situations (100 percent and 67 percent of the average production worker earnings), three family situations (single, with dependent spouse, with spouse in work), and three unemployment durations (1st year, 2nd and 3rd years, and 4th and 5th years of unemployment). The original data are from the OECD's Benefits and Wages Database.
- Labor tax wedge is the difference between the labor cost to the employer and the corresponding net take-home pay of the employee for a single-earner couple with two children earning 100 percent of the

average production worker earnings. It is thus the sum of personal income tax and all social security contributions expressed as a percentage of the total labor cost. The original data are from the OECD Taxing Wages Database.

- Employment protection legislation is the OECD summary indicator of the stringency of Employment Protection Legislation. The original data are from the *OECD Employment Outlook* (2004).
- Product market regulation is the OECD summary indicator of regulatory impediments to product market competition in seven nonmanufacturing industries (gas, electricity, post, telecom, passenger air transport, railways passenger and freight services, and road freight). The original data are from Conway and others (2006).
- Union density measures the share of workers affiliated with a trade union. The original data are from the *OECD Employment Outlook* (2004).

Econometric Approach

This section presents the model used to examine the relationship between globalization and labor shares and reports the results from the estimations.

Methodology

The econometric approach used in this chapter is based on a model used frequently in the trade literature (see Feenstra, 2004; Harrigan, 1998; and Kohli, 1991). The model uses a revenue function with fixed factor quantities (of labor and capital) and exogenous product prices (of exports, imports, and domestic absorption). It assumes that firms are maximizing profits, all markets are competitive, and factors can move freely between firms. The revenue function is linearly homogeneous and concave in factor quantities and convex in product prices. It is typically specified as a flexible translogarithmic, or translog, form (Christensen, Jorgenson, and Lau, 1975).

Using the translog revenue function, product and factor shares can be obtained as

$$S_i = \frac{p_i y_i}{G} = \alpha_i + \sum \alpha_{ij} \ln p_j + \sum \gamma_{ij} \ln v_j + \sum \phi_{ij} z_j$$

$$R_i = \frac{w_i v_i}{G} = \beta_i + \sum \gamma_{ij} \ln p_j + \sum \beta_{ij} \ln v_j + \sum \phi_{ij} z_j,$$

where S are product shares, R are factor shares, p are product prices, v are factor quantities, and z are shift variables. The shift variables capture any factors that could be expected to shift the revenue function, for example, measures of technological progress or offshoring, as suggested by Feenstra (2004). The share equations are subject to a number of cross-equation restrictions that follow from symmetry and linear homogeneity of the corresponding revenue function.

Given the theme of this chapter, the estimations focused primarily on the labor share equations. The following equation was adopted as the basic specification for the analysis:

$$R_L = \beta_L + \gamma_{EL} \ln \frac{p_E}{p_A} + \gamma_{ML} \ln \frac{p_M}{p_A} + \beta_{LL} \ln \frac{L}{K} + \phi_{LX} X + \phi_{LM} \frac{L_M}{L} + \phi_{LC} \frac{K_{ICT}}{K} + \phi_{LC2} \left(\frac{K_{ICT}}{K} \right)^2 + \varepsilon_L,$$

where P_E , P_M , and P_A are prices of exports, imports, and absorption; L is labor; K is capital; X is offshoring; L_M is immigrant employment; and K_{ICT} is ICT capital. The relative prices and quantities are used to impose the necessary homogeneity restrictions. Labor shares are corrected for the income of other (nonemployee) categories of workers, prices and the capital stock variables are measured in 2000 U.S. dollars, and labor stock variables are represented by employment. Offshoring is measured as a share of imported intermediate inputs in total intermediate inputs, immigration is captured as a share of immigrant employment in total domestic employment, and ICT capital is modeled as a share of ICT capital in the total capital stock (more detail on these measurements is provided above). The effect of ICT capital is represented by a quadratic function

to reflect potential nonlinearities associated with the need for learning the new technology: the adverse effect on wages and employment is likely to be greatest before workers acquire the skills necessary to effectively handle the new equipment. The model was estimated on a panel of 18 countries over 1982–2002 using country fixed effects. The basic specification was extended to include several measures of labor market policies, including the tax wedge, the replacement rate of unemployment benefits, indices of product market regulation, employment protection legislation, and union density.³⁰

A potential concern with the accuracy of the estimation is that the variables related to labor globalization—trade prices, offshoring, and immigration—may be endogenous. Trade prices are unlikely to be exogenous for countries whose economic size is sufficiently large.³¹ Reverse causality or common third factors may bias the effects of offshoring and immigration on the labor share. To address this concern, an instrumental variables estimation was used with variables reflecting domestic and foreign supply and demand conditions, as well as lags of the potentially endogenous variables as instruments. Specifically, the list of instruments included the share of government consumption in GDP; the consumption tax rate; the (log of) total population; the (log of) export-weighted real GDP of trading partners; the distance-weighted export-adjusted employment in the rest of the world (a measure of the global labor supply); and lags of (logs of) relative trade prices, offshoring, and immigration.

In addition to the aggregate labor share equation, a system of labor share equations for skilled and unskilled workers was also estimated as follows:

³⁰A specification including interaction terms between these policy variables and measures of labor globalization and technological progress was also explored.

³¹The price of absorption could also be affected by changes in the labor share, which reflect changes in unit labor costs.

$$R_S = \beta_S + \sum_{k=E,M} \gamma_{kS} \ln \frac{p_k}{p_A} + \sum_{k=S,U} \beta_{Sk} \ln \frac{L_k}{K} + \phi_{SX} X$$

$$+ \phi_{SM} \frac{L_M}{L} + \phi_{SC} \frac{K_{ICT}}{K} + \phi_{SC2} \left(\frac{K_{ICT}}{K} \right)^2 + \varepsilon_S$$

$$R_U = \beta_U + \sum_{k=E,M} \gamma_{kU} \ln \frac{p_k}{p_A} + \sum_{k=S,U} \beta_{kU} \ln \frac{L_k}{K} + \phi_{UX} X$$

$$+ \phi_{UM} \frac{L_M}{L} + \phi_{UC} \frac{K_{ICT}}{K} + \phi_{UC2} \left(\frac{K_{ICT}}{K} \right)^2 + \varepsilon_U,$$

where S and U denote skilled and unskilled, respectively, and the other variables are the same as above. A symmetry restriction postulates that the coefficients on the (log of) labor-capital ratio of the unskilled in the first equation and the skilled in the second equation are the same. This system was augmented to include country fixed effects and the measures of labor market policies, and was estimated by iterated three-stage least squares using the instruments listed above.

Estimation Results

The estimation results from the aggregate labor share equation are shown in Table 5.2. Most of the variables are statistically significant and have expected signs:

- Higher relative export prices and lower relative import prices are associated with the lower labor share. This is consistent with advanced economies' exports being relatively capital intensive and their imports, which increasingly come from developing countries, being relatively labor intensive.
- Offshoring and immigration are negatively related to the labor share, consistent with the rising global labor supply exerting a negative effect on domestic labor demand. The coefficients on these variables in the instrumental variables regression are somewhat larger in absolute value, suggesting the presence of reverse causality: a lower labor share, which reflects lower unit labor costs, makes offshoring less appealing for domestic firms and makes immigration less attractive for foreign workers.
- Technological progress appears to have a nonlinear effect on the labor share, consistent with

Table 5.2. Impact of Labor Globalization and Technological Change on Labor Shares

Dependent Variable: Labor Share	Fixed Effects Estimation (excluding labor market policies)	Fixed Effects Estimation	Instrumental Variables Estimation
Relative export price (log of)	-0.117***	-0.113***	-0.165***
Relative import price (log of)	0.076**	0.087***	0.138***
Labor-capital ratio (log of)	0.055**	0.015	-0.025
Offshoring	-0.196*	-0.156*	-0.285***
Immigration	-0.627***	-0.553***	-0.746***
ICT capital	-2.871***	-2.643***	-3.517***
ICT capital squared	56.407***	44.962***	55.598***
Tax wedge	...	-0.002*	-0.002***
Unemployment benefits	...	-0.001***	-0.001***
Fixed effects	Yes	Yes	Yes
Observations	231	225	208
R-squared	0.61	0.62	
Anderson test	...	...	151.63***
Hansen test	...	...	6.61

Source: IMF staff calculations.

Note: * denotes statistical significance at the 10 percent level; ** denotes statistical significance at the 5 percent level; and *** denotes statistical significance at the 1 percent level. Standard errors are heteroscedasticity and autocorrelation robust. ICT = information and communications technology.

the idea that labor-saving innovations initially create the need for extra learning on the part of workers, but enhance their productivity later on as the necessary skills are acquired.

- Among the policy variables, only higher tax wedges and unemployment benefit replacement rates are associated with a lower labor share, reflecting labor market rigidities stemming from these policies.³² A nonlinear specification including interaction terms with labor globalization and technological progress variables suggested, in addition, that employment protection legislation tends to increase the effects of these variables on the labor share.

³²Other labor and product market variables, specifically, the index of employment protection legislation, the index of product market regulation, and the union density measure, were not statistically significant and were, therefore, excluded from the final specification.

Table 5.3. Impact of Labor Globalization and Technological Change on Skilled and Unskilled Labor Shares

Dependent Variable	Fixed Effects Estimation		Instrumental Variables Estimation		Three-Stage Least Square Estimation	
	Skilled labor share	Unskilled labor share	Skilled labor share	Unskilled labor share	Skilled labor share	Unskilled labor share
Log of:						
Relative export price	-0.072***	-0.049***	-0.117***	-0.060***	-0.115***	-0.058***
Relative import price	0.053***	0.031**	0.089***	0.041***	0.097***	0.044***
Skilled labor-capital ratio	0.093**	-0.203***	0.075**	-0.210***	0.156***	-0.163***
Unskilled labor-capital ratio	-0.089***	0.181***	-0.098***	0.177***	-0.163***	0.143***
Offshoring	-0.134*	-0.016	-0.203***	-0.052	-0.191***	-0.043
Immigration	-0.507***	-0.162**	-0.678***	-0.225**	-0.663***	-0.216***
ICT capital	-0.808	-0.922*	-1.413*	-1.099**	-2.046***	-1.409***
ICT capital squared	22.358*	10.458	29.792***	13.346*	38.688***	17.860***
Tax wedge	-0.001	-0.001**	-0.002***	-0.001***	-0.002***	-0.001***
Unemployment benefits	-0.001**	-0.000*	-0.001***	-0.000**	-0.001***	-0.000***
Product market regulation	0.000	0.002	0.001	0.002**	0.000	0.002**
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	219	219	202	202	202	202
R-squared	0.53	0.94	...	...	...	...
Anderson test	...	...	140.83***	140.83***	...	...
Hansen test	...	...	7.7	8.4	...	...

Source: IMF staff calculations.

Note: * denotes statistical significance at the 10 percent level; ** denotes statistical significance at the 5 percent level; and *** denotes statistical significance at the 1 percent level. Standard errors are heteroscedasticity and autocorrelation robust. ICT = information and communications technology.

The findings are generally robust to the exclusion of outliers (identified in terms of their influence on predicted values and the variance-covariance matrix of the estimates) and of individual countries.³³ They are also robust to splitting the import price into that of oil and non-oil imports (while the oil price has a statistically significant effect on the labor share, it is small in magnitude). The coefficients on the ICT capital stock, its square, and offshoring become statistically insignificant when time effects are included. This is not surprising since time effects are often used in empirical studies to capture the effect of worldwide technological progress and other broad global trends. The time effects show a declining pattern over time, consistent with the negative effect of the growth

in the ICT capital stock and offshoring on the labor share. The coefficients on the share of ICT capital are more robust to the inclusion of time effects when measured as a share of investment, rather than of capital stock. Similarly, the coefficient on offshoring of skilled inputs is more robust to the inclusion of time effects than that on total offshoring.

The estimation results from the labor share equations for skilled and unskilled sectors are shown in Table 5.3. The first two columns contain independent fixed effects estimations of the two equations, the middle two columns present independent instrumental variables estimations, and the last two columns show the system estimation with the cross-equation restriction imposed. Labor globalization and technological progress appear to have somewhat different effects on the labor shares of workers in skilled and unskilled sectors. Labor globalization has a somewhat stronger effect on the skilled sectors, in line, for example,

³³Partial correlation plots, showing the correlation between the labor share and each regressor after controlling for the other explanatory variables, confirm that the estimated relationships are quite robust.

with more offshoring occurring in the skilled sectors. Technological change affects both skill groups negatively, but the effect is less strong for the skilled, consistent with the nonlinearity due to learning requirements, as suggested above. These results should be treated as somewhat more tentative, however, given that the classification by skill is based on broad economic sectors.

The contributions of the various factors to the change in the labor shares shown in the main text are calculated as the average annual change in the respective variable multiplied by the corresponding coefficient estimate. The averages across country groups are weighted by the number of years of data available for each country, so that countries with more data receive a larger weight in these averages. These contributions allow introducing cross-country differences in the role of various factors, although they do not fully reflect cross-country heterogeneity, since the estimated coefficients are the same for all countries in the sample.

Elasticity Calculations

The econometric model used in this chapter allows going beyond the effects of various factors on the labor share by computing the elasticities of labor compensation per worker and employment to these factors (Kohli, 1991).

The elasticities of labor compensation per worker to trade prices (given employment) are obtained as follows:

$$\varepsilon(W, p_i) = \frac{\gamma_{iL}}{R_L} + S_i,$$

where $i = E, M$, and the output shares R_L and S_i are evaluated at the mean for each country.

The employment elasticities with respect to trade prices (given labor compensation per worker) are obtained as follows:

$$\varepsilon(L, p_i) = -\frac{\varepsilon(W, p_i)}{\varepsilon(W, L)},$$

$$\text{where } \varepsilon(W, L) = \frac{\beta_{LL}}{R_L} + R_L - 1 \text{ and } i = E, M.$$

Combining these elasticities gives the elasticity of the total labor compensation to trade prices:

$$\varepsilon(WL, p_i) = \varepsilon(W, p_i) + \varepsilon(L, p_i),$$

where $i = E, M$. It is important to point out that these elasticities are derived from the model that assumes fixed prices, hence possible price adjustments are not taken into account in these calculations.³⁴

To compute the actual percent changes in the total labor compensation resulting from changes in trade prices, these elasticities are multiplied by the average percent changes in relative trade prices in each country. The averages across country groups are weighted by the number of years of data available for each country, so that countries with more data receive a larger weight in these averages. The results are shown in the main text.

References

- Amiti, Mary, and Shang-Jin Wei, 2005, "Fear of Service Outsourcing: Is It Justified?" *Economic Policy*, Vol. 20 (April), pp. 308–47.
- , 2006, "Service Offshoring and Productivity: Evidence from the United States," NBER Working Paper No. 11926 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Annett, Anthony, 2006, "Lessons from Successful Labor Market Reformers in Europe," in *Euro Area Policies: Selected Issues*, IMF Country Report No. 06/288 (Washington: International Monetary Fund).
- Aydemir, Abdurrahman, and George J. Borjas, 2006, "A Comparative Analysis of the Labor Market Impact of International Migration: Canada, Mexico, and the United States," NBER Working Paper No. 12327 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Barro, Robert J., and Jong-Wha Lee, 2000, "International Data on Educational Attainment: Updates

³⁴Further, the elasticities of the total labor compensation to import and export prices might be somewhat overestimated since the elasticity of the wage (employment) assumes constant employment (wage). However, the net effect of trade prices on total labor compensation should not be affected much.

- and Implications," CID Working Paper No. 42 (Cambridge, Massachusetts: Center for International Development).
- Bassanini, Andrea, and Romain Duval, 2006, "Employment Patterns in OECD Countries: Reassessing the Role of Policies and Institutions," OECD Economics Department Working Paper No. 486 (Paris: Organization for Economic Cooperation and Development).
- Berg, Andrew, and Anne O. Krueger, 2003, "Trade, Growth, and Poverty: A Selective Survey," IMF Working Paper 03/30 (Washington: International Monetary Fund).
- Blanchard, Olivier, 1998, "Revisiting European Unemployment: Unemployment, Capital Accumulation and Factor Prices," NBER Working Paper No. 6566 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Blinder, Alan S., 2006, "Offshoring: The Next Industrial Revolution?" *Foreign Affairs*, Vol. 85 (March/April).
- Borjas, George J., 1994, "The Economics of Immigration," *Journal of Economic Literature*, Vol. 32 (December), pp. 1667–717.
- , 1995, "The Economic Benefits from Immigration," *Journal of Economic Perspectives*, Vol. 9 (Spring), pp. 3–22.
- Cardarelli, Roberto, and Kenichi Ueda, 2004, "Domestic and Global Perspectives of Migration to the United States," in *United States: Selected Issues*, IMF Country Report No. 04/228 (Washington: International Monetary Fund).
- Christensen, Laurits R., Dale W. Jorgenson, and Lawrence J. Lau, 1975, "Transcendental Logarithmic Utility Functions," *American Economic Review*, Vol. 65 (June), pp. 367–83.
- Conway, Paul, Donato de Rosa, Giuseppe Nicoletti, and Faye Steiner, 2006, "Regulation, Competition and Productivity Convergence," OECD Economics Department Working Paper No. 509 (Paris: Organization for Economic Cooperation and Development).
- Davis, Donald R., and Prachi Mishra, 2007, "Stolper-Samuelson Is Dead, and Other Crimes of Both Theory and Data," in *Globalization and Poverty*, ed. by Ann Harrison (Chicago: University of Chicago Press and National Bureau of Economic Research).
- Docquier, Frédéric, and Abdeslam Marfouk, 2005, "International Migration by Educational Attainment, 1990–2000," in *International Migration, Remittances and the Brain Drain*, ed. by Ç. Özden and M. Schiff (Washington: World Bank).
- Dutta, Puja Vasudeva, 2004, "Trade Protection and Inter-Industry Wages in India," PRUS Working Paper No. 27 (Sussex: Poverty Research Unit, Department of Economics, University of Sussex).
- Edmonds, Eric, Nina Pavcnik, and Petia Topalova, 2007, "Trade Adjustment and Human Capital Investments: Evidence from Indian Tariff Reform," NBER Working Paper No. 12884 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Fajnzylber, Pablo, and Daniel Lederman, 1999, "Economic Reforms and Total Factor Productivity Growth in Latin America and the Caribbean (1950–95)—An Empirical Note," Policy Research Working Paper No. 2114 (Washington: World Bank).
- Feenstra, Robert C., 2004, *Advanced International Trade: Theory and Evidence* (Princeton, New Jersey: Princeton University Press).
- , 2007, "Globalization and Its Impact on Labor," Global Economy Lecture 2007, Vienna Institute for International Economic Studies, Vienna, February 8. Available via the Internet: <http://www.econ.ucdavis.edu/faculty/fzfeens/papers.html>.
- Feliciano, Zadia M., 2001, "Workers and Trade Liberalization: The Impact of Trade Reforms in Mexico on Wages and Employment," *Industrial and Labor Relations Review*, Vol. 55 (October), pp. 95–115.
- Freeman, Richard B., 1995, "Are Your Wages Set in Beijing?" *Journal of Economic Perspectives*, Vol. 9 (Summer), pp. 15–32.
- , 2006, "Labor Market Imbalances: Shortages, or Surpluses, or Fish Stories?" paper presented at the Boston Federal Reserve Economic Conference, "Global Imbalances—As Giants Evolve," Chatham, Massachusetts, June 14–16.
- Goh, Chor-Ching, and Beata S. Javorcik, 2007, "Trade Protection and Industry Wage Structure in Poland," in *Globalization and Poverty*, ed. by Ann Harrison (Chicago: University of Chicago Press and the National Bureau of Economic Research).
- Goldberg, Pinelopi, and Nina Pavcnik, 2005, "Trade, Wages, and the Political Economy of Trade Protection: Evidence from the Colombian Trade Reforms," *Journal of International Economics*, Vol. 66 (May), pp. 75–105.
- , forthcoming, "Distributional Effects of Globalization in Developing Countries," *Journal of Economic Literature*.

- Gollin, Douglas, 2002, "Getting Income Shares Right," *Journal of Political Economy*, Vol. 110 (April), pp. 458–74.
- Greenwood, Michael J., Gary Hunt, and Ulrich Kohli, 1996, "The Short-Run and Long-Run Factor-Market Consequences of Immigration to the United States," *Journal of Regional Science*, Vol. 36 (February), pp. 43–66.
- Grossman, Gene M., and Esteban Rossi-Hansberg, 2006, "The Rise of Offshoring: It's Not Wine for Cloth Anymore," paper presented at Federal Reserve Bank of Kansas City symposium, "The New Economic Geography: Effects and Policy Implications," Jackson Hole, Wyoming, August 24–26. Available via the Internet: <http://www.kc.frb.org/PUBLICAT/SYMPOS/2006/PDF/Grossmanand-Rossi-Hansberg.paper.0831.pdf>.
- Gupta, Sanjeev, Catherine Pattillo, and Smita Wagh, 2007, "Impact of Remittances on Poverty and Financial Development in Sub-Saharan Africa," IMF Working Paper 07/38 (Washington: International Monetary Fund).
- Guscina, Anastasia, 2006, "Effects of Globalization on Labor's Share in National Income," IMF Working Paper 06/294 (Washington: International Monetary Fund).
- Hanson, Gordon, forthcoming, "Emigration, Labor Supply, and Earnings in Mexico," in *Mexican Immigration to the United States*, ed. by George Borjas (Chicago: University of Chicago Press and National Bureau of Economic Research).
- , 2007, "Globalization, Labor Income, and Poverty in Mexico," in *Globalization and Poverty*, ed. by Ann Harrison (Chicago: University of Chicago Press and National Bureau of Economic Research).
- Harrigan, James, 1998, "International Trade and American Wages in General Equilibrium, 1967–1995," Staff Report No. 46 (New York: Federal Reserve Bank of New York).
- , and Rita A. Balaban, 1999, "U.S. Wages in General Equilibrium: The Effects of Prices, Technology, and Factor Supplies, 1963–1991," NBER Working Paper No. 6981 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Harrison, Anne E., 2002, "Has Globalization Eroded Labor's Share? Some Cross-Country Evidence" (unpublished; Berkeley, California: University of California at Berkeley).
- International Labor Office and World Trade Organization, 2007, *Trade and Employment: Challenges for Policy Research* (Geneva: International Labor Organization).
- Jean, Sébastien, and Giuseppe Nicoletti, 2002, "Product Market Regulation and Wage Premia in Europe and North America: An Empirical Investigation," OECD Economics Department Working Paper No. 318 (Paris: Organization for Economic Cooperation and Development).
- Jensen, J. Bradford, and Lori G. Kletzer, 2005, "Tradable Services: Understanding the Scope and Impact of Services Outsourcing," IIE Working Paper No. 05-9 (Washington: Institute for International Economics).
- Jorgenson, Dale W., and Khuong Vu, 2005, "Information Technology and the World Economy," *Scandinavian Journal of Economics*, Vol. 107 (December), pp. 631–50.
- Katz, Larry F., and David H. Autor, 1999, "Changes in the Wage Structure and Earnings Inequality," in *Handbook of Labor Economics*, Vol. 3A, ed. by Orley C. Ashenfelter and David Card (Amsterdam: North-Holland).
- Kohli, Ulrich, 1991, *Technology, Duality, and Foreign Trade: The GNP Function Approach to Modeling Imports and Exports* (Ann Arbor: University of Michigan Press).
- Kumar, Utsav, and Prachi Mishra, forthcoming, "Trade Liberalization and Wage Inequality: Evidence from India," *Review of Development Economics*.
- Lewer, Joshua J., and Hendrik Van den Berg, 2003, "How Large Is International Trade's Effect on Economic Growth?" *Journal of Economic Surveys*, Vol. 17 (July), pp. 363–96.
- Mishra, Prachi, 2006, "Emigration and Brain-Drain: Evidence from the Caribbean," IMF Working Paper 06/25 (Washington: International Monetary Fund).
- , 2007, "Emigration and Wages in Source Countries: Evidence from Mexico," *Journal of Development Economics*, Vol. 82 (January), pp. 180–99.
- Nehru, Vikram, and Ashok Dhareshwar, 1993, "A New Database on Physical Capital Stock: Sources, Methodology, and Results," *Revista de Análisis Económico*, Vol. 8, No. 1, pp. 37–59.
- Olsen, Karsten Bjerring, 2006, "Productivity Impacts of Offshoring and Outsourcing: A Review," OECD Science, Technology and Industry Working Paper No. 2006/1 (Paris: Organization for Economic Cooperation and Development).
- Organization for Economic Cooperation and Development (OECD), 2004, *OECD Employment Outlook* (Paris).

- , 2005, "Trade-Adjustment Costs in OECD Labour Markets: A Mountain or a Molehill?" in *OECD Employment Outlook* (Paris).
 - , 2006a, "The Internationalization of Production, International Outsourcing and OECD Labour Markets" (Paris).
 - , 2006b, "Migration in OECD Countries: Labour Market Impact and Integration Issues" (Paris).
- Pavcnik, Nina, Andreas Blom, Pinelopi Goldberg, and Norbert Schady, 2004, "Trade Liberalization and Industry Wage Structure: Evidence from Brazil," *World Bank Economic Review*, Vol. 18, No. 3, pp. 319–44.
- Porto, Guido, 2006, "Using Survey Data to Assess the Distributional Effects of Trade Policy," *Journal of International Economics*, Vol. 70 (September), pp. 140–60.
- Rodrik, Dani, 2006, "What's So Special About China's Exports?" NBER Working Paper No. 11947 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Slaughter, Matthew J., 2001, "International Trade and Labor-Demand Elasticities," *Journal of International Economics*, Vol. 54 (June), pp. 27–56.
- Topalova, Petia, 2005, "Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty and Inequality from India" (unpublished; Cambridge, Massachusetts: Massachusetts Institute of Technology). Available via the Internet: <http://www.isid.ac.in/~planning/Topalova.pdf>.
- Young, Alwyn, 1995, "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience," *Quarterly Journal of Economics*, Vol. 110 (August), pp. 641–80.
- , 2003, "Gold into Base Metals: Productivity Growth in the People's Republic of China During the Reform Period," *Journal of Political Economy*, Vol. 111 (December), pp. 1220–61.
- World Bank, 2006, *Global Economic Prospects 2007: Managing the Next Wave of Globalization* (Washington).