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February 28, 1997

To: Members of the Executive Board

From: The Secretary

Subject: **Background Studies for the World Economic Outlook**

The attached papers on deindustrialization and on the effects of trade on wages in advanced economies have been prepared as background studies for the World Economic Outlook tentatively scheduled for discussion on March 31, 1997.

Mr. Ramaswamy (ext. 38591) or Mr. Swagel (ext. 37301) is available to answer technical or factual questions relating to this paper prior to the Board discussion.

Att. (1)

Other Distribution:
Department Heads

that on July 1, 1996, the dual exchange rate system in effect at that time was unified by adopting for all official transactions the floating free market exchange rate which applies to all other transactions in the economy. With the elimination of this multiple currency practice, the exchange system of the Republic of Yemen is now free of restrictions on the making of payments and transfers for current international transactions (EBD/96/161, 12/19/96).

BB. Zaïre

Effective December 27, 1996, the Zaïrian authorities issued new exchange regulations aimed at improving the transparency of the foreign exchange market, superseding all previous regulations, and providing for a complete liberalization of the foreign exchange and trade system, including freely determined exchange rates, the lifting of all restrictions on current and capital transactions, and the elimination of surrender requirements.

INTERNATIONAL MONETARY FUND

Background Studies for the World Economic Outlook

Prepared by the Research Department

Approved by Michael Mussa

February 26, 1997

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PART I. DEINDUSTRIALIZATION: CAUSES AND IMPLICATIONS

All advanced economies have experienced a secular decline in the share of manufacturing employment--a phenomenon referred to as deindustrialization. This paper argues that, contrary to popular perceptions, deindustrialization is not a negative phenomenon, but is the natural consequence of the industrial dynamism in an already developed economy, and North-South trade has had very little to do with deindustrialization.

I. INTRODUCTION¹

1. Three broad developments have caused concern in the advanced economies in recent years: (i) the shrinking share of manufacturing employment; (ii) the stagnation of average real wages and the rise in inequality of earnings since 1973 in the United States; and (iii) the massive rise in unemployment since the early 1970s in much of Europe.² These developments have coincided with what is commonly perceived to have been a period of unusually rapid growth in trade and capital movements--particularly between the advanced and developing countries. The coexistence of these phenomena has tended to foster the perception of a causal link from "globalization" to the labor market problems confronting the advanced economies. The main focus of this paper is on the causes of the long-term decline in the share of manufacturing employment in the advanced economies--a phenomenon referred to as "deindustrialization." It is, however, useful in this context to review briefly the debate on the inter-relationships among globalization, earnings inequality and unemployment, before moving on to the issue of deindustrialization.

2. There has been a wide ranging academic debate in the United States about the extent to which trade with the developing countries has contributed to the widening of the earnings inequality between skilled and unskilled labor. International trade economists such as Lawrence and Slaughter (1993), Krugman and Lawrence (1994), Bhagwati (1995), and Krugman (1996) have argued that the decline in unskilled wages, and the growing inequality of earnings between skilled and unskilled labor in the last two decades in the United States have very little to do with the growing trade links with the developing countries. Their arguments are that manufactured imports from the developing countries constitute only a small fraction of U.S. GDP--just over 2 percent in 1994, and that there is very little evidence

¹This paper was prepared by Ramana Ramaswamy of the Research Department and Robert Rowthorn of Cambridge University.

²In this paper, "advanced economies" refer in most contexts to the "industrial countries" as traditionally defined in the World Economic Outlook, while "developing countries" include the newly industrialized economies. The empirical analysis has been conducted on that basis because deindustrialization so far has been most pronounced in the "industrial" economies. However, deindustrialization is a process that is now under way in all advanced economies.

of Stolper-Samuelson effects in the United States--i.e., of a trade-induced decline in the relative prices of goods whose production uses unskilled labor intensively. The inference drawn is that other factors, such as skill-biased technological change--especially the increased use of computers--provide the main explanation for the widening inequality of earnings between skilled and unskilled workers.³

3. A different viewpoint is that of Wood (1994, 1995) and Freeman (1995) who argue that manufactured imports from the developing countries are highly labor intensive, and displace many times more workers in the advanced economies than their dollar value would suggest. Their argument implies that North-South trade could result in major job losses for unskilled workers in advanced economies even when the import penetration ratio is low, and trade between the two groups is balanced.⁴ However, even the economists who are sympathetic to the hypothesis that North-South trade did have an adverse impact on the demand for unskilled labor in the advanced economies, do not identify it to be the main factor.⁵

4. As pointed out earlier, the main focus of this paper is on deindustrialization--the term used in the literature to refer to the secular decline in the share of manufacturing employment in the advanced economies. Deindustrialization has received relatively little attention in the recent academic debate on "globalization"--for instance, there is very little systematic discussion of the relationship between trade, growth, and the decline of manufacturing employment in the literature reviewed above. Public debate about deindustrialization tends in general to be confined to categorizing it as a problem analogous to the widening disparity of earnings and the rising unemployment in advanced economies. However, there is a conceptual difference between deindustrialization and these other two developments. Unemployment, and the widening disparities in earnings, can be viewed as problems that require solutions. This paper argues that deindustrialization, in contrast, is not a negative phenomenon in its own right. It is an inevitable feature of the process of economic development, predating the emergence of both rising inequality and unemployment in the advanced economies.

³Rowthorn (1992), Wood (1994), and Freeman (1995) argue that the rise in unemployment in continental Europe through the 1980s and into the 1990s can be perceived as the mirror image of the rising inequality of earnings in the United States, a point that has also frequently been made in the *World Economic Outlook*.

⁴In this context, Sachs and Shatz (1994) also dispute the proposition that North-South trade has had no adverse impact on unskilled labor in the advanced economies. They find evidence of Stolper-Samuelson effects between 1978 and 1989 once computer prices (which fell steeply in this period) are excluded from the sample. See also the discussion by Leamer (1996) in this context.

⁵See the companion paper by Slaughter and Swagel (1997) for a more detailed review of the debate on trade and wages.

5. The discussion of deindustrialization in this paper largely follows the approach in Rowthorn and Wells (1987). They extended the earlier contributions of Lengelle (1966), Baumol (1967), and Fuchs (1968), to provide a unified and formal analysis of deindustrialization by linking it explicitly to the process of economic development and the pattern of foreign trade. Rowthorn and Wells' main contribution was in arguing that deindustrialization is not always a pathological phenomenon, but is the normal result of industrial dynamism in an already highly developed economy. Baumol, Blackman and Wolff (1989) extended the analysis of deindustrialization to explore the implications for economic growth when employment shifts predominantly to the service sector.

6. The main propositions of this paper are: (i) deindustrialization is primarily a feature of successful economic development; (ii) North-South trade has had very little to do with deindustrialization; (iii) the pattern of trade specialization among the advanced economies does, however, explain the wide differences in the structure of employment among them; (iv) measured in real terms, the share of domestic expenditure devoted to manufactures has been comparatively stable, and the most important factor accounting for deindustrialization is the systematic tendency of productivity in manufacturing to grow faster than in services; (v) the growth of living standards as well as industrial relations in the advanced economies are likely to be increasingly influenced by developments in the service sector. Appendixes I and II provide a formal analysis of these propositions.

II. DEINDUSTRIALIZATION: THE EVIDENCE

7. Manufacturing employment as a share of civilian employment has declined continuously since the beginning of the 1970s in most advanced economies (Chart 1a). For the group of industrial countries, the share of manufacturing employment declined from about 28 percent in 1970 to about 18 percent in 1994.⁶ There have, of course, been differences among the advanced economies in the extent to which the share of manufacturing employment has declined, and in when the process of deindustrialization got started. Deindustrialization began in earnest as early as the mid-1960s in the United States, and it has experienced one of the steepest declines in the share of manufacturing employment--from about 28 percent in 1965 to 16 percent in 1994. In Japan, in contrast, the share of manufacturing employment began declining later, and has fallen less precipitously than in the United States--from a high of 27.4 percent in 1973 to about 23 percent in 1994. The share of manufacturing employment was comparatively high in 1970 (a bit over 30 percent) in the

⁶"Industrial countries" refers in this paper to the group of 23 countries that are classified as "industrial countries" in the *World Economic Outlook*. "Industrial Countries" also corresponds to the traditional group of OECD countries.

Chart 1a. Employment by Sector as a Share of Total Civilian Employment
(Percent)

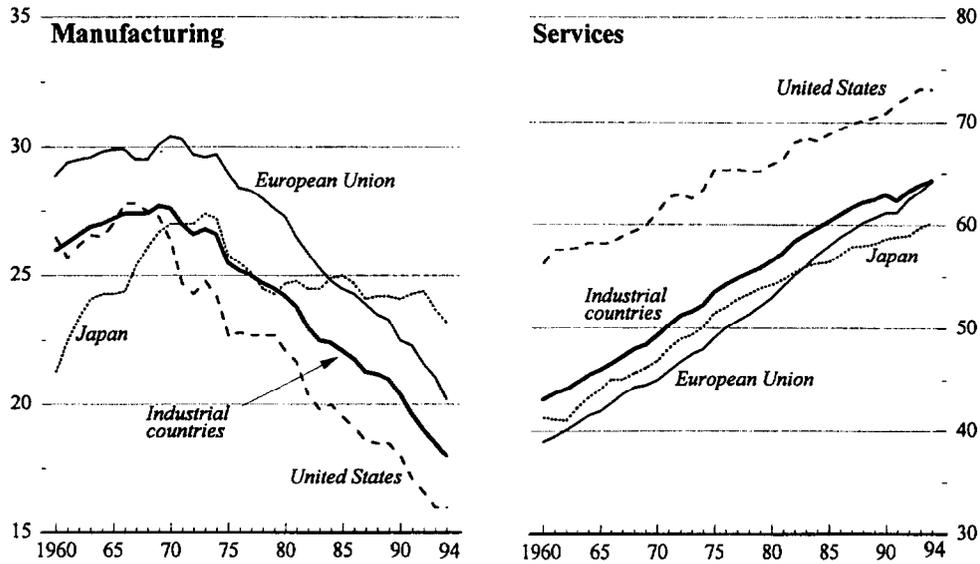
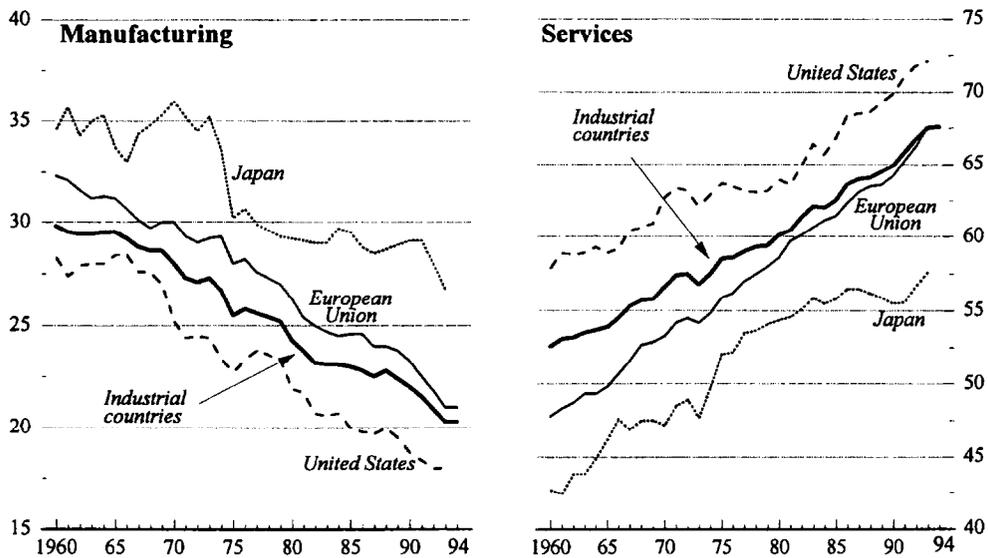


Chart 1b. Value Added by Sector as a Share of GDP at Current Prices
(Percent)



Source: OECD Historical Statistics 1960-94.

combined European Union countries (EU-15), but the decline since then has been steep--and only 20 percent of total civilian employment of this group were in manufacturing in 1994.⁷

8. The other side of this development has been a continuous increase in the share of employment in services in the advanced economies. The increase has been fairly uniform, with all advanced economies having witnessed virtually continuous increases in the share of services employment since 1960. The United States has been one of the pioneers in this context--it started off with a much larger service sector (about 56 percent of civilian employment in 1960), and has currently a higher share of employment in services than any other advanced economy (about 73 percent in 1994). Despite these differences, the overall picture is very similar--most advanced economies have witnessed continuous declines in the share of employment in manufacturing in the last two decades, and a large rise in the share of services.

III. EXPLAINING DEINDUSTRIALIZATION: THE GENERAL ARGUMENTS

9. What accounts for deindustrialization? The analysis will follow a two-step procedure. First, a broad overview of the main factors that account for deindustrialization is provided. This is followed by a more detailed regression analysis that quantifies the importance of the different factors accounting for the observed trends in manufacturing employment in the advanced economies.

10. Looking at Charts 1a and 1b, the declining share of manufacturing employment appears to mirror the decline in the share of manufacturing value added in GDP. That is, deindustrialization appears at first glance to reflect a shift in the pattern of expenditure from manufacturing to services. Rowthorn and Wells (1987), and Baumol, Blackman and Wolff (1989) argued against the hypothesis that such a shift provides the main explanation for deindustrialization. They demonstrated that the growing current price share of services in value added reflected the impact of differential productivity growth--labor productivity has grown more slowly in services than in manufacturing. This has pushed up their relative price, tending to raise the service sector's share of current price output. However, when output in the two sectors is measured in constant prices, there does not appear to be evidence of a shift in expenditure from manufacturing to services that corresponds to the magnitude of the shifts in employment that have taken place between these two sectors in the advanced economies.

⁷The focus of the analysis is on "manufacturing" rather than "industry". The latter definition encompasses, in addition to manufacturing, both mining and construction. The reason for focusing the empirical analysis on manufacturing is because much of the debate about deindustrialization has been about the loss of manufacturing jobs. Moreover, mining is of importance in only a small number of the advanced economies, and employment in the construction sector is volatile, which therefore introduces an element of difficulty in making international comparisons of the industrial sector.

Chart 2a bears this stylized fact out.⁸ For the group of industrial countries, the constant price share of manufacturing value added in GDP is roughly unchanged between 1970 and 1994, in contrast to the current price share, which fell steeply during this period.⁹

11. However, unlike the case for the entire group of industrial countries, the constant price share of manufacturing value added in GDP exhibits a trend for both Japan and the United States (Chart 2a). That is, there appears at first sight to have been a significant shift in the pattern of expenditure--from services to manufacturing in the case of Japan, and from manufacturing to services in the case of the United States--which offers a potential explanation for the differences in the evolution of the share of manufacturing employment in these countries noted earlier. Charts 2a and 2b, however, indicate that in both cases domestic expenditure shifts were not the main driving force. The rise in the constant price share of manufacturing value added in Japan, and the fall in this share in the United States appear to reflect changes in net exports of manufactures in these countries--the rising manufacturing trade surplus in Japan, and the growing trade deficits in manufacturing in the United States. A more systematic analysis is provided below, using regression analysis, to argue that the pattern of trade specialization in manufacturing among the advanced countries is an important factor that accounts for the variation in the structure of employment from one advanced country to another. This analysis also helps to explain why the United States has deindustrialized faster than Japan.

12. If a shift in domestic expenditure from manufacturing to services has not been a major determinant of deindustrialization, what then are the main explanations for this phenomenon? More specifically, there is a need to account for two features that can be observed from Chart 1a: (i) the rise in the share of manufacturing employment in most advanced economies until the late 1960s, and the continuous decline in this share thereafter; and (ii) the sustained increase in the share of services employment throughout this period.

⁸It is shown below that the structure of foreign trade in manufactures for the group of industrial countries has been relatively stable over time. Consequently, observed trends in manufacturing output in this context broadly reflect expenditure shares.

⁹The observed stability of the real output share of manufacturing is likely to be the outcome of offsetting income and price effects on demand. The income elasticity of demand for manufactures may be somewhat less than unity, but real expenditure on such goods is stimulated by falling relative prices due to relatively rapid productivity growth in the manufacturing sector. This paper does not seek to disentangle such effects, but takes their combined effect as given. (It may be noted, however, that an international cross-section study of expenditure patterns by Summers (1985) showed that, after correcting for international differences in relative prices, rich countries spend no greater share of their incomes on services than do poor countries.)

Chart 2a. Value Added in Manufacturing, Constant Prices

(In percent of real GDP; PPP weights)

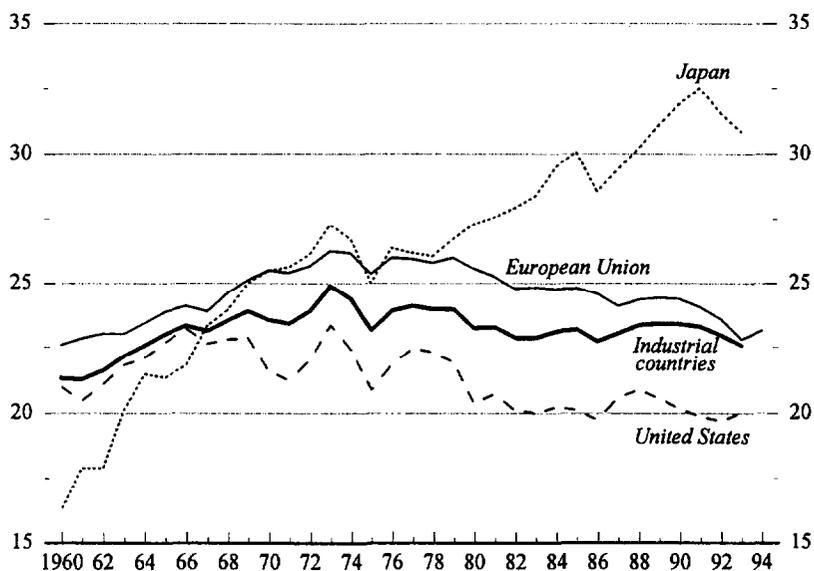
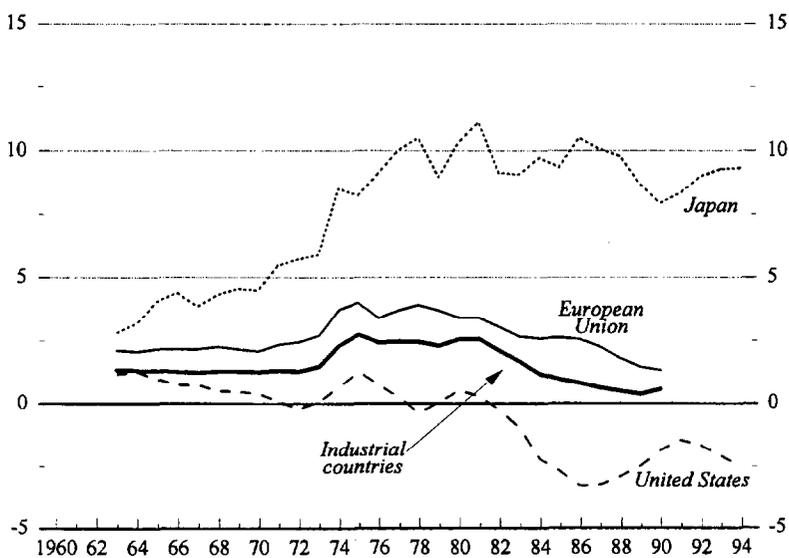


Chart 2b. Balance of Trade in Manufactured Goods

(In percent of GDP; PPP weights)



Source: The data in the top chart were derived from *OECD Historical Statistics 1960-94* and *OECD National Accounts - Volume II*. The data in the bottom chart are from the OECD Analytical Database.

13. The rising share of employment in manufacturing in the industrialization stage of development represents to a large degree the movement of employment from agriculture to industry. Two factors explain this shift. The first is the operation of Engel's law--the proportion of income spent on food declines as per capita income rises--which leads to a shift in the pattern of demand from agricultural products to manufactured products and services with economic growth.¹⁰ The second factor, on the supply side, is the rapid growth of labor productivity in agriculture due to a whole range of innovations. The combined effect of the demand and supply side factors is a large-scale shift of employment from agriculture to industry (as well as to services), accounting for the rising share of employment in manufacturing in the industrialization phase of the development process. The declines in agricultural employment (both in absolute and relative terms) were quite dramatic in the industrialization phase. Just over 11 percent of the total civilian employment in the group of industrial countries was in agriculture in the middle of the 1970s, down from over 20 percent in the early 1960s.¹¹ Given the scale of the contraction that had already taken place in the agricultural sector, a further expansion in the share of services employment had subsequently to be at the expense of manufacturing employment.

14. The secular shift in employment from manufacturing to services since the early 1970s, as noted earlier, has not been associated with any significant shift in the pattern of expenditures between these two sectors. Instead, deindustrialization appears to reflect mainly the impact of differential productivity growth between manufacturing and services. It is clear that if there is no long-term tendency for the real output of services to grow faster than manufactured goods, but productivity in manufacturing increases consistently faster than in services, then the pattern of employment will shift away from manufacturing and into services. The service sector will have to absorb an ever greater proportion of total employment just to keep its output rising in line with that of manufacturing. Table 1 shows that these long-term trends do appear to hold broadly for the industrial countries as a whole. The average annual growth rates of output have been roughly similar in services and manufacturing between 1960 and 1994 for the group of industrial countries. However, labor productivity in manufacturing has consistently outpaced that of services during this period. While there are variations to this pattern in various sub periods (Table 1), the productivity growth differentials between manufacturing and services have consistently been much larger than the differences in output growth between these sectors in the different sub-periods, indicating the important role played by productivity differentials in explaining deindustrialization.

¹⁰See Rowthorn and Wells (1987) for evidence on the operation of Engel's law in agriculture in the advanced economies.

¹¹The corresponding figure for the United States in 1970 was 4 percent. The United Kingdom being the first to go through the industrial revolution had reached this share by the 1950s itself.

Table 1. Industrial Countries: Growth of Output and Employment

	1960-70	1971-94	1960-94
Output			
Manufacturing	6.3	2.5	3.6
Services	5.3	3.3	3.8
Output per person employed			
Manufacturing	4.6	3.1	3.6
Services	3.0	1.1	1.6
Employment			
Manufacturing	1.7	-0.6	0.0
Services	2.4	2.2	2.2

Source: *OECD Historical Statistics 1960-1994*.

15. It is, of course, well known that there are many data and conceptual problems in the measurement of output in services. These could affect both the recorded level of productivity in services, and its growth rate over time. It is possible that the measured slow growth of productivity in services is partly due to the undermeasurement of output growth in this sector. Some of these issues are discussed in Baumol, Blackman, and Wolff (1989), and at greater length in Griliches et al (1992). These studies suggest that any measurement bias in the growth rate of service productivity is small in comparison with the larger recorded differences in productivity growth between manufacturing and services.¹²

16. Thus, the continuous increase in the share of employment in the service sector throughout this period reflects both the shift in employment from agriculture to services in the industrialization stage of development, and later, from manufacturing to services. Appendix I provides a simple model to show how the process of economic growth leads to both an increase in the share of industrial employment in the early phase of economic development, and also to the eventual deindustrialization and transition to a service economy in the later stages. The model is particularly useful for illustrating how deindustrialization can

¹²It is important to note in this context that quality biases also result in the undermeasurement of output growth in the manufacturing sector (Boskin Committee, 1996). It is, of course, possible that productivity growth is mismeasured proportionately more in services than in manufacturing. Though interestingly enough in this context, the study by Murray (1992) suggests that there was an unrecorded reduction in productivity in public services in Sweden over the period 1960-90, a finding that may be applicable to other advanced countries as well. However, since measured growth of productivity in services is significantly lower than in manufacturing, a more than proportionate mismeasurement of productivity growth in services will have a relatively smaller impact on the differential productivity growth between manufacturing and services.

occur purely as the product of successful economic development, even in the absence of foreign trade.

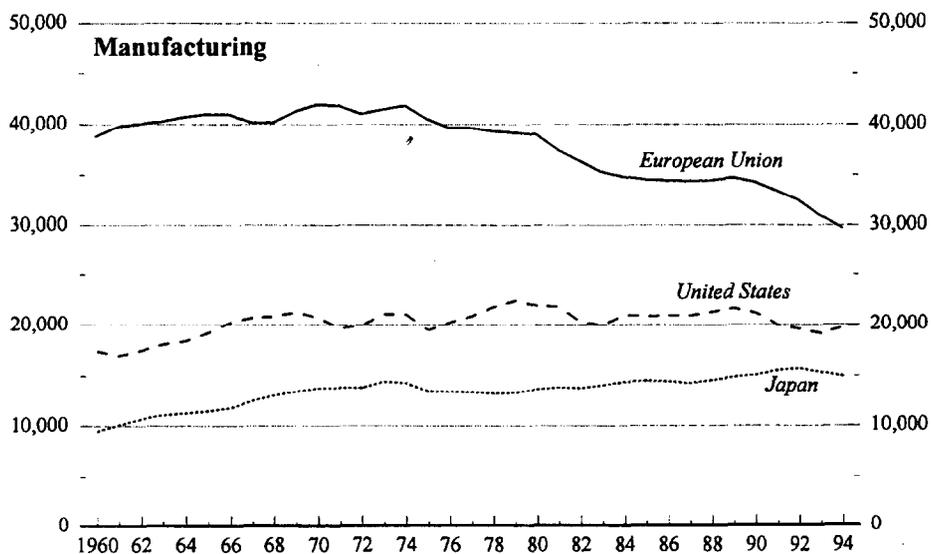
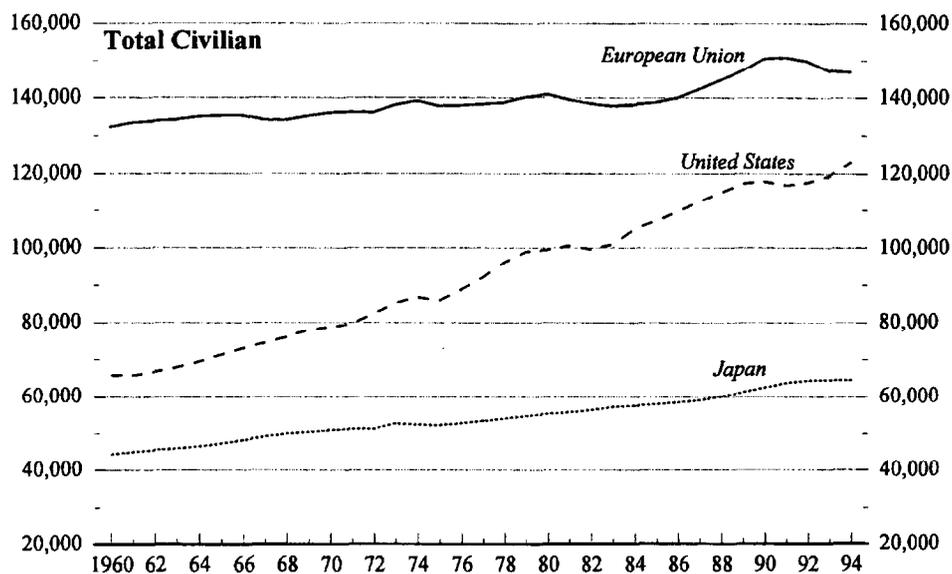
17. An important implication of this discussion is that deindustrialization is not necessarily a symptom of the failure of a country's manufacturing sector, or for that matter, of the economy as a whole. On the contrary, deindustrialization is simply the natural outcome of the process of successful economic development, and is in general, associated with rising living standards. However, this is not to deny that deindustrialization can, at times, be associated with difficulties in the manufacturing sector or the economy as a whole. A country can lose manufacturing jobs as a result of an adverse shock (such as from a large real exchange rate appreciation), and the service sector may be unable to fully absorb the labor released. In this case, deindustrialization may be associated with rising unemployment, and either a slow or even falling growth in living standards. Rowthorn and Wells (1987) identify this as "negative" deindustrialization, in contrast to the "positive" deindustrialization which occurs as a consequence of the industrial dynamism and the rapid absorption of labor in the service sector.

18. Chart 3 shows the contrasts between the United States and the group of 15 European Union countries. Despite the very steep fall in the share of manufacturing employment in the United States, the absolute numbers employed in manufacturing have remained roughly constant since 1970, alongside a large increase in total civilian employment. These developments have, however, been associated with stagnant earnings and the widening of income disparities that was discussed in the introduction. The experience for the EU has, however, been different. The falling share of manufacturing employment for this group of countries has been associated with a sharp decline in the absolute numbers employed in manufacturing. Moreover, unlike in the case of the United States, there has only been a relatively small increase in total employment between 1970 and 1994, which is reflected in the current high rates of unemployment in the EU. It can therefore be argued that both the U.S. and the EU have experienced, broadly speaking, elements of both positive and negative deindustrialization--positive, because industrial dynamism explains a large part of the decline in the share of manufacturing employment, and negative, because this decline has been associated with high unemployment in one case, and stagnant earnings and widening income disparities in the other. However, the point is that even if these countries had grown faster than they actually did during this period, deindustrialization would still have occurred, though with more favorable effects on living standards.

19. It is interesting, in this context, to examine the nature of structural change that has been taking place in the advanced East Asian economies. Chart 4 shows that both Korea and Taiwan Province of China began the process of deindustrialization around the latter half of the 1980s, as their per capita incomes rose rapidly, and surpassed the levels achieved by the advanced countries in the early-1970s. There has, however, been a marked difference during recent decades between these two countries on the one hand, and Hong Kong and Singapore on the other hand. While the share of manufacturing employment rose rapidly until the mid-1980s in both Korea and Taiwan Province of China, this share has exhibited no clear cut

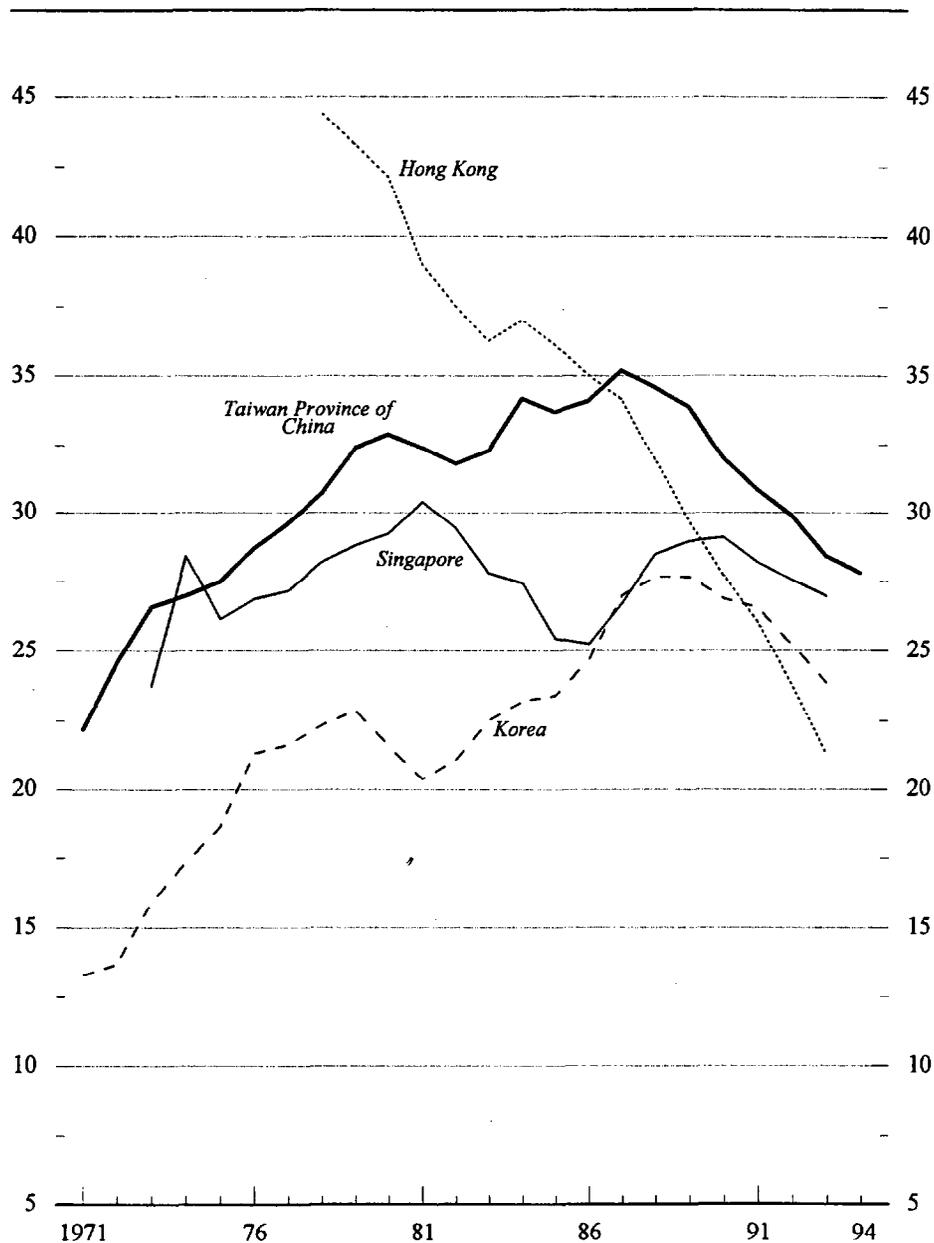
Chart 3. Employment

(Thousands)



Source: OECD Historical Statistics 1960-94.

Chart 4. Selected East Asian Countries: Share of Manufacturing in Employment
(Percent)



Sources: ILO Yearbook of Labour Statistics and the Statistical Yearbook of the Republic of China

trend in Singapore, and has been falling since the 1970s in the case of Hong Kong. This difference, however, appears to be primarily on account of Singapore and Hong Kong being city states, with no large agricultural sector. They, consequently, did not experience the shift in employment from agriculture to industry that is associated with the phase of industrialization. The changes in the structure of employment in the deindustrialization phase are, however, likely to follow a similar pattern in all these countries. The experience of deindustrialization in these advanced East Asian economies appears, at least up until now, to have been predominantly of the positive variety.

IV. ACCOUNTING FOR DEINDUSTRIALIZATION: THE SPECIFIC FACTORS

20. This section draws on the regression results in Appendix II to provide a rough quantification of the importance of the different factors in accounting for deindustrialization. To get an idea of the importance of the relative productivity effects in accounting for the declining share of manufacturing employment, it was assumed, in a simulation exercise for the group of industrial countries, that the ratio of real output in manufacturing to that in services remains constant, but that productivity in the two sectors grows at the rates actually observed between 1970 and 1994. Table 2, which reports the results of the simulations, shows that for the industrial countries as a whole, the share of manufacturing employment would have fallen by 6.3 percentage points during this period under these assumptions. That is, about two-thirds of the actual decline in the industrial countries' share of manufacturing employment during this period can be accounted for by pure relative productivity effects. This implies that about a third of the decline in the share of manufacturing employment for the industrial countries as a group has to be accounted for by relative output changes--i.e., by the fact that output in the two sectors did not in practice grow at exactly the same rate.

21. However, as was noted in the previous section, the fact that output in manufacturing did not grow at exactly the same rate as in services between 1970-1994 is not purely a reflection of a shift in demand towards services, though that may very well have happened to some extent. The somewhat faster growth of services output in this period could also reflect, among other things, factors such as changes in the pattern of net exports, the decline in the rate of investment in the advanced economies during this period, as well as the growing importance of sub-contracting. The regression results in Appendix II point to a role for both the overall manufacturing trade balance and investment in explaining the trends in the share of manufacturing employment. The overall trade balance in manufactures appears to have been an important determinant of cross-country differences in the share of manufacturing employment, but is of less importance in explaining changes in this share over time for

Table 2. Factors Responsible for Deindustrialization 1970-94

	Industrial Countries	EU-15 1/	U.S.	Japan
Share of Manufacturing Employment (in percent)				
1970	27.6	30.4	26.4	27.0
1994	18.0	20.2	16.0	23.2
Change	-9.6	-10.2	-10.4	-3.8
Due to:				
Relative productivity growth	-6.3	-6.1	-6.8	-6.0
Trade balance 2/	0.2	0.3	-1.0	1.8
Investment	-1.8	-2.1	-0.4	-2.7
Other factors	-1.7	-2.3	-2.2	3.1

Note: Estimates for the effect of relative productivity growth assume that productivity in manufacturing and services grows at the rates actually observed over the period 1970-94, whilst the ratio of output in the two sectors remains constant; the employment share of agriculture and other industry (mining, construction, electricity, water, and gas) is assumed to be unaffected. Trade balance estimates assume that a reduction of 1 percentage point in the ratio of this balance to GDP leads to a fall of 0.37 points in the share of manufacturing employment; investment estimates assume that a fall of 1 point in the ratio of gross fixed capital formation to GDP causes the manufacturing share to fall by 0.39 points. These coefficients are based on equation (9) of Table A5, and weighted by the 1970 employment shares of each country.

1/ West Germany only.

2/ West Germany up to 1990 only.

individual countries.¹³ As discussed in the introduction, the Wood hypothesis presumes that a balanced increase in North-South trade will tend to reduce manufacturing employment in the advanced economies. The regression analysis in Appendix II specifically tests for the presence of these effects. The results indicate that contrary to popular perceptions, North-South trade probably had only a very small impact on the process of deindustrialization.

22. Using the regression results from Appendix II, which indicate that a 1 percentage point reduction in the manufacturing trade balance to GDP leads to a fall of 0.37 points in the share of manufacturing employment, it is found that for the industrial countries as a group the trade balance effect had only a very small role in accounting for the changes in the share of manufacturing employment during 1970-1994 (Table 2). This is, of course, consistent with the fact that the balance of trade in manufactures for the industrial countries as a whole did not change very much in this period (Chart 2b).¹⁴ However, the trade balance effects have been much stronger for both the United States and Japan than for the EU-15. In the case of the United States, the growing trade deficits in manufactures accounted, under these assumptions, for a 1 percentage point decline in the share of manufacturing employment between 1970 and 1994. In Japan, in contrast, the growing trade surpluses in manufacturing offset to a significant extent the tendency to deindustrialize as a consequence of the relative productivity effects (Table 2).

23. The decline in the rate of investment in this period, on the basis of the coefficients derived from Appendix II, appears to have played a role in accounting for deindustrialization in most countries, with the possible exception of the United States (Table 2). "Other factors", encompasses the influences from variables such as possible shifts in the pattern of consumption, the contracting out of activities formerly done in the manufacturing sector to the service sector, possible North-South effects, and unidentified influences. The simulations indicate that "other factors" also appear to have some role in explaining the evolution of the share of manufacturing employment in the advanced economies (about 18 percent of the deindustrialization in the group of industrial countries). However, the crucial finding from the simulations reported in Table 2 is that the relative productivity effects are the most important--they account for more than 60 percent of deindustrialization in all the different groupings of the advanced economies.

¹³In this context, a sudden deterioration in a country's manufacturing trade balance due to the discovery of a natural resource such as oil or gas--a phenomenon referred to as the "Dutch disease" in the literature--can have a significant impact on its share of manufacturing employment.

¹⁴In this regard, the claim by Brown and Julius (1994) that deindustrialization in the advanced economies is due to the relocation of manufacturing activity to poorer countries, and its replacement by production of services for export does not appear to be consistent with the empirical evidence.

24. An interesting exercise, in this context, is to examine the implications for the future pattern of employment if these trends continue. The simulations indicate that if past trends in productivity growth continue to hold in the future, then the share of manufacturing employment in the industrial countries as a group will decline to 12 percent in twenty years from now. In the case of the United States, the corresponding figure will be about 10 percent. For both Japan and the European Union, the share of manufacturing employment, under these assumptions, will decline to around 14 percent in twenty years time--i.e., roughly to where the United States is today. The current price share of manufacturing value added will also fall in a similar fashion in the advanced economies.

V. DEINDUSTRIALIZATION: THE IMPLICATIONS

25. This section discusses the implications of continued deindustrialization for long-term growth prospects and industrial relations in the advanced economies. A useful framework for analyzing issues of growth in the context of deindustrialization is the one provided by Baumol, Blackman and Wolff (1989). Their starting point is the observation that productivity growth is persistently faster in some activities than in others. To describe activities which experience persistently high rates of productivity growth, Baumol, Blackman and Wolff use the term "technologically progressive", whilst activities experiencing relatively lower rates of productivity growth are described as "technologically stagnant".¹⁵

26. Manufacturing, in general, is "technologically progressive". This characteristic, as argued earlier, has been the basis for deindustrialization. The reason why manufacturing is "technologically progressive" has to do with its intrinsic attributes--production in this sector can be readily standardized, and consequently, the information required for production can be formalized in a set of instructions which can then be easily replicated. In the case of services, there are large differences between various activities in their amenability to productivity growth. Some services which are impersonal, as in telecommunications, have attributes similar to manufacturing, and hence, can be "technologically progressive". However, personal services, such as certain types of medical care, cannot be easily standardized and subject to the same mass production methods used in manufacturing. These types of services, therefore, will be "technologically stagnant".

27. In general, if there are two activities, one of which is "technologically progressive", and the other "technologically stagnant", then in the long term the average rate of growth will be determined by the activity in which productivity growth is slowest. The intuition for this proposition--termed the theory of "asymptotic stagnancy" by Baumol, Blackman and Wolff--

¹⁵It is important to note that "progressive" and "stagnant", as used in this context, refer to relative attributes. A "technologically stagnant" activity need not necessarily have to experience a low growth of productivity in absolute terms. This is discussed in more detail below.

can be illustrated with a simple example. Consider the computer industry. Suppose that hardware production is “technologically progressive”, and software production “technologically stagnant”. Then, the computer industry will be “asymptotically stagnant”, in the sense that productivity growth in the industry as a whole will asymptotically approach productivity growth in software production. The intuition is that over time the ratio of software to hardware producers will increase to such an extent that even extremely high rates of productivity growth in hardware production will have only a negligible impact on overall productivity growth in this industry.

28. The analogy holds for the economy too. If manufacturing is “technologically progressive”, and services “technologically stagnant”, then the economy as a whole is “asymptotically stagnant”—i.e., the growth rate over the long run will be determined to a large extent by the growth of productivity in the services sector (this proposition is mathematically demonstrated in Appendix I).¹⁶ The theory of “asymptotic stagnancy” has important implications for an understanding of the relationship between competitiveness, productivity and living standards—a theme recently popularized by Krugman (1994). It essentially implies that contrary to popular perceptions, productivity growth in manufacturing is likely to be less important than it used to be for increasing the overall growth of productivity and living standards in the advanced economies. As the process of deindustrialization continues, the overall growth of productivity will increasingly depend upon productivity developments in the service sector. The evolution of productivity growth in the service sector will depend on future developments in areas such as information technology, as well as changes in the competitive structures in this sector. New technological developments will make it feasible for some services to grow faster than others, and thus, the service sector will undergo significant internal structural changes over time. However, product innovation in manufacturing will continue to be important because of the spillovers to productivity growth in services.

29. Deindustrialization is also likely to have important implications for industrial relations in the advanced economies. The role played by trade unions in the economy, for instance, is likely to change over time. Trade unions have traditionally derived their strength from industry, where the mode of organizing production and the nature of work make it easier for unions to organize workers. Unionization is less prevalent and typically more difficult to organize in the service sector (with public services possibly being a notable exception) due to the wide differences in the nature of work and the size of enterprises across different activities. In particular, countries with centralized wage bargaining arrangements are likely to face serious challenges as a consequence of deindustrialization. The reason is that centralized wage bargaining has in practice been associated with a conscious attempt to narrow wage differentials between different groups of workers. Such a policy may have proved benign in a

¹⁶It is again important to emphasize that the term “asymptotic stagnancy” does not have any normative connotations. It does not, for instance, imply that the rate of productivity growth in the service sector, and the economy as a whole will necessarily have to be low in absolute terms over the long run.

period when traditional manufacturing, with roughly similar work requirements across activities, provided the major source of employment. However, a bargaining arrangement that compresses wage differentials is likely to prove problematic as employment shifts increasingly towards the service sector. As noted above, the nature of work in the service sector varies a lot between activities. Some service jobs, as in financial services, require relatively high skills, while others, as in certain types of retailing are likely to be less skilled. There are also wide variations in job security in the service sector. Employment in public services is in general more secure than employment in many retail services. Consequently, appropriate wage differentials are needed to compensate for differences in skills and intensity of work that this diversity entails. It is, in general, difficult for a centralized union to make decisions on the appropriate wage differentials in a fast changing environment. Centralized wage bargaining in a service economy could therefore have adverse consequences for the growth of productivity.¹⁷

VI. CONCLUSIONS

30. The advanced economies have witnessed a virtually continuous decline in the share of employment in manufacturing in the last two decades, and an inexorable rise in the share of employment in the service sector. Employment in manufacturing now constitutes only a small fraction of civilian employment in most of the "old" industrial economies. The dynamic economies of East Asia also appear to have embarked on the process of deindustrialization in recent years. An important conclusion of this paper is that deindustrialization, unlike the problems of rising income inequalities and unemployment, is not a negative phenomenon, but a natural consequence of the process of economic development in an already highly developed economy. The most important factor that accounts for deindustrialization is the systematic tendency for productivity in manufacturing to grow faster than in services. North-South trade has played very little role in deindustrialization. Trade among the advanced economies appears to account for the variation in the structure of employment from one developed country to another, though this factor appears to be of less importance in explaining changes over time for individual countries.

31. Deindustrialization has far reaching implications for growth and industrial relations in the advanced economies. The growth of living standards in the advanced economies is likely to be increasingly influenced by productivity developments in the service sector. Deindustrialization also implies that the role of trade unions is likely to change over time in the advanced economies.

¹⁷These issues are explored in more detail in Ramaswamy and Rowthorn (1993), and Ramaswamy (1994).

A SIMPLE MODEL OF DEINDUSTRIALIZATION

1. This appendix presents a simple model which demonstrates how deindustrialization is a natural outcome of economic growth in a mature economy, and may occur independently of trade with other countries. It is based on the following stylized facts:

- (1) The demand for food is income-inelastic (Engel's Law);
- (2) The real demand for services rises roughly in line with real national income;
- (3) Labor productivity rises more slowly in services than in manufacturing or industry as a whole.

2. The model shows how these propositions suffice to explain both the rising importance of industrial output and employment during the industrialization phase of economic development, and the eventual transition to a 'service' economy in which the employment share of industry declines.

The Model

3. We make the following assumptions. The economy is closed and real output is given by

$$Y = Y_a + Y_i + Y_s \quad (1)$$

where Y_a , Y_i and Y_s stand for output, measured at constant prices, in agriculture, industry and services respectively. Consumption of the agricultural product, food, per head of population is fixed. Population is also fixed and is equal to L ; everyone is employed. Since the economy is closed this implies that

$$Y_a = bL \quad (2)$$

where b is a constant. The output of services is a constant fraction of real output:

$$Y_s = cY \quad (3)$$

Labor Productivity

4. We assume that labor productivity grows more slowly in services than in industry. We also assume that labor productivity grows at the same rate in agriculture as in industry. This greatly simplifies the analysis without affecting the main conclusions. Productivity growth rates remain constant through time, and output per worker is the same in each sector of the economy at time zero. With these assumptions we can write

$$\begin{aligned} y_a &= y^0 e^{\lambda\alpha t} \\ y_i &= y^0 e^{\lambda\alpha t} \\ y_s &= y^0 e^{\alpha t} \end{aligned} \quad (4)$$

where y_a , y_i and y_s stand for output per worker in agriculture, industry and services respectively, and $\lambda > 1$, $y^0 > 0$ and $\alpha > 0$ are constants. The parameter λ is an index of uneven productivity growth.

5. Output per worker in each sector is as follows

$$\begin{aligned} y_a &= \frac{Y_a}{L_a} \\ y_i &= \frac{Y_i}{L_i} \\ y_s &= \frac{Y_s}{L_s} \end{aligned} \quad (5)$$

where the L's denote employment. Total employment is given by

$$L = L_a + L_i + L_s \quad (6)$$

Using equations (2) - (5) we can show that

$$L = \frac{Y}{y^0} [ce^{-\alpha t} + (1-c)e^{-\lambda\alpha t}] \quad (7)$$

which implies that

$$\begin{aligned}
 y &= \frac{y^0 e^{\alpha t}}{c + (1-c)e^{-\alpha(\lambda-1)t}} \\
 &= \frac{y_s}{c + (1-c)e^{-\alpha(\lambda-1)t}}
 \end{aligned}
 \tag{8}$$

where $y = Y/L$ is average labor productivity in the economy as a whole. Since $\alpha > 0$ and $\lambda > 1$,

$$\frac{y}{y_s} \rightarrow \frac{1}{c}
 \tag{9}$$

as t tends to infinity. This implies that average productivity growth will eventually decline to the rate of productivity growth achieved in the service sector. It is an illustration of the theory of asymptotic stagnancy whereby overall growth is constrained by what happens in the least dynamic sector of the economy (Baumol et al., 1989).

Employment Shares

6. Denote the share of the labor force employed in each sector as follows

$$\begin{aligned}
 P_a &= \frac{L_a}{L} \\
 P_i &= \frac{L_i}{L} \\
 P_s &= \frac{L_s}{L}
 \end{aligned}
 \tag{10}$$

It can be shown that

$$\begin{aligned}
 P_a &= \frac{b}{y^0} e^{-\lambda \alpha t} \\
 P_s &= \frac{c}{c + (1-c)e^{-(\lambda-1)\alpha t}}
 \end{aligned}
 \tag{11}$$

The share of industrial employment is given by

$$P_i = 1 - P_a - P_s \quad (12)$$

and hence

$$P_i = 1 - \frac{be^{-\lambda\alpha t}}{y^0} - \frac{c}{c+(1-c)e^{-(\lambda-1)\alpha t}} \quad (13)$$

It is clear from (11) and (12) that, as t tends to infinity,

$$\begin{aligned} P_a &\rightarrow 0 \\ P_i &\rightarrow 0 \\ P_s &\rightarrow 1 \end{aligned}$$

7. In the case of agriculture and the services, convergence to the final limit is uniform: the share of agriculture in total employment falls steadily to zero, whilst that of services rises steadily to 1. However, the case of industry requires further analysis.

The Share of Industry

8. Differentiating equation (12), we obtain

$$\frac{dP_i}{dt} = -\frac{dP_a}{dt} - \frac{dP_s}{dt} \quad (14)$$

which, from (11), can be written

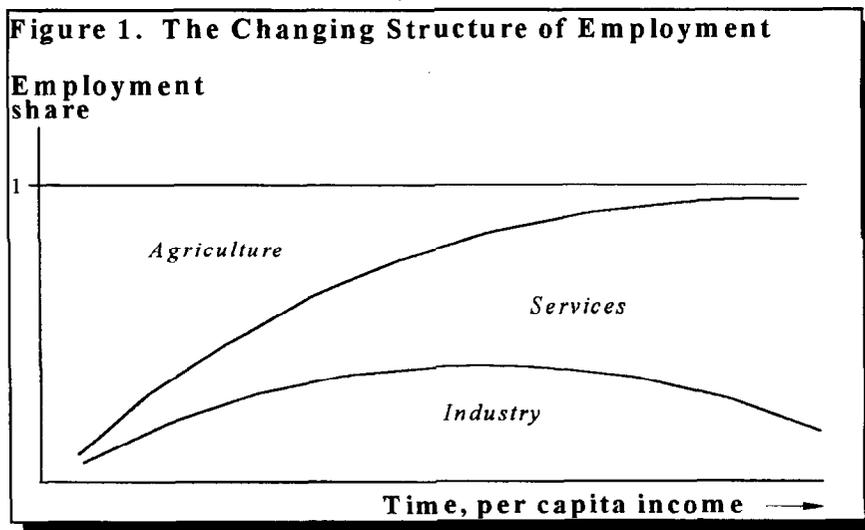
$$\frac{dP_i}{dt} = \lambda\alpha P_a - (\lambda-1)\alpha P_s(1-P_s) \quad (15)$$

Hence $\frac{dP_i}{dt} > 0$ if and only if

$$\lambda \alpha P_a > (\lambda - 1) \alpha P_s (1 - P_s) \tag{16}$$

9. The term on the left hand side indicates the rate at which the employment share of agriculture is decreasing and the right hand side is the rate at which the share of services is increasing. In a poor country P_a is large, and the above inequality is therefore satisfied, and the share of industrial employment will rise. As P_a falls in the course of development, the point will be reached when the inequality is reversed, and the industrial share of employment will start to fall.

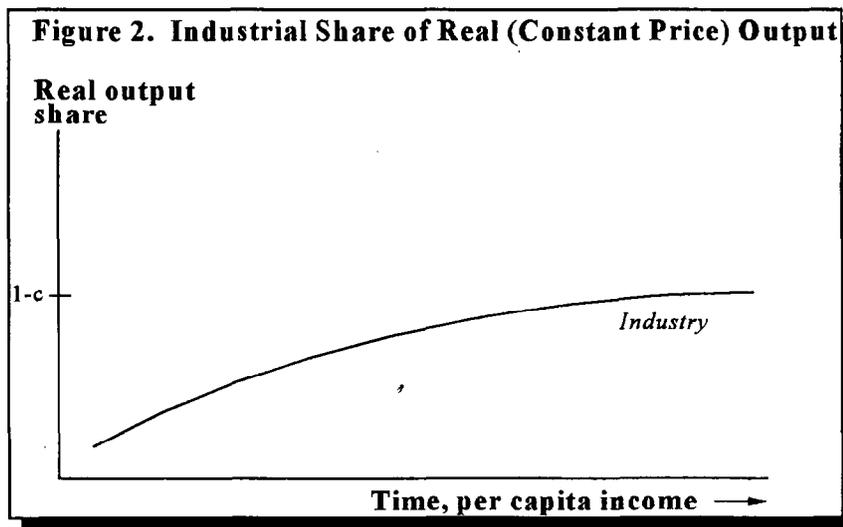
10. The relation between the three sectors in the course of time is shown in Figure 1. It is clear from the diagram that the share of industrial employment is subject to opposing forces. The share of agriculture in total employment is always falling, whilst the share of services is always rising. The balance between the two forces alters in the course of time, and this explains why the share of industrial employment at first rises and then later falls. When development begins, much of the country's labor force still works on the land, and the exodus of labor from this sector outweighs any expansion in the services sector, with the result that industry increases its share of total employment. As development proceeds, however, the balance changes. Agriculture declines as a source of labor, whilst the service sector continues to expand and absorb additional labor. Eventually, there comes a point where the shift into services outweighs the shift out of agriculture. At this point, the share of industry starts to fall.



11. It can be shown that the share of industry in real output is given by

$$\begin{aligned} \frac{Y_i}{Y} &= 1 - \frac{Y_s}{Y} - \frac{Y_a}{Y} \\ &= 1 - c - \frac{be^{-\alpha t}}{y_0} [c + (1-c)e^{-\alpha(\lambda-1)t}] \end{aligned} \tag{17}$$

This share rises rapidly in the initial stage of development, but eventually converges to an upper limit in the course of time. This is illustrated in Figure 2. Thus, in a mature economy, the industrial share of real output stabilizes, whilst the proportion of workers employed in this sector declines because of rapid productivity growth.



THE DETERMINANTS OF DEINDUSTRIALIZATION

1. This appendix uses regression analysis to quantify the impact of various factors on the share of manufacturing employment in the group of industrial countries. It follows the general approach of Rowthorn and Wells (1987), which has been modified to allow for the effects of capital formation and North-South trade.
2. In the normal course of development, the share of manufacturing employment follows a non-linear trend, rising at first and then falling back again as the economy eventually matures. Superimposed on this trend is the influence of factors such as foreign trade, fixed capital formation and the economic cycle. Net manufactured exports and fixed capital formation increase the relative demand for manufactured goods, causing manufacturing employment to be larger than would otherwise be the case. If a developed country exports skill-intensive manufactures in return for labor-intensive imports from low wage countries, this will cause a net reduction in manufacturing employment and the share of this sector in total employment will fall. Thus, even when imports and exports are equal in value, trade with the developing countries of the South should reduce manufacturing employment in the North. These are the primary considerations which govern the choice of variables for our regression analysis. In addition, we examine the extent to which variations in the manufacturing share are associated with unemployment.

The Data

3. A data set was assembled for the years 1963, 1970, 1975, 1980, 1985, 1990 and 1994 covering 21 out of the 23 countries classified as industrial countries in the World Economic Outlook (which corresponds to the traditional group of OECD countries); separate data on trade were not available for Luxemburg; Iceland was excluded due to statistical problems arising from the central role of fishing in its economy.¹⁸
4. The dependent variable in the regressions is the share (in percent) of manufacturing in civil employment as given in *OECD Historical Statistics*. A variety of independent variables are used. To capture the effect of economic development on the structure of employment, all equations use the log and the squared log of real per capita income, converted to 1986 US dollars by means of purchasing power parities in the *IMF World Economic Outlook* database. Trade variables refer to exports or imports of manufactured goods in current dollars expressed as a percentage of GDP in U.S. dollars at purchasing power parity. This method of normalization avoids distortions caused by large fluctuations in exchange rates.

¹⁸Fish products, which account for more than 80 percent of Icelandic merchandise exports, are classified as a non-manufactured item in official trade statistics; whereas fish processing, which is a major employer of labor, is classified as manufacturing in industrial and labor statistics.

5. To quantify the overall impact of trade on individual countries, we use variables such as a country's total manufactured exports or imports. To identify special effects arising from North-South trade, we include separate variables for trade between the group of industrial countries and the developing countries. Trade statistics are drawn from the UNCTAD database, and our use of the term "developing country" accords with current UN practice. Thus, Singapore and Hong Kong are classified as developing countries although their per capita income is now similar to the industrial country average and although they are now counted as advanced economies in the *World Economic Outlook*. Manufactures are goods included in SITC sections 5 to 8 excluding division 68 (non-ferrous metals). Other independent variables are gross fixed capital formation as a percent of GDP at current prices, which is taken from the *OECD National Accounts*, and the percent unemployment rate from *OECD Labor Force Statistics*. Finally, some regressions include dummy variables for countries or years.

Income and Trade Balance Effects

6. Table A1 reports the results of cross section regressions using only per capita income and the global manufacturing trade balance (total exports *minus* total imports) as explanatory variables. Apart from two cases, the income variables are statistically insignificant and some times of the wrong sign. On the other hand, the trade balance variable is always highly significant, with a coefficient equal to at least three times its standard error in every case. For most of the time this coefficient is around 0.4. These results indicate that international differences in the share of manufacturing employment are mainly explained by patterns of trade specialization, as indicated by the manufacturing trade balance

Table A1 Cross-Section Estimates of the Manufacturing Share of Employment 1963-94

Dependent Variable: Manufacturing Share of Employment							
Data Sample: 21 Industrial Countries							
	1963	1970	1975	1980	1985	1990	1994
LGDP	78.01 (83.01)	82.48 (140.10)	129.26 (155.18)	-25.12 (210.44)	104.29 (171.90)	-87.03 (218.89)	-112.11 (193.54)
LGDP ²	-3.93 (4.72)	-4.21 (7.70)	-6.94 (8.43)	1.28 (11.26)	-5.57 (9.16)	4.39 (11.47)	5.85 (10.11)
Overall trade balance	0.61* (0.18)	0.51* (0.17)	0.44* (0.11)	0.36* (0.12)	0.44* (0.13)	0.43* (0.11)	0.31* (0.09)
R ²	0.651	0.441	0.469	0.247	0.310	0.359	0.337

Notes: The constant term is not reported. Standard errors in parentheses. Coefficients that are statistically significant at the 1 percent level are marked with '*'. The data exclude New Zealand for 1963 and Germany for 1994; German data refer to west Germany only. The manufacturing share of employment is measured in percent. LGDP is the log of per capita real GDP in 1986 U.S. dollars at PPP. LGDP² is the square of LGDP. Overall trade balance is total exports minus total imports of manufactures (SITC 5-8 less 68) as a percent of GDP at PPP.

7. The same variables are used in equation (1) of Table A2 which is derived by pooling all years in one sample of 145 observations. All variables are highly significant, the coefficient estimates being many times their standard errors. The income coefficients imply that, other things being equal, the share of manufacturing employment will peak at a per capita income of \$8185 (+/- \$990) measured in 1986 US dollars.¹⁹ When an economy reaches this point, further growth will cause the employment share of manufacturing to fall. The estimated turning point is similar to an earlier estimate by Rowthorn and Wells (1987), and is around the level achieved by many European countries in the 1960s and in the USA more than a decade before. The estimated trade balance coefficient implies that a fall of 1 percentage point in the ratio of net manufactured exports to GDP will cause the employment share of manufacturing to shrink by 0.44 of 1 percentage point. Although quite large, this estimate is below the figure of 0.69 obtained by Rowthorn and Wells (1987) or that of 0.60 used by Krugman and Lawrence (1994). It confirms the cross-section finding concerning the importance of trade specialization as an influence on the structure of employment.

Table A2. Pooled Estimates of the Manufacturing in Employment 1960-73

Dependent Variable: Manufacturing Share of Employment								
Data Sample: Panel of 21 Industrial Countries								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LGDP	180.69* (33.41)	134.04* (33.30)	127.47* (32.50)	135.92 (33.56)	126.45* (27.82)	136.42* (28.58)	130.84* (27.87)	126.83* (28.46)
LGDP SQ	-10.03* (1.81)	-7.40* (1.82)	-7.03* (1.77)	-7.45 (1.83)	-6.71* (1.56)	-7.30* (1.56)	-6.99* (1.52)	-6.73* (1.55)
Overall trade balance	0.44* (0.06)		0.30* (0.06)	0.42 (0.06)	0.40* (0.05)		0.30* (0.06)	0.40* (0.05)
Total exports		0.28* (0.07)				0.27* (0.06)		
Total imports		-0.32* (0.06)				-0.31* (0.06)		
Exports to South		1.29* (0.38)	1.11* (0.33)			1.15* (0.41)	0.99* (0.37)	
Imports from South		-2.98* (0.82)	-3.38* (0.69)	-2.84** (0.70)		-0.67 (0.89)	-0.98 (0.82)	-0.05 (0.74)
Time dummies					yes	yes	yes	yes

Notes: All regressions are based on 145 observations. Total exports and total imports refer to a country's trade in manufactures with the entire world. South refers to all developing countries (UN definition). North refers to the 21 industrial countries in our sample. There is a separate time dummy for each year. For further information see Table A1.

¹⁹The limits are two standard errors on each side of the estimate.

North-South Trade

8. The preceding estimates assume that trade can influence domestic manufacturing employment only through an alteration in the balance of trade, so that an equal change in both exports and imports has no effect on the domestic employment structure. Wood (1994) has vigorously challenged this proposition in the case of North-South trade. He argues that a dollar's worth of labor-intensive imports into the North from developing countries will destroy far more jobs than are generated by a dollar's worth of skill-intensive goods exported by the North. Thus, a balanced increase in North-South trade will reduce manufacturing employment in the North, because the number of low-skill jobs lost in import competing industries will greatly exceed the new jobs created in the export sector.

9. One way of testing this proposition is to include explicit variables for North-South exports and imports.²⁰ Equation (2) of Table A2 reports the estimates obtained when total exports and imports, and North-South exports and imports are included separately. In this equation, the North-South coefficients indicate the extent to which trade with developing countries has an above average impact on employment in the North. The estimated values of these coefficients are indeed relatively large and highly significant. For the Wood hypothesis to hold, the coefficient on imports from the South must be substantially greater in absolute magnitude than the coefficient on exports. A Wald test implies that the two coefficients are different at the 7.3 percent level, which provides some support for the Wood hypothesis. A further Wald test implies that the coefficients for total exports and total imports are not significantly different in absolute magnitude, as we should expect given that most trade occurs between the industrial countries in our sample and there is therefore no reason to expect an asymmetry.

10. There appears to be stronger support for the Wood hypothesis in equations (3) and (4), which suggest that imports from the South greatly reduce manufacturing employment in the North, even when they are matched by an equal value of exports in the opposite direction. However, this conclusion is not robust. Equations (5) to (8) show what happened when time dummies were included in the regressions. There is a separate time dummy for each year whose role is to eliminate effects which are common to all countries in that year. These dummies function in much the same fashion as a time trend, and experiments indicate that our results would have been much the same had we inserted a trend term instead of dummies. In every case where time dummies are included, the North-South trade coefficients shrink dramatically in size and statistical significance. The coefficient for imports from the South is never remotely significant, and in one equation is virtually zero. The cross-section regressions shown in Table A3 paint a similar picture. The coefficients for the overall trade balance are broadly similar across time and always highly significant, whilst the coefficients for imports from the South are mostly of the wrong sign and have very large standard errors.

²⁰The idea of modifying the Rowthorn-Wells approach in this fashion was first suggested by Seager (1996).

Table A3. Cross-Section Estimates of the Effect of Imports from the South

Dependent Variable: Manufacturing Share of Employment							
Data Sample: 21 Industrial Countries							
	1963	1970	1975	1980	1985	1990	1994
LGDP	75.96 (79.45)	107.71 (136.36)	107.99 (147.43)	-65.14 (206.41)	99.26 (174.84)	-89.20 (225.88)	-116.02 (189.51)
LGDPSQ	-3.77 (4.52)	-5.56 (7.49)	-5.88 (8.00)	3.29 (11.03)	-5.23 (9.32)	4.49 (11.83)	6.13 (9.90)
Overall trade balance	0.77* (0.20)	0.58* (0.17)	0.49* (0.10)	0.39* (0.12)	0.45* (0.14)	0.43* (0.12)	0.34* (0.09)
Imports from South	14.51 (9.21)	6.96 (4.67)	5.92 (3.44)	4.89 (3.45)	-2.99 (4.40)	-0.17 (1.06)	-1.56 (1.20)
\bar{R}^2	0.681	0.479	0.524	0.289	0.288	0.321	0.364

Notes: See Tables A1 and A2.

11. Thus, the apparent influence of North-South variables is absent in the cross section regressions and disappears in the pooled regression when time dummies are included. This suggests that the North-South coefficients in the earlier equations were accidentally capturing the influence of some unidentified time factor. Thus, North-South trade does not seem to be a major factor behind the decline of manufacturing employment in the advanced economies.

Unemployment

12. In Rowthorn and Wells (1987) the unemployment rate was included as a variable to help explain the behavior of manufacturing employment. It is interesting to reexamine the results obtained when unemployment is included in the regressions. Table A4 shows the cross-section estimates. Two things are striking about this table. The trade balance coefficients are virtually the same as in Table A1 and are again highly significant. The unemployment coefficient is universally negative, although mostly of quite low statistical significance. In the pooled regressions shown in Table A5, this coefficient is negative and highly significant. The evidence for some link between manufacturing employment and unemployment is thus quite strong, although as mentioned above the direction of causality is uncertain.

Table A4. Unemployment and the Share of Manufacturing

Dependent Variable: Manufacturing Share of Employment Data Sample: 21 Industrial Countries							
	1963	1970	1975	1980	1985	1990	1994
LGDP	12.55 (65.80)	11.60 (119.53)	73.04 (139.22)	-63.42 (201.79)	153.49 (162.96)	23.16 (227.60)	-6.73 (204.80)
LGDP SQ	-2.47 (3.74)	-0.39 (6.56)	-3.91 (7.56)	3.23 (10.79)	-8.34 (8.69)	-1.49 (11.95)	0.24 (10.73)
Overall trade balance	0.43* (0.14)	0.50* (0.15)	0.44* (0.10)	0.38* (0.11)	0.45* (0.13)	0.43* (0.11)	0.33* (0.09)
Unemployment	-1.59* (0.45)	-1.25* (0.43)	-0.72 (0.30)	-0.47 (0.29)	-0.28 (0.15)	-0.29 (0.21)	-0.20 (0.15)
\bar{R}^2	0.798	0.611	0.595	0.316	0.397	0.392	0.368

Notes: Unemployment as a percent of the labor force. For further information see Table A1.

Investment

13. A important influence on the composition of demand is the rate of capital formation. The majority of investment expenditure involves the purchase of manufactured goods such as prefabricated buildings, construction materials and producer durables. Other things being equal, a high rate of investment should be reflected in a high share of manufacturing in both output and employment. This presumption is confirmed by the pooled regressions shown in Table A5. The investment variable is always significant even when time dummies are included.

Inter-temporal and Cross-country Effects

14. The total variation in the manufacturing share over the sample as a whole is of two kinds: (a) *between* one country and another at any given point of time, and (b) *within* individual countries over the course of time. It appears from the cross-section regressions that a major variable explaining differences between countries is the manufacturing trade balance. This impression is to some degree confirmed by those equations in Table A5 which use dummy variables to eliminate persistent differences between countries. When these country dummies are included, the trade balance coefficient falls, although not by a great deal in most cases. The same is true for unemployment, suggesting that this variable also helps to explain international differences in the share of manufacturing employment. On the other hand, the presence of country dummies has little effect on either the investment coefficient or on the income coefficients, thereby confirming the cross section finding that these variables are of less importance in explaining cross-section differences between countries.

Table A5. Intertemporal and Cross Country Effects

Dependent Variable: Manufacturing Share of Employment									
Data Sample: Panel of 21 Industrial Countries									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LGDP	180.69*	126.45*	210.92*	183.76*	151.23*	197.51*	167.72*	126.82*	175.10*
	(33.41)	(27.82)	(21.23)	(25.55)	(26.28)	(18.70)	(32.13)	(27.21)	(21.37)
LGDP SQ	-10.03*	-6.71*	-11.96*	-10.11*	-8.14*	-11.06*	-9.25*	-6.70*	-9.93*
	(1.81)	(1.51)	(1.15)	(1.39)	(1.43)	(1.02)	(1.75)	(1.48)	(1.17)
Overall trade balance	0.44*	0.40*	0.21*	0.45*	0.42*	0.33*	0.46*	0.41*	0.37*
	(0.06)	(0.04)	(0.08)	(0.04)	(0.04)	(0.07)	(0.06)	(0.04)	(0.08)
Unemployment				-0.65*	-0.39*	-0.42*			
				(0.06)	(0.08)	(0.07)			
Investment							0.33*	0.20*	0.39*
							(0.09)	(0.07)	(0.09)
Time dummies		yes			yes			yes	
Country dummies			yes			yes			yes
\bar{R}^2	0.401	0.646	0.807	0.650	0.700	0.852	0.452	0.671	0.823

Notes: There is a separate country dummy for each country. Investment is gross fixed capital formation as a percent of value added. For other notes see the preceding tables.

15. An interesting feature is the behavior of the trade balance coefficient, which is highly significant both in the cross-section regressions and in the pooled regressions, including those with country or time dummies. Indeed, the trade balance is the only variable for which this is true. Even so, this variable plays a much greater role in explaining cross-country differences in employment structure than it does in explaining intertemporal developments. This is due to the fact that trade balances exhibit huge differences between countries--the spread is well over 20 percent of GDP in most years--but are comparatively stable through time for individual countries. Those countries which enjoyed a large manufacturing trade surplus in the 1960s, such as Belgium, Germany and Japan, have continued to do so right up to the present, whilst those with a large deficit in manufactures, such as Australia, Canada and Norway, have remained heavily in deficit.

Summary of the Results

16. The findings of the regression analysis can be summarized as follows. There is evidence of a non-linear relationship between per capita income and the manufacturing share of employment. Other things being equal, this share should, on the basis of the estimation, peak around the level of per capita income achieved by many European countries in the 1960s and by the United States some time previously. Beyond this level, further economic growth should cause the employment share of manufacturing to fall. The more advanced

East Asian economies have surpassed this level of per capita income, and in all of them the share of manufacturing employment is falling. The decline has been greatest in Hong Kong and Taiwan where the absolute numbers employed in manufacturing have fallen. This process has been more gradual in Japan, Korea, and Singapore, but will possibly accelerate in the future. These are clear cut examples of positive deindustrialization. There is strong evidence that the manufacturing share of employment is influenced by the trade balance in manufactured goods. The trade balance is easily the most important factor explaining cross-country differences in economic structure, but is of less importance in explaining why the employment share of manufacturing has declined so dramatically in many countries. These findings are similar to those of Rowthorn and Wells (1987). There is little evidence that North South trade has been a major factor behind the relative decline of manufacturing employment. Finally, most of the industrial countries have seen a fall in the investment rate and this has contributed to the shrinkage of manufacturing employment.

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PART II. THE EFFECT OF GLOBALIZATION ON WAGES IN THE ADVANCED ECONOMIES

This paper examines the effect of globalization on labor markets in the advanced economies, focusing particularly on the claim that increased economic integration has widened the gap between the wages of more skilled and less skilled workers. The broad consensus of research on this important question is that globalization, both in terms of increased trade as well as increased capital mobility and foreign direct investment, has had only a modest effect on wages. Instead, changes in technology have led to a pervasive shift in demand for labor that has favored skilled workers to the detriment of less skilled workers.

I. INTRODUCTION¹

1. This paper examines the extent to which “globalization”--the increasing international integration of markets for goods, factors, and technology--affects labor markets in the advanced economies, focusing particularly on the effect of globalization on wages.² Globalization has been occurring through both expanded trade in goods and increased movement of factors across countries, as exemplified by the phenomena of capital and technology flows, foreign direct investment, and migration. At the same time as globalization has increased, labor demand in many advanced economies has shifted away from less-skilled workers toward those with more skills. In many advanced economies, this trend has produced a widening of the gap in wages between the two groups of workers, along with rises in both income inequality and unemployment, primarily among the less skilled. This rise in inequality potentially has adverse social and economic consequences. The paper examines the claim that globalization has been an important cause of these changes.

2. It first summarizes the important facts about globalization and advanced economy labor markets in recent decades. The discussion then focuses on one aspect of globalization: the claim that import competition from increased international trade with developing countries has directly hurt less-skilled workers in the advanced economies by lowering their wages. This aspect of globalization has received the greatest share of attention in the United States, but increasing attention in other countries as well. The paper reviews economic theory that links trade flows to labor markets and then discusses empirical findings. The broad consensus of this research for the United States is that import competition accounts for only a modest part of increased income inequality. Estimates of the share of the increase in inequality accounted for by trade range from zero to one-third, with nearly all indications falling in the

¹This paper was prepared by Phillip Swagel of the Research Department and Matthew J. Slaughter of Dartmouth College and the National Bureau of Economic Research.

²In this paper, reflecting the focus of the empirical analysis, “advanced economies” in most contexts refer to the “industrial countries” as traditionally classified in the World Economic Outlook, while “developing countries” include the newly industrialized economies.

lower part of the range. What is particularly noteworthy is that several very different methodologies have been used to estimate the contribution of trade to U.S. income inequality, but almost all approaches find that the contribution is fairly small. Although there has been less research on other advanced economies, the evidence to date suggests a similarly small effect of imports on wages but possibly a larger effect on employment in Europe, which is likely in part a reflection of structural rigidities in European labor markets.

3. Two other ways in which international trade affects wages are then explored: (1) by altering wage differentials across industries within a country and thus equalizing wages across countries, and (2) by increasing labor-demand elasticities and thus making labor markets more sensitive to external shocks. Again, however, research to date suggests that these indirect effects of trade on wages have been fairly modest.

4. The paper further examines aspects of globalization other than trade that affect labor markets. First, international capital mobility may contribute to wage and income inequality in the advanced economies if low-skill-intensive activities tend to migrate to developing countries, for example through the operations of multinational firms. Increased capital mobility might also tend to equalize rates of return to capital across countries so that the costs of adjustment to external shocks fall more heavily on labor. This is particularly relevant for countries in which labor markets are characterized by substantial structural rigidities, as in much of Europe. Second, international labor mobility could contribute to increased inequality in advanced economies if less-skilled workers there face relatively strong competition from immigrants seeking higher wages. Third, transfer of technology across countries potentially affects labor markets. These issues have been studied somewhat, but not as much as the effect of international trade on wages and income inequality.

5. Finally, some public policy implications of globalization for labor markets are discussed. Although globalization on balance tends to raise aggregate welfare for every country, the gains are likely to be distributed unevenly across countries and between different sectors and groups within countries. Policymakers are likely to need to take account of distributional issues as well as the transitional costs in designing policies aimed at easing adjustments to changed economic circumstances. However, such policies must be implemented in such a way as to promote adjustment rather than hamper it.

II. BASIC FACTS ABOUT GLOBALIZATION AND LABOR MARKETS

6. How closely connected are economies around the world? Has increased integration of economies coincided with adverse developments in labor markets? These issues are examined in turn.

A. Globalization of Product Markets

7. The share of trade (either imports or exports or both together) in output provides a ready measure of the extent of product market globalization. It is important to emphasize that

however measured, product market integration has *not* expanded continuously over time. World trade grew in relation to output from the mid-1800s to 1913, but then fell from 1913 to 1950, as international trade in goods and services was curtailed by the effects of the two world wars and protectionist policies implemented during the Great Depression (Table 1). Krugman (1995a) and Irwin (1996) point out that only since the 1970s have trade flows reached the same proportion of output as at the turn of the century, with the increase in trade spurred both by an easing of artificial barriers to trade such as tariffs and quotas, and by technological advances which have overcome natural barriers to trade, particularly increased efficiency of communication and falling transportation costs.

Table 1. Globalization Measured by Exports as a Share of Output
(In percent)

Year ¹	World Exports of Goods and Services/GDP	World Exports of Merchandise/GDP	United States Exports of Merchandise/GDP	United States Exports of Merchandise/Tradeables Production
1820	...	1.0
1850	5.1
1870	...	5.0
1880	9.8	...	5.6	14.3
1913	11.9	8.7	6.1	13.2
1929	...	9.0	5.2	13.9
1950	7.1	7.0	3.6	8.9
1970	11.7	11.2	4.2	14.1
1985	14.5	...	8.3	29.2
1990	17.1	13.5	7.0	31.4

Sources: Krugman (1995a), p. 331; Maddison (1995), p. 38, and Irwin (1996), p. 42.

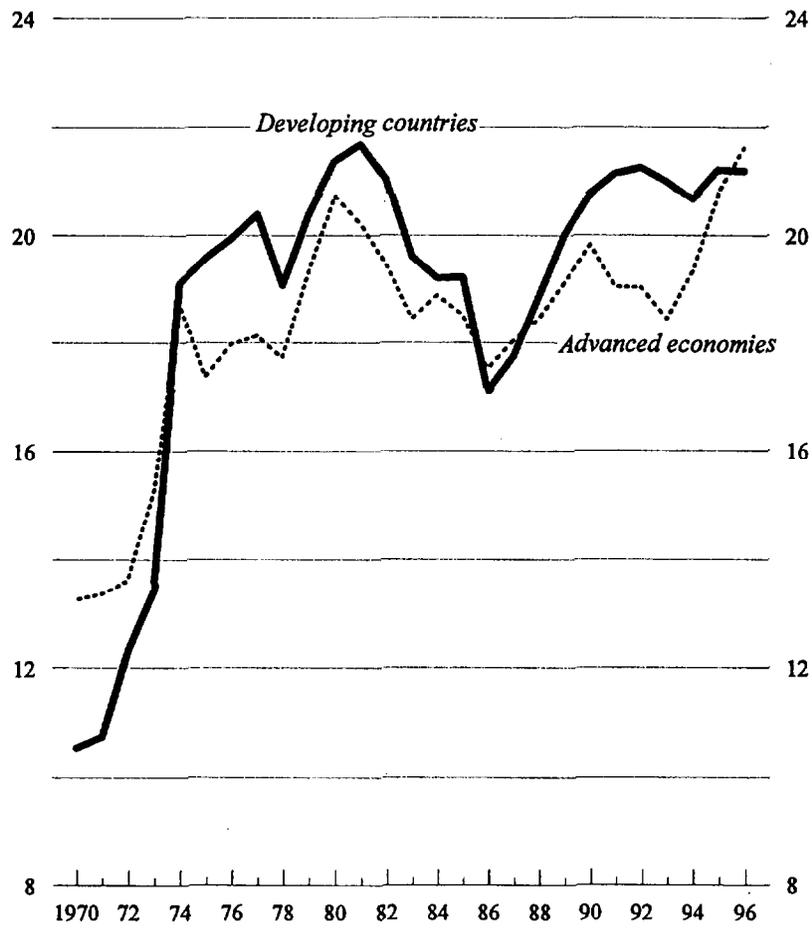
¹Years vary slightly by source.

8. Two additional points about trade volumes are important to keep in mind. First, the rise in the ratio of exports to total output likely understates the degree of product market globalization. As documented by Rowthorn and Ramaswamy (1997), an increasing share of output in the advanced economies consists of largely nontradable services: education, government, finance, insurance, real estate, and wholesale and retail trade. Given this, Irwin notes that “perhaps a better indication of the importance of international trade is to consider merchandise exports as a share of the production of [just] tradable goods” (p.42). This alternative measure shows a much larger role of trade (Table 1).

9. Second, for many countries, the most important decade since World War II for globalization was the 1970's, during which the ratio of trade to output rose markedly across both advanced economies and developing countries, mainly in the wake of the two oil shocks (Chart 1). In assessing whether trade contributes to income inequality, it is important to keep in mind that the largest expansion of advanced economies' trade in relation to output occurred before the increase in inequality. In developing countries, exposure to international trade picked up once again in the late 1980's, coinciding with their movement toward trade

Chart 1. Trade in Goods and Services as a Share of Output
(In percent of GDP)

The importance of trade grew markedly in the 1970's.



liberalization. For the advanced economies, by contrast, data suggest that product markets have become steadily more open to global competition since about 1950.

10. An alternative measure of product market globalization would be data on prices of tradable goods rather than quantities. Indeed, as will be discussed in section III, international trade theory suggests that trade affects labor markets through the prices at which trade occurs, not through the quantity of goods involved. Trade volumes do not necessarily carry information on the extent to which trade affects labor markets, since even a small import share can have a large effect on wages if it leads to wholesale changes in the competitive structure of a domestic industry. Given this, product market integration is perhaps better measured with information on the extent to which prices for traded products are similar across countries. Complete globalization in the sense of openness to trade would then imply that the law of one price prevails worldwide.

11. Unfortunately, data on international product prices are more difficult to obtain than data on international trade flows. Williamson (1995) shows that in the decades preceding 1913, several product markets experienced significant and prolonged movements toward price convergence across countries. Some evidence on the strength of price convergence more recently can be gleaned from analysis of whether purchasing power parity (PPP) holds in its absolute or relative forms, albeit with the caveat that this research examines average prices of goods rather than prices of individual commodities and may say as much about the working of the foreign exchange market (and the importance of financial transactions vis-a-vis trade) as about the integration of goods markets. Froot and Rogoff (1996) conclude that deviations from PPP in the post-war advanced economies persist for several years, implying that there remain substantial barriers to product and financial market integration.

B. Recent Labor Markets Developments

12. An important trend in labor markets in the advanced economies has been a steady shift in relative labor demand away from the less skilled toward the more skilled. This is the case however skill levels are defined, whether in terms of education, experience, or job classification. This has produced dramatic rises in wage and income inequality between the two groups in some countries and in unemployment among the less skilled in others.

13. Until fairly recently, this phenomenon received most attention in the United States. Since the late 1970's, wages of less-skilled Americans have fallen dramatically relative to the more skilled. The precise timing and magnitude of the changes differ somewhat with the measure of skill, but all show dramatic changes: Bound and Johnson (1992) find that between 1979 and 1988, the ratio of the average wage of a college graduate to the average wage of a high school graduate rose by 20 percent; Davis (1992) finds that between 1979 and 1987, the ratio of average weekly earnings of males in their forties to average weekly earnings of males in their twenties rose by 25 percent; and Lawrence and Slaughter (1993) find that between 1979 and 1989 in manufacturing, the ratio of average annual earnings of nonproduction workers to average annual earnings of production workers rose by 10 percent.

Abstracting from all measures of skill and defining the skilled and unskilled simply as those at the top and bottom of the earnings distribution, Katz and Murphy (1992) find that remuneration of workers (male or female) at the 90th percentile in the distribution relative to that of workers at the 10th percentile has increased steadily since the late 1960's, with a sharp acceleration in this trend since about 1980.³ This growing inequality reverses a trend of previous decades (by some estimates, going as far back as the 1910's) towards greater income equality between the more skilled and the less skilled.

14. In principle, this dramatic development could have been caused by either an increase in the supply of or a decrease in the demand for less-skilled workers relative to the more skilled. However, Katz and Murphy show that for the United States economy as a whole, supply changes cannot explain growing income inequality, simply because the relative supply of more-skilled workers has increased. If labor markets work freely, relative earnings can increase in the face of increased relative supply only if relative demand increases by more. Katz and Murphy conclude that "demand growth was an important component of the change in factor prices over the period as a whole [1963-1987] and particularly during the 1980s" (p. 52).

15. Berman, Bound, and Griliches (1994) find that for the manufacturing sector, labor demand shifted only in part because of a shift *across* industries in output toward skill-intensive industries. They find that approximately 70 percent of the overall shift in labor demand was a change in skill demands *within* industries. Lawrence and Slaughter demonstrate that at all levels of industrial classification, the majority of U.S. manufacturing industries during the 1980's employed relatively more high-skilled workers than in the 1970s, even though the relative wages of these workers had risen. This can be explained only by a shift in demand toward more-skilled workers. Berman, Machin, and Bound (1996) find similar results across advanced economies--that changes in the wage structure are primarily the result of "pervasive" skill-biased technological change that has led to a shift in labor demand toward skilled workers.

16. To summarize: U.S. labor demand since the late 1970s has shifted sharply away from less-skilled workers and towards more-skilled workers. The result has been a substantial increase in income inequality between these two groups.⁴ It is also important to note that, as

³These numbers, like almost all in the literature, measure just wages and do not include non-wage compensation or fringe benefits such as health care and pension plans. However, Freeman (1996) presents evidence that over time skilled workers have also received a larger share of fringe benefits. The numbers presented above thus may *understate* the widening of income inequality.

⁴Another type of income inequality has emerged recently: an increase in inequality between workers within particular skill or experience groups. Juhn, Murphy, and Pierce (1993) show
(continued...)

deflated by the consumer price index, the average real wage in the United States has grown only slowly since the early 1970s and the real wage for unskilled workers has actually fallen.⁵ Freeman estimates that male high-school dropouts have suffered a 20 percent decline in real earnings since the early 1970s.

17. Similar developments have occurred in the wage structures of other advanced economies, although except in the United Kingdom, the changes in wage differentials have generally been much less marked than in the United States. Freeman and Katz (1996) report that since the 1970s, Australia, Canada, Japan, Spain and Sweden have experienced a modest rise in wage differentials, France, Germany, and Italy no rise, and the Netherlands a small fall. In Japan and the United Kingdom, although the wage differential widened to varying degrees, real wages rose for all workers, in contrast to the U.S. case, where wages fell for those at the bottom.

18. Although wages did not change as much as in the United States, Freeman and Katz report that most advanced economies experienced a shift in labor demand away from the less skilled toward the more skilled. Countries with smaller increases in wage inequality suffered instead from higher rates of unemployment for less-skilled workers. According to Freeman and Katz, "... most other industrial nations with less increase in wage inequality... than the United States suffered from much slower employment growth and sharper increases in unemployment/nonemployment among less educated and younger workers" (p. 4).⁶

19. What explains the differences in outcomes for wages and employment across countries is differences in labor market structures. In countries with relatively flexible wages set in decentralized labor markets such as the United States, and increasingly, the United Kingdom, the decline in relative demand for less-skilled labor translated into lower relative (though in the UK, not absolute) wages for these workers. In contrast, in countries with relatively rigid wages set in centralized labor markets such as France, Germany, and Italy, it meant lower

⁴(...continued)

that even within narrowly defined segments of the labor market (e.g., male college graduates with one to ten years of work experience) the variation in earnings has risen dramatically. Ramaswamy and Rowthorn (1991) develop a model which generates this sort of increased wage dispersion.

⁵However, the consumer price index possibly overstates inflation and thus exaggerates the decline in real wages.

⁶This analysis is challenged by Bertola and Ichino (1995) and Nickell and Bell (1996), who cite evidence that unemployment rates rose in many European countries for both skilled and unskilled workers. As discussed by Murphy (1995), however, this possibly reflects changes within skill categories, with the increase in skilled unemployment caused by rising unemployment for workers at the bottom of the "skilled" category.

relative employment. Freeman and Katz further note: "By allowing the full brunt of shifts in supply and demand to fall on wages in the 1980s, when those shifts operated against the low skilled and lower paid, the United States could be expected to have especially large drops in the relative earnings of less educated workers, as it did. In western European countries, by contrast, explicit government and union policies dampened pressures of increased wage differentials in the 1980s" (p. 18). However, the floor on wages for unskilled workers led instead to unemployment. Across advanced economies, then, the basic trend seems to have been a sharp decline in the demand for less-skilled workers relative to those with more skills, leading to some combination of lower relative earnings and higher relative unemployment for the less skilled.

20. Robbins (1996) presents evidence that income inequality has risen in a number of developing countries as well. For several countries, including Chile, Columbia, Costa Rica, Mexico, and Uruguay, he finds that the rise in wage dispersion coincided with periods of trade liberalization; however, Robbins does not find evidence of a causal link between inequality and trade. In fact, in some developing countries, he finds that the relative supply of skilled labor increased at the same time as trade liberalization in these countries' export markets expanded the demand for unskilled labor. These changes would have been expected to lower skilled wages and raise unskilled wages, and thus to narrow income inequality in developing countries. That the opposite transpired suggests that labor demand in developing countries has also shifted toward workers with high skill levels relative to the average in developing countries. Feliciano (1995) similarly finds that trade liberalization in Mexico in the mid-to-late 1980s led to increased relative wages of high-skilled workers.

III. DOES IMPORT COMPETITION AFFECT WAGES?

21. Not surprisingly, it is often asserted that there is a link between increased globalization and the declining relative wages of less-skilled workers in the advanced economies. This section focuses on the most visible aspect of this supposed link: whether increased international trade, particularly with developing countries, contributes to rising income inequality. Reflecting the bulk of research on the topic, the focus is again on developments in the United States. A remarkable development in the analytical literature on trade and wages is a divergence in the methodologies used to study the issue: trade economists have focused on the role of imports in lowering product prices and thus wages, while labor economists have used the quantity rather than the price of imports as a measure of the intensity of import competition. The paper first discusses research by trade economists, then research by labor economists and contrasts the two approaches.

A. The Effect of Import Prices on Wages

22. Economic theory provides a compelling hypothesis for how trade might cause increased income inequality: the Stolper-Samuelson theorem. In the simple trade model with two tradable goods and two non-tradable factors of production, the strong form of the theorem states that a decrease in the relative price of one of the goods leads to a decrease in the real return to the factor used relatively intensively in making that product, along with an increase in the real return to the other factor.⁷ For example, trade pressure which results in lower prices of import-competing goods would lead to lower wages for workers whose skills are used intensively in the production of the affected goods.

23. As with many strong results obtained from simple models, this one weakens considerably when generalized to a more realistic framework. The analogue of the Stolper-Samuelson theorem for a world with many goods and factors is that an increase in the relative prices of a bundle of traded products tends to increase the relative return to the factors used relatively intensively in making those products and tends to lower the relative return to the other factors, but the precise effects on any particular factor is not easily derived. In these more general models, stronger statements cannot be made without restrictive assumptions about production technology. Lawrence and Slaughter provide a detailed discussion.

24. Nonetheless, the basic intuition of the Stolper-Samuelson theorem is straightforward. International trade affects product prices across countries, and this affects factor prices within countries by influencing relative factor demands. At the initial factor prices, changes in product prices brought about by competition from imports alter the profit opportunities facing firms in a country. Firms respond by shifting resources toward industries in which profitability has risen and away from those in which it has fallen. Trade flows thus give rise to shifts in factor demands, as demand rises for the factors used relatively intensively in newly profitable sectors and falls in unprofitable sectors. With fixed supplies of factors, these demand changes lead to changes in factor prices.

25. The Stolper-Samuelson theorem thus suggests a mechanism by which import competition can lead to a shift in demand toward skilled labor and thus to an increase in skilled wages relative to unskilled wages: import competition lowers the price of unskilled-labor-intensive products relative to the price of skilled-labor-intensive ones, so that domestic firms shift toward producing skill-intensive goods. The issue then becomes empirical: have relative product prices in the advanced economies, in fact, changed in this way? If so, trade might have contributed to rising income inequality, but it must first be shown that changes in product prices are the result of trade rather than other, purely domestic, influences.

⁷The Stolper-Samuelson theorem applies in some version in both the basic Heckscher-Ohlin-Samuelson trade model and in the extension to models of imperfect competition. Helpman and Krugman (1985) derive the Stolper-Samuelson theorem in the context of a general model which allows for both perfect and imperfect competition.

26. Lawrence and Slaughter analyze U.S. manufacturing prices from 1979 to 1989. They find no evidence of larger price increases in skilled-labor-intensive products; if anything, price increases were larger in the unskilled-labor-intensive industries. Since prices of import-competing goods did not change in a way consistent with pressure from import competition, they conclude that trade did not contribute through the Stolper-Samuelson process to rising wage dispersion and income inequality in the 1980s. For 13 industrial countries during the 1970s and 1980s, Saeger (1996) finds considerable variation across countries in product price changes. For Europe, he finds that rapid technology change led to relative price declines in skill-intensive industries rather than the price decreases in unskilled-labor-intensive industries one would expect in the face of import competition from developing countries.

27. Subsequent papers have refined this analysis by handling differently some of the methodological issues raised by Lawrence and Slaughter. Three important issues are: (1) which prices to use, (2) how to measure skills, and (3) how to control for other influences on product prices such as technological change. Lawrence and Slaughter assume that changes in technology do not affect product prices and take the breakdown between production and nonproduction workers as representing the breakdown between skilled and unskilled workers. They use several measures of prices: producer prices obtained from surveying all domestic firms, export prices obtained from surveying only firms which export, and import prices obtained from surveying just importers.

28. Sachs and Shatz (1994) argue that computer prices should be dropped from the sample because of the difficulty in measuring quality change in these goods. Having done this, for some prices and time periods they find that the relative prices of skilled-labor-intensive products have increased, but for other specifications their findings are similar to Lawrence and Slaughter's results. Leamer (1996a) allows technological change to affect product prices, since it could be that technological advances have substantially lowered the relative price of skilled-labor-intensive goods, offsetting what would otherwise have been relative price increases caused by low-priced imports of unskilled-labor-intensive goods. He examines the 1960s and 1970s in addition to the 1980s, and uses prices of all domestically produced goods. He confirms Lawrence and Slaughter's results in all specifications for the 1960s and 1980s. For the 1970s, however, Leamer consistently finds relative price increases for skilled-labor-intensive products. He thus concludes that "the 1970s were the Stolper-Samuelson decade."

29. Krugman (1995a) uses a computable general equilibrium model of the U.S. economy to calculate the changes in relative product prices and relative wages that are consistent with the observed increase in imports from developing countries. He finds that the small volume of U.S. imports from developing countries (around thirty percent of total U.S. imports in 1995, or only about four percent of U.S. output) has led to only small changes in prices and wages--magnitudes Krugman terms "well within measurement error" (p. 359). He concludes that trade has contributed only a small amount, if anything, to rising income inequality.

30. Finally, Revenga (1992) measures the impact of changes in import prices on wages and employment in individual U.S. industries. She finds that import prices have only small effects on wages and somewhat larger but still not enormous effects on employment. Neven and Wyplosz (1996) perform a similar analysis for manufacturing industries in Germany, France, Italy, and the United Kingdom. They find no clear pattern for the effect of import competition on wages and employment. In Germany, wages and employment appear to be adversely affected by imports from developing countries; in Italy and the United Kingdom, however, imports from other advanced economies are more important influences on labor markets. Along the lines of Lawrence and Slaughter's results for the United States, they find no clear evidence that prices generally fell in unskilled-labor-intensive industries relative to prices in skill-intensive industries, suggesting again that trade with developing nations is unlikely to have played an important role in affecting wages.

31. Several papers have thus analyzed whether trade via the Stolper-Samuelson process contributed to rising U.S. income inequality during the 1980s. Each concludes that trade through this channel likely accounts for only a small part of the increase in wage dispersion and the shift towards high-skilled workers.

B. The Effect of Import Volumes on Wages

32. Labor economists looking at the effect of trade on wages have applied a methodology very different from that of Stolper-Samuelson, focusing instead on the volume of trade and on the factors embodied in these flows rather than the prices of the imports. Borjas, Freeman, and Katz (1992) are perhaps the best example of this approach. They view trade as effectively shipping between countries the services of the factors of production embodied in the traded goods. All else equal, imports add to a country's effective endowment of factors while exports reduce these endowments. The effect of trade on labor markets can thus be thought of as working through factor supplies, rather than factor demands, because the effective endowment of a factor consists of the quantity located within a country's borders *plus* the net quantity imported or exported through trade. The idea is that had the net import bundle instead been produced in the consuming country, the quantity of factors embodied in those imports would have been demanded in that country.

33. Borjas, Freeman, and Katz use input-output tables and data on U.S. trade flows to infer the quantities of factor services embodied in trade flows. The United States tends to export skilled-labor-intensive products and import unskilled-labor-intensive products, so that the growing importance of trade in the U.S. economy has increased the effective supply of unskilled labor relative to skilled labor. Using wage elasticities from other studies, the authors calculate the effect of these supply changes on wages. They conclude that from 1980 to 1985, trade accounted for around 15 percent of the total rise in income inequality, but that this effect diminished in later years.

34. Wood (1994) takes a similar approach, but with a focus broader than solely the United States during the 1980s. He attempts to calculate how much of the decline in demand for

labor in manufacturing industries across advanced economies during the past several decades can be attributed to import competition from developing countries. Using a factor content methodology somewhat similar to that of Borjas, Freeman, and Katz, he estimates that trade led to about a 20 percent decline in the demand for labor in advanced economy manufacturing industries, with the decline concentrated among unskilled workers.

35. However, Wood makes two important assumptions to arrive at this estimate of 20 percent (see Wood 1995, pages 64-68). He first argues that advanced economies do not produce the same goods as those imported from developing countries; for example, imported textiles are made with more unskilled labor than textiles produced in advanced economies and can thus be thought of as a distinct product. This means that input-output tables for the advanced economies understate the amount of less-skilled labor embodied in net trade flows and consequently understate the effect of trade on labor supply and thus on wages. To compensate, he uses input-output tables for developing countries to calculate the factors embodied in imports, an approach which yields effects of trade on the labor supply of unskilled workers ten times larger than that of Borjas, Freeman, and Katz. However, this assumption is rather questionable, since it is likely that differences in factor prices between advanced and developing countries are in fact connected to different factor usages, so that it is not appropriate to assume identical production techniques across countries -- had the imported goods been produced in the advanced economies, they would in fact have been produced using relatively less unskilled labor. The lack of an analytical framework underlying the factor content studies means that the "correct" methodology by which to calculate the quantity of labor displaced by imports is unclear.

36. Second, Wood asserts that import competition leads firms in the advanced economies to focus on labor-saving innovations, the effect of which according to Wood is to reduce the demand for unskilled labor by more than the direct effect of trade itself. Acknowledging that this effect is difficult to quantify, Wood argues that a plausible magnitude would be to double the effect of trade on wages calculated from his factor content approach. Although it is clearly valuable to explore how technological change might be driven by trade rather than just assuming innovation to be an exogenous process, Wood's assumption that this technology channel implies a doubling of the effect of trade has been sharply questioned, principally because it is based largely on conjecture. Moreover, if trade makes labor-intensive goods relatively cheaper, this would be expected to raise the relative price of capital and thus increase the incentives for the development of *capital* saving technology.

37. Borjas and Ramey (1995) develop a model in which imports directly displace domestic production, with the lower output in the import-competing sectors putting pressure on wages in those sectors. In particular, trade competition reduces the labor rents generated from extra normal profits in industries in which firms have some market power. Insofar as these rents tend to accrue to less-skilled workers (wages in industries such as automobiles and steel being the archetypical examples), increased import competition widens income inequality. Applying this model to data for the United States, Borjas and Ramey conclude that

the increased U.S. trade deficits during the 1980s account for 6 percent to 10 percent of the growth in wage inequality in that decade.

38. Bound and Johnson, and Berman, Bound, and Griliches examine not only trade but also skill-biased technological change, deunionization, the increase in Federal defense spending, and other factors as possible explanations for the increased demand for skilled labor in the United States. Both conclude that trade contributes little.

39. Bound and Johnson decompose wage changes for 32 demographic groups of employees in 17 industries into changes in labor supply, product market demand, industry market power, and technology (that is, productive efficiency). Import competition is not measured directly, but is instead subsumed as one of the factors which shift product market demand. They find that the increase in income inequality between college-educated and high school-educated workers is accounted for almost entirely by changes in technology. Shifts in product market demand, including the effect of imports, account for less than 10 percent of the increase in the wage differential.

40. As discussed in Section II, Berman, Bound, and Griliches focus on the role of trade in shifting the mix of resources used by industries in production. The Stolper-Samuelson process entails expansion of the industries with relative price increases and contraction of others. Based on this, they argue that the effect of trade on labor markets works through cross-industry shifts in labor demand. Again, however, they find that the large majority of the manufacturing-wide demand shift occurred within industries, not across industries. From this they conclude that trade, which would be expected to shift resources across industries, played no significant role in affecting wages. It is worth noting that this methodology ignores the possibility that the Stolper-Samuelson process also entails within-industry shifts in labor demand--assuming flexible production technologies, firms in all industries substitute away from the more expensive factor of skilled labor toward less expensive one unskilled labor.

C. The Effect of Trade on Wages: Synthesis and Analysis

41. Despite the different methodologies used, nearly all of this research finds only a modest effect of international trade on wages and income inequality. Wood finds quite large effects of trade on employment, but uses a methodology which, while intriguing, has certain arbitrary aspects. The average estimate of the effect of trade on wages and employment is not zero--most research finds some role for trade--but it is certainly lower than what might be expected from purely anecdotal evidence, and certainly far from the claim that import competition makes a "giant sucking sound."

42. This might seem puzzling in light of the presumption indicating that the advanced economies have become more open to trade since the late 1970s. Given the progression of the Tokyo and Uruguay Rounds of GATT negotiations, the regional free trade areas in Europe and North America, and various unilateral liberalizations, it is surprising that this does not show up in data on product prices. There are at least two possible explanations. One

possibility is that on balance the advanced economies have *not* in fact become substantially more open to trade. Although tariffs have fallen, in some cases they have been replaced with non-tariff barriers such as voluntary export restraints in automobiles and steel, the continuation and expansion of the global Multi-Fibre Arrangement for textiles and apparel, and the web of bilateral non-tariff barriers to protect “sensitive” industries. Another possible explanation is that firms in the advanced economies have upgraded their product mix in the face of low-wage foreign competition. If this is true, foreign competition is potentially blunted and need not lead to large changes in relative product prices.

43. The results of Leamer (1996a) suggest a role for both possibilities. Leamer finds that during the 1970s, the relative prices of unskilled-labor-intensive industries such as textiles, apparel, and footwear fell dramatically. In the United States, however, this price decline did not continue through the 1980s. One explanation for this is that a tightening of the Multi-Fibre Arrangement stopped the decline in the relative prices of these goods. The other is that U.S. producers responded to foreign competition by abandoning the labor-intensive products most directly exposed to this competition. By the 1980s, the remaining textile, footwear, and apparel activity in the United States faced less intense competition because they produced higher-quality alternatives to rather than direct substitutes for foreign goods. Neven and Wyplosz present similar evidence that firms in Europe have upgraded their product ranges and skill demands in the face of import competition.

44. Despite the apparently robust finding that there is only a modest connection between trade and increased inequality in wages and income, there is still sharp disagreement about the appropriate methodology. The basic rift between trade economists and labor economists is whether trade prices or trade quantities are the most important channel through which international trade affects wages. Discussions of the methodological divide include Freeman (1995), Lawrence (1996), Richardson (1995), Wood (1995), and Deardorff and Haikura (1994).

45. The split is over both theory and its empirical implementation. In terms of the theory, there remains disagreement as to whether factor content studies such as Borjas, Freeman, and Katz isolate an independent effect of trade on wages, or whether there are underlying factors such as changes in technology that influence both trade flows and labor markets. That is, does the implicit import of low-skill labor embodied in imports represent an exogenous shift in labor supply in the advanced economies? From the perspective of international trade theory, the answer is no: trade volumes depend on tastes, technology, and resource endowments, and are not necessarily linked to product prices and thus the intensity of import competition. Even a small volume of imports can influence wages if this leads to large changes in domestic prices. However, labor economists and some trade economists counter that under certain conditions, factor content studies do in fact relate the volume of imports to changes in product prices and thus contain information on the effect of trade. Even trade economists differ sharply here; see for example the exchange between Krugman (1995b) and Leamer (1996a, 1996b).

46. Labor economists further argue that even if product prices are the theoretically correct channel through which trade affects the domestic economy, data on product prices are of such poor quality that they contain little information. Given this, the only alternative is to look at trade quantities, for which it is claimed that the higher quality of the data compensates for the theoretical problems. Freeman (1995) exemplifies this argument. Indeed, data presented earlier on historical U.S. trade volumes may represent *prima facie* support for Freeman's point. Recall that the big jump in U.S. trade volumes as a share of U.S. output occurred during the 1970s, not the 1980s, and that this matches the largest movements in product prices, which occurred in the 1970s rather than the 1980s.

47. This issue of how to measure properly the impact of trade on labor markets is still largely unresolved--if anything, the disagreements are becoming more contentious. What is remarkable, however, is the common finding across both literatures of only a small impact of trade on wages and income inequality.

IV. Other Links From Globalization to Labor Markets

48. The research discussed in the previous section address only one aspect of the link between globalization and labor markets: whether international trade has directly contributed to lower wages and higher unemployment for unskilled workers, and increased income inequality. This section takes a broader view. It first examines other effects of trade on labor markets, and then summarizes research on the labor market effects of capital mobility, movements of workers across countries, and the spread of technology across countries.

A. Other Influences of International Trade on Labor Markets

49. Trade can have effects on labor markets beyond shifting labor demand from unskilled to skilled workers and thus changing factor demands and wages. One such effect is that of import competition on interindustry wage differentials, the phenomenon in which seemingly equivalent workers are paid more in some industries than in others. The models discussed in Section III typically assume perfectly mobile factors within each country, so that unskilled workers earn the same wage in all industries. However, Katz and Summers (1989) and others document that some industries (e.g., aerospace, petroleum, and tobacco companies) pay their workers more than similar workers in other industries, and that these differences in compensation are persistent across time. While the existence of these interindustry wage differentials is well established, there is less consensus about their cause. One explanation is that they reflect unobserved worker characteristics and are thus consistent with competitive labor markets--for example, it may be that Boeing attracts more highly skilled mechanics than other companies, even though its workers have substantially the same age, education, and other job market characteristics as those in lower-paying industries. The other explanation, which likely applies to unionized industries such as autos and steel, is that higher wages reflect rents shared with workers by firms earning extranormal profits in imperfectly competitive product markets, where union bargaining power allows workers to extract the rents.

50. If the latter explanation is correct, international trade can affect wages by influencing product market competition and thus the profitability of firms. Abowd and Lemieux (1993) assess whether product market competition affects union wage agreements in Canada. Since wage settlements and firm performance are obviously linked, they assume that trade competition as measured by Canadian import prices affects firm performance independent of union agreements. They find that firm performance, and thus import competition, matters greatly for wage agreements in these unionized industries. For manufacturing industries in the United States, however, Basu and Fernald (1997) show that there are only small markups of price above marginal cost and thus few rents to be affected by import competition.

51. Depending on the nature of wage bargaining, import competition that squeezes firms' profits can lead not only to smaller wage premia in high-wage industries, but also to a reordering of the differentials across industries as unskilled workers in declining industries such as steel find their wages falling behind wages of unskilled workers in more successful industries. Katz and Summers further show that the ranking of industry wage differentials looks similar across countries. Given this, if an industry becomes more competitive worldwide (perhaps as a result of trade liberalization), this would be expected to result in both lower wages and smaller wage differences across countries.

52. This is important because many of those who oppose free trade do so not because of the redistributive effects *within* countries, but rather because they worry about the equalizing effects of trade *across* countries. For example, a prime concern of U.S. critics of the North American Free Trade Agreement (NAFTA) has been that import competition will force wages for unskilled workers in the United States down to the level of Mexican wages, while similar fears have more recently been voiced more generally in many advanced economies that the increased volume of trade with developing countries will lower wages to developing country levels.

53. Free trade can in principle equalize wages across countries, an outcome referred to as "Factor Price Equalization" (FPE). Trade allows for the exchange of factor services across national boundaries, and under certain conditions this is sufficient to equalize factor prices across countries even though the factors themselves do not move across borders. The idea is that each country exports services of factors with which it is relatively well endowed and imports its scarce factors. Trade thus increases the effective relative supply of each country's scarce factors, thereby decreasing their prices, and decreases the relative supply of the abundant factors, increasing their prices. These within-country factor price changes lead to convergence of factor prices across countries. If factor price equalization obtains between the United States and Mexico, then NAFTA would lower the wages of less-skilled workers in low-skilled-labor-scarce America and raise wages of less-skilled workers in low-skilled-labor-abundant Mexico until the same wage structure prevails in both countries.

54. However, there are important caveats to this theoretical possibility. One is that it holds only under a set of rather restrictive assumptions: identical consumer tastes and

production technologies across all countries, perfect factor mobility across industries within each country, and production of the same mix of goods across all countries. Relaxing these assumptions even slightly provides for cases in which trade does not equalize wages across countries--an example of this would be if labor were more efficient in one country than in another, a situation which is surely relevant for the case of NAFTA. The other caveat is that the theory under which factor price equilibrium occurs refers only to a steady state equilibrium, but provides no information as to the path of wages during trade liberalization.⁸ Leamer (1995) proposes a dynamic analogue to the FPE theorem called the Factor Price Convergence theorem: "When two countries eliminate their mutual trade barriers, product price equalization eliminates factor price differences" (p. 7). Yet Leamer acknowledges that for this theorem to hold requires a particular combination of factor supplies, tastes, technology, and the distribution of production across countries. Deardorff (1984) examines a case in which this combination does not hold, with the result that trade liberalization actually causes cross-country wages to diverge rather than converge.

55. Nevertheless, under some circumstances, a movement toward free trade can lead to convergence of factor prices across countries. Ben-David (1993) and Sachs and Warner (1995) identify historical episodes of per capita income convergence across countries and argue that movements toward free trade contributed to these episodes. Ben-David examines the European Community and finds that episodes of trade liberalization among members tended to be followed by convergence in per capita incomes. Sachs and Warner divide countries into those that were "open" and those that were closed to trade in 1970, based on a collection of measures including trade as a share of output and black market premia on exchange rates. They find strong evidence of convergence of per capita income between 1970 and 1985 for the group of open economies but no convergence for the closed group.

56. These results are interesting in that they are consistent with the explanation that the movement towards free trade has helped to equalize international factor prices. However, Slaughter (1997) emphasizes that consistency does not imply causation. Data on per capita income combine both factor prices and factor quantities, but the factor price equalization theorem is about factor prices only. Convergence of per capita income might be caused by convergence in factor quantities rather than factor prices--that is, wages rise in countries which liberalize trade because these countries enjoy a deepening of their capital stock as a result of the liberalization. Convergence of technological progress through technology spillovers would have similar implications. Slaughter demonstrates that the episodes presented by Ben-David and Sachs and Warner are for the most part instances of convergence in per capita capital stocks rather than factor prices.

57. A direct approach to determining the extent to which wages across countries are becoming more equal would be to compare wage levels across countries. However, this

⁸In contrast, the Stolper-Samuelson theorem is explicitly a theory about changes in factor prices in response to changes in the external economy.

would face two problems: finding measures of wages for similar types of labor across many countries, and then settling on the exchange rate at which to convert wages denominated in national currencies into a common currency. Slaughter (1995b) avoids these issues by analyzing the effect on wages of the construction of canals and railroads in the United States in the early 1800s. He finds that the new transportation infrastructure dramatically lowered transportation costs and thus led to convergence of commodity prices across regions in the United States. But wages across regions changed by very little, as regional differences in technology and the output mix prevented strong wage convergence. This again demonstrates that free trade would not be expected to equalize wages across countries with different levels of productivity.

58. A third channel through which trade affects labor markets relates to changes in the elasticity of demand for factors--the degree to which changes in wages lead to changes in the quantity of labor demanded by firms. In models with either perfect or imperfect competition, increased import competition makes factor demands within an industry (and factor demands by firms under imperfect competition) more elastic for a country. When factor price equalization obtains, countries exhibit completely elastic demand schedules for factors so that changes in factor prices give rise to large movements in factor demands. If domestic factor prices rise above the prevailing world level, domestic firms cannot keep costs below world prices and lose market share to foreign firms. Trade thus affects wages by amplifying the effect of changes in costs on production and thus on labor demand.

59. The effect of trade competition on factor demand elasticities is independent of the direct effect of trade on factor prices. Indeed, a country in which relative product prices happen by coincidence to already match world prices will experience no change in factor prices in opening to trade. But when factor price equalization holds, factor demands in that country become infinitely elastic so that any subsequent change in factor prices will have large effects on product and labor markets. One effect is that more elastic demand generally implies less power for workers in bargaining with firms over the division of rents, since with elastic labor demand an increase in wages will lead firms to hire substantially fewer workers than if labor demand were inelastic.

60. Slaughter (1996a) applies this theory to more realistic situations in which a movement toward free trade makes factor demands more elastic, but not infinitely so. While he finds that between 1960 and 1990 the majority of U.S. manufacturing industries experienced increases in labor demand elasticities, there is only a weak correlation between these increases and measures of industry exposure to international trade.

B. Capital Mobility and Labor Markets

61. Capital flows that change a country's stock of capital relative to labor potentially affect relative factor prices. The volume of capital flows across borders has increased rapidly

since about 1970, growing at a rate much higher than that of international trade in products.⁹ As discussed in the May 1995 *World Economic Outlook* (p. 80), cross-border financial transactions in most advanced economies expanded from less than 10 percent of GDP in 1980 to well in excess of 100 percent of GDP in 1992.

62. The claim is often made that outflows of capital from advanced economies have lowered wages, as multinational firms establish and/or expand overseas affiliates, to which the firms then “export” or “outsource” jobs. Slaughter (1995a) shows that this process of outsourcing can generate the within-industry demand shifts towards skilled labor that have in fact occurred across most U.S. industries. However, using detailed firm-level data on the activity of U.S. multinationals, he finds that outsourcing contributed little to rising U.S. income inequality during the 1980s. He constructs a set of stylized facts about the employment, investment, and production patterns of these firms and finds that most of the facts are inconsistent with widespread outsourcing. He also estimates the factor price elasticities of demand between parent and affiliate labor to test whether these firms substitute heavily between labor in the two locations. The results indicate that home and foreign labor are at best weak substitutes and in fact might be complements.

63. Feenstra and Hanson (1995, 1996) also explore outsourcing, but they do not restrict the definition of this activity to multinationals and their direct affiliates. The goal is to examine cases such as Nike, which has shoes assembled in southeast Asia by independent contractors rather than by Nike affiliates. For U.S. manufacturing firms, they proxy the extent of outsourcing by the share of inputs to production estimated to come from abroad, although they do not distinguish the imported intermediate goods as coming from either developing or advanced economies. They find that the growth of imported intermediates accounts for 15 to 33 percent of the decline in the share of wages going to unskilled production workers. However, only about one third of these imports are from developing countries, so that the effect of outsourcing to low-wage countries is likely to be far smaller. As with import competition directly measured by import prices or quantities, outsourcing appears to have had only a modest effect on wages of unskilled workers in the United States, and even the effects of trade flows and capital movements summed together remains smaller than the share of changes in inequality explained by technology-driven changes in labor demand.

64. Countries other than the United States share many of the same concerns about the effect of capital flows on wages. For example, German firms are increasingly outsourcing production activity to eastern European countries. This phenomenon of “Standortwettbewerb” (locational competition) has received much popular attention, but less formal analysis, so that research on the effects of this activity would be quite valuable. Fitzenberger (1996) finds that trade has hurt less-skilled workers in Germany since 1970.

⁹See Goldstein and Mussa (1993).

65. Slaughter (1996b) shows that another effect of capital mobility on labor markets might be that enhanced capital mobility increases the degree to which workers bear the costs of adjustment to terms of trade shocks. As discussed earlier, the basic insight of the Stolper-Samuelson theorem is that changes in product prices affect factor prices by leading to shifts in relative demands for factors of production. Exactly how factor prices change can be complicated in models with more than two factors of production, but the key idea is that all factor prices absorb the product price shock.

66. However, increased capital mobility narrows the range of movement in capital rental rates within a country since as a country integrates its capital market with the rest of the world, risk-adjusted rates of return increasingly match "world" rates. With perfect capital mobility, the rate of return would exactly equal that in the rest of the world, as deviations from world returns are arbitrated away by capital flows.¹⁰

67. If movements in the return to capital are constrained by increased capital mobility, then the effects of terms of trade movements cannot be absorbed equally by all factors of production, so that labor, both more skilled and less skilled, must absorb more of any product price changes. Increased capital mobility thus potentially results in increased volatility of wages in response to external shocks. This would lead to higher wage dispersion if wages of low-skill workers adjust more readily than those of high-skill workers. In Europe, the combination of returns to capital fixed by capital mobility and wages for low-skill workers which are essentially fixed in real terms by structural rigidities means that the impact of terms of trade shocks falls instead on the number of workers hired rather than on wages. Increased capital mobility thus potentially magnifies the effect of external shocks on European unemployment.

C. Labor Mobility and Wages

68. Movements of labor across countries can also affect wages. The main issue in the advanced economies is whether immigration of less-skilled workers from developing countries depresses the relative earnings of less-skilled natives. In contrast to the smaller role they attribute for imports, Borjas, Freeman, and Katz (1992, 1996) estimate that as much as one-third of the overall increase in wage inequality in the United States can be attributed to increased immigration during the 1980s, an effect two to three times as large as that of imports. Borjas (1994) argues that studies which find only small effects of immigration neglect important aspects of the effect of immigration on wages, because these studies typically look for wage effects only in the local labor market where the immigration under study was concentrated, rather than on the country wide effects. For example, Card (1990) finds that the 1980 Mariel boatlift of Cubans into Miami did not depress wages of less-skilled

¹⁰A vast literature starting from Feldstein and Horioka (1980) suggests that the degree of global capital mobility, though increasing, might be less than is indicated by the growth of capital flows alone.

workers in that city compared to nearby cities which did not experience the immigration. Borjas claims that this misses the fact that less-skilled natives adjusted to the influx of immigrants by moving out of Florida altogether. To capture the effect of immigration, Borjas asserts that one must look at national rather than local labor markets.

69. In recent years, many European countries have experienced larger flows of labor relative to their populations both inward and outward than the United States. Mirroring the cross-Atlantic difference in labor markets, immigrants in European countries are typically blamed for causing increases in unemployment rather than declines in wages as in the United States. Zimmerman (1996) summarizes research which finds generally statistically significant effects of immigration on wages and unemployment in Germany, with the adverse effects falling entirely on blue-collar workers while white-collar wages and employment actually rise. Moreover, rigidities in European labor markets limit the speed of adjustment to changes such as migration and import competition, so that any adverse effects may tend to be longer-lasting than in the United States.

70. Friedberg (1996) finds that the recent influx of migrants from the former Soviet Union to Israel has not affected the structure of relative wages in Israel. This is because many of the new immigrants, though to a large degree highly-skilled workers such as scientists and engineers, initially took jobs at wages and skill levels below those they left behind, and thus did not put downward pressure on wages of high-skilled Israeli natives.

71. Immigration can also lead to increased growth, particularly if, as in the case of the recent influx of high-skilled migrants from the former Soviet Union to Israel, immigrants bring with them human capital that offsets the initial decrease in the per capita stock of physical capital that results from the immigration. In this case, the immigration potentially leads to increased investment as the higher levels of human capital raise the return to physical capital. The increase in investment would then be expected to lead to both higher wages and output. In recent years, however, immigrants to most advanced economies have had on average lower levels of human capital than natives, suggesting that economy-wide growth effects from recent flows of immigration will be less immediate.

D. Technology Flows and Wages

72. Although technology is not usually modeled as a factor of production, international technology flows across countries can also affect wages. An inflow of technology can raise factor prices by increasing productivity, with the particular effects depending on the nature of the technology, which can be biased towards enhancing the productivity of capital or labor. In general, however, one would expect wages across countries to become more equalized as technology and production techniques spread across countries.

73. One potential channel through which technology flows across countries is the transfer of technology by multinational firms from the parent to the affiliate countries. Aitken, Harrison, and Lipsey (1996) find evidence of this for Mexico, Venezuela, and the United

States. For all three countries, they find that a higher level of foreign investment in a particular industry is associated with higher wages in that industry. In Mexico and Venezuela, however, FDI appears to raise wages only within the plants of the foreign affiliates; there is no evidence that the technology "spills over" to increase wages or productivity in domestically owned firms.

74. Coe and Helpman (1995) and Coe, Helpman, and Hoffmaister (1997) examine whether technology moves across countries through trade flows. Using data for 77 developing countries and 22 advanced economies from 1971 to 1990, they find that the more these countries import from advanced economies that carry out a lot of research and development, the higher is total factor productivity growth. Eaton and Kortum (1996) find similar results. They estimate that advanced economies generate at least 50 percent of their productivity growth through imports from and proximity to the United States, Japan, and Germany--the three countries that generate most of the inventions in the advanced economies. These studies suggest that trade spurs the transfer of technology across countries. While neither study examines the link between technology transfer and wages in the importing countries, wages would generally be expected to rise as technology increased productivity. Of course, there could be distributional effects were the productivity-enhancing effects of technology to favor a particular segment of the workforce.

V. PUBLIC POLICY ISSUES RELATED TO GLOBALIZATION

75. Increased globalization has been viewed with concern in many advanced economies, with the belief common that globalization harms the interests of workers, especially unskilled workers, either directly through immigration or indirectly through trade and capital mobility. Particularly with respect to import competition, these beliefs appear to be at odds with the empirical evidence discussed above that this aspect of globalization has had only modest effects on wages, employment, and income inequality in the advanced economies.

76. What is interesting about these beliefs is the apparent perception that policies to counter the effects of globalization would improve national welfare. This contradicts the historical evidence that free trade and factor mobility improve global welfare and tend to improve national welfare for all countries involved (this is almost always the case for trade, though not always for factor mobility). Although free trade and factor mobility tend to improve national welfare, some would argue that restrictions might be justified under particular circumstances. One would be concerned about the distribution of welfare within a country, since globalization produces winners and losers despite the overall benefits. Policy makers might choose to forego some aggregate welfare gains in order to improve the welfare of particular constituents such as less-skilled labor. However, restrictions on trade flows or capital movements are typically second-best policies compared to measures which directly compensate parties who do not share in the gains from globalization.

77. On the other hand, increased globalization can exacerbate the effects of preexisting economic problems, such as the phenomenon in which the combination of wage rigidity and capital mobility in Europe magnifies the impact of external shocks on unemployment. However, policies which seek to limit economic integration will dilute the benefits of globalization, which come in the form of lower prices for imports, as well as the increased flow of capital and technological innovations across countries. Rather than attempting to limit or delay globalization, the appropriate policy response is instead to address the underlying structural rigidities that prevent labor markets from adjusting to external shocks. In this respect, education and training have important roles to play, since these are important means by which workers in the advanced economies can upgrade their skills to match the demands of the changing global economy.

78. There might also be long-term concerns about income distribution. Benabou (1993) and Galor and Zeira (1993) develop analytical frameworks in which increased inequality potentially slows human capital formation for the entire economy. The basic idea is that greater income inequality isolates the less skilled from the institutions of human capital formation. For example, inequality can aggravate existing capital market imperfections and slow private investment in education; it can shift voters' preferences away from funding public education and other forms of public infrastructure and can segment the population across jobs and residences in a way which limits the social and economic benefits derived from mixing different groups of people. If globalization results in isolation--financial, geographical, intellectual, or otherwise--those most affected by these changes may not have the resources needed to invest in the process of transition. If human capital growth in particular groups suffers as a result of globalization, the consequent economy-wide effect of lower productivity growth might make even the more skilled worse off as well.

79. Another policy consideration might be the existence of short-term adjustment costs. The adjustment of workers displaced by import competition occurs slowly and with significant costs, such as the need to obtain information about new opportunities, relocation, and the loss of firm- or industry-specific knowledge.¹¹ For example, Blanchard and Katz (1992) find that U.S. regional labor markets take several years to fully recover from declines in aggregate demand. They also find that most of this adjustment entails people moving out of the affected region rather than wages adjusting downward to maintain employment. Even though empirical research suggests that trade has only modest effects on workers, some government action may be required to ensure the existence of a social safety net so that those who are displaced do not become marginalized. It is important, however, that any such actions provide incentives for workers and firms to adjust to and therefore gain from changes in the global economic environment.

¹¹See Rodrik (1997) for a discussion of social dislocations that have accompanied changes in the global economy.

80. The adjustment costs can be minimized by encouraging flexible labor markets and by reducing structural rigidities facing firms, such as onerous work rules, staffing requirements, and hiring and firing costs. Other policies might include gathering and spreading information about labor market conditions, standardizing professional certification procedures across countries, and enhancing training and educational opportunities. These issues seem relevant both for European countries in which structural rigidities such as centralized wage bargaining and extensive hiring and firing costs inhibit labor mobility, and for the United States, where problems with the educational system are widely believed to limit the growth of the skilled workforce.

81. Unfortunately, policymakers with short political time horizons might be more concerned with avoiding the short-term adjustment costs which result from globalization and technological progress rather than with the long-term benefits of free trade, increased factor flows, and labor market reforms.

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