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Deindustrialization: Causes and Implications

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Abstract

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 that North-South trade has had very little to do with deindustrialization. The paper also discusses the implications of deindustrialization for the growth prospects and the nature of labor market arrangements in the advanced economies.

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SUMMARY

The advanced economies have witnessed a virtually continuous decline in the share of manufacturing employment in the last two decades--a phenomenon referred to as deindustrialization. Employment in manufacturing now constitutes only a small fraction of civilian employment in most of the traditional "industrial" countries. The dynamic economies of East Asia also appear to have embarked on deindustrialization in recent years.

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. North-South trade has had very little to do with deindustrialization. However, the pattern of trade specialization among the advanced economies explains the differences in the structure of employment among them.

The paper argues that deindustrialization implies that 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.

I. INTRODUCTION

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.

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 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]

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[2]In 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.

[3]Rowthorn (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.*

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]

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.

The discussion of deindustrialization in this paper largely follows the approach in Rowthorn and Wells (1987). They extended the earlier contributions of Lengellé (1966), Baumol (1967), Fuchs (1968), and Singh (1977), 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.

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[4]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.

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

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

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 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]

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

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[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.

[7]The 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 1a. Employment by Sector as a Share of Total Civilian Employment

(Percent)

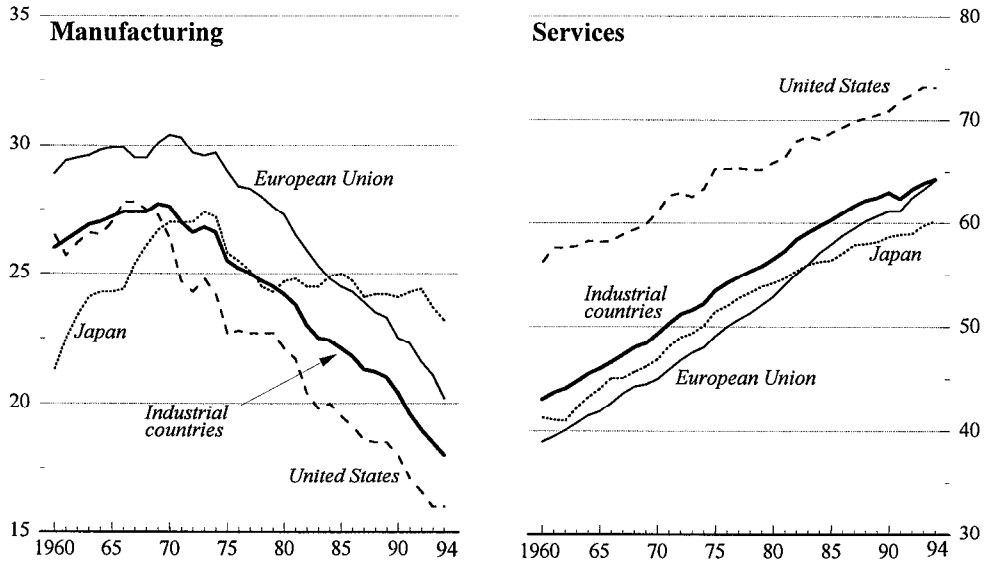
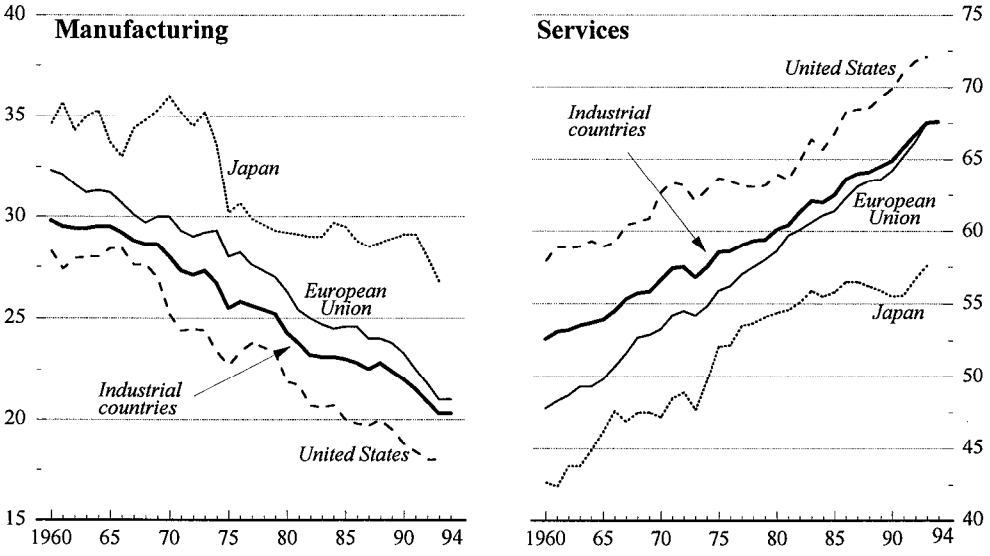


Chart 1b. Value Added by Sector as a Share of GDP at Current Prices

(Percent)



Source: *OECD Historical Statistics 1960-94.*

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

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.

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. Chart 2a bears this stylized fact out.[8] For the group of industrial countries, the constant price

[8]It 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.

Chart 2a. Value Added in Manufacturing, Constant Prices

(In percent of real GDP; PPP weights)

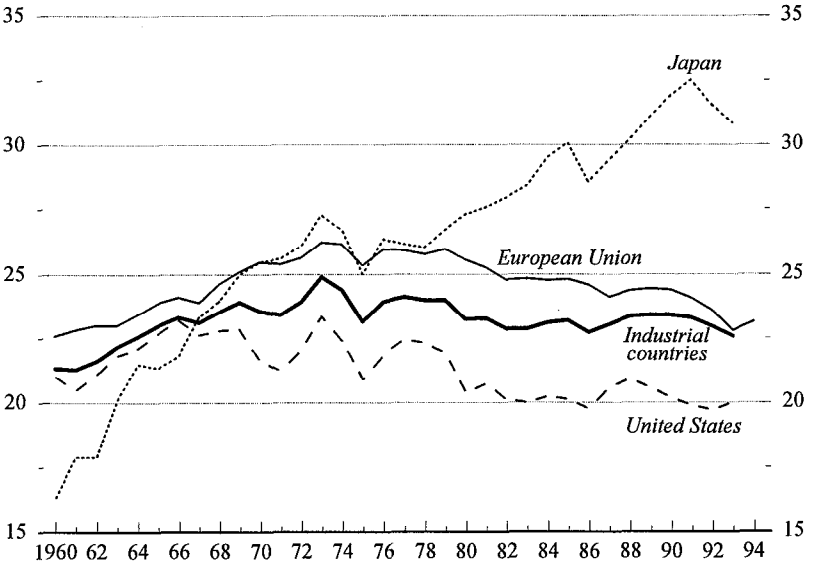
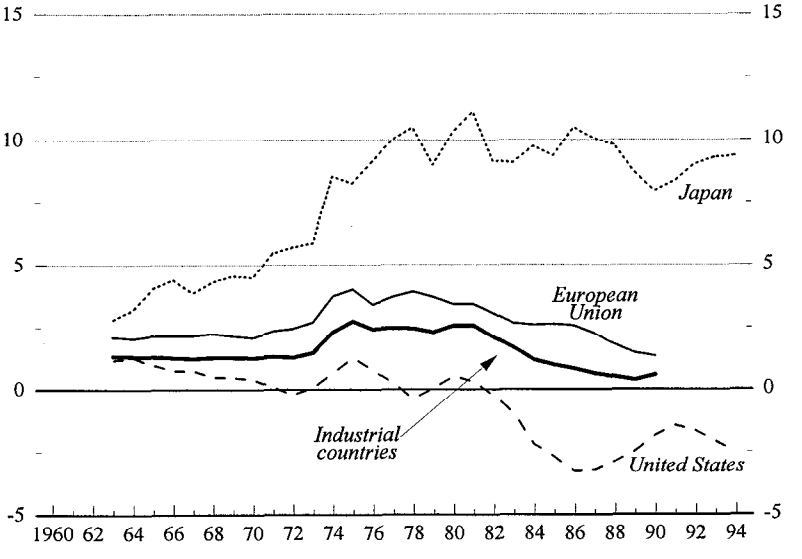


Chart 2b. Balance of Trade in Manufactured Goods

(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.

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]

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.

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.

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

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[9]The 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. A more recent study by Falvey and Gemmel (1996) using cross-section data confirms Summers' finding that services overall have an income elasticity of approximately unity.)

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.

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.

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

[11]The 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.*

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]

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

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[12]Note that quality biases may also result in the undermeasurement of output growth in the manufacturing sector (Boskin Committee, 1996). It is possible that productivity growth is underestimated more in services than in manufacturing, but this is not certain. Indeed a study reported by Murray (1992) suggests that there was an unrecorded *decline* in productivity in public services in Sweden over the period 1960-90, and the same may also be true in some other countries. 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.

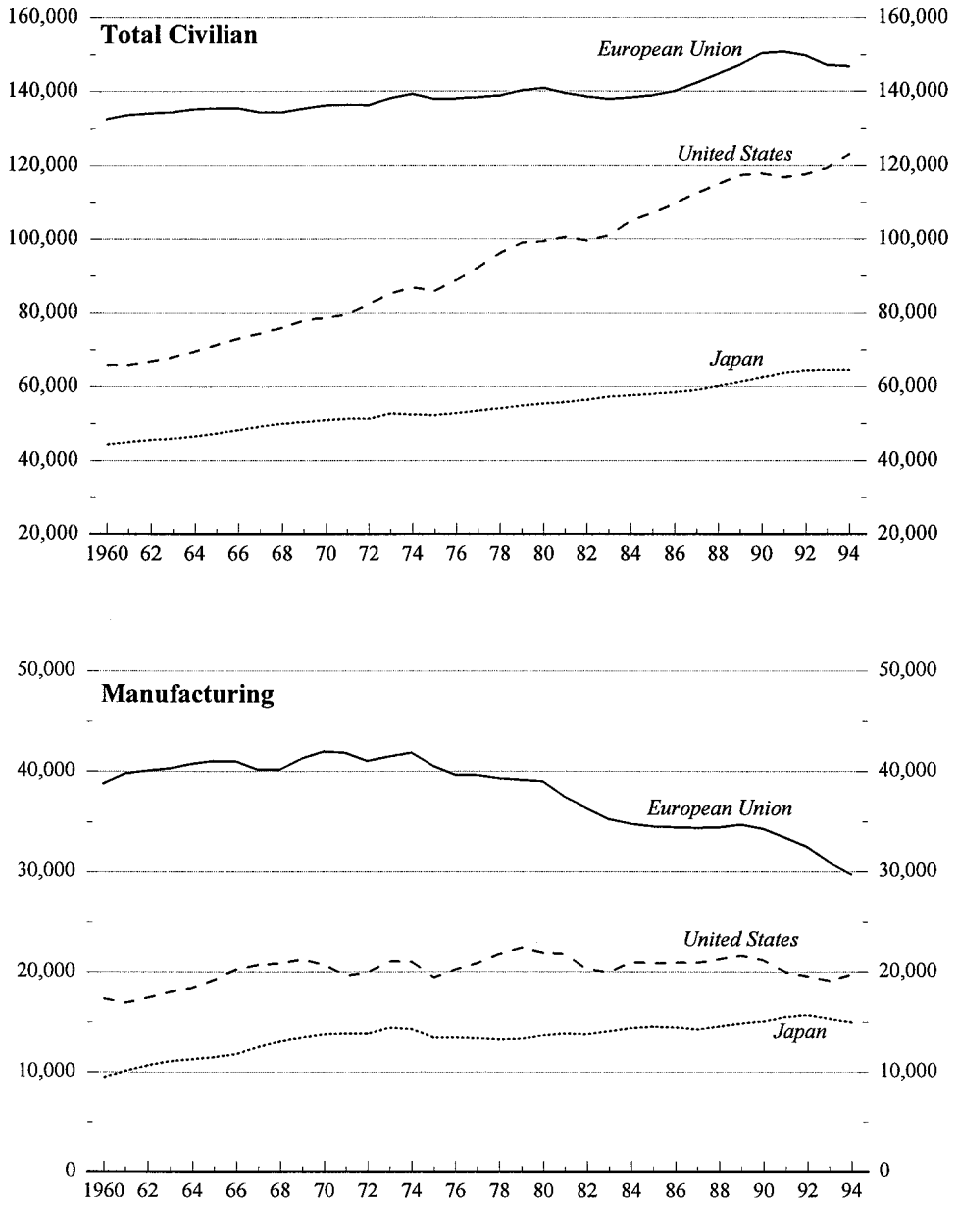
An important implication of this discussion is that deindustrialization is not necessarily a symptom of the failure of a country's manufacturing sector, or for that matter, of the economy as a whole. On the contrary, deindustrialization is simply the natural outcome of the process of successful economic 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.

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. Hence, while economic dynamism explains a large part of the decline in the share of manufacturing employment in both the United States and Europe, the process of deindustrialization has been associated with some negative features--stagnant earnings and widening income disparities in one case, and high unemployment 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 and employment during the adjustment period.

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

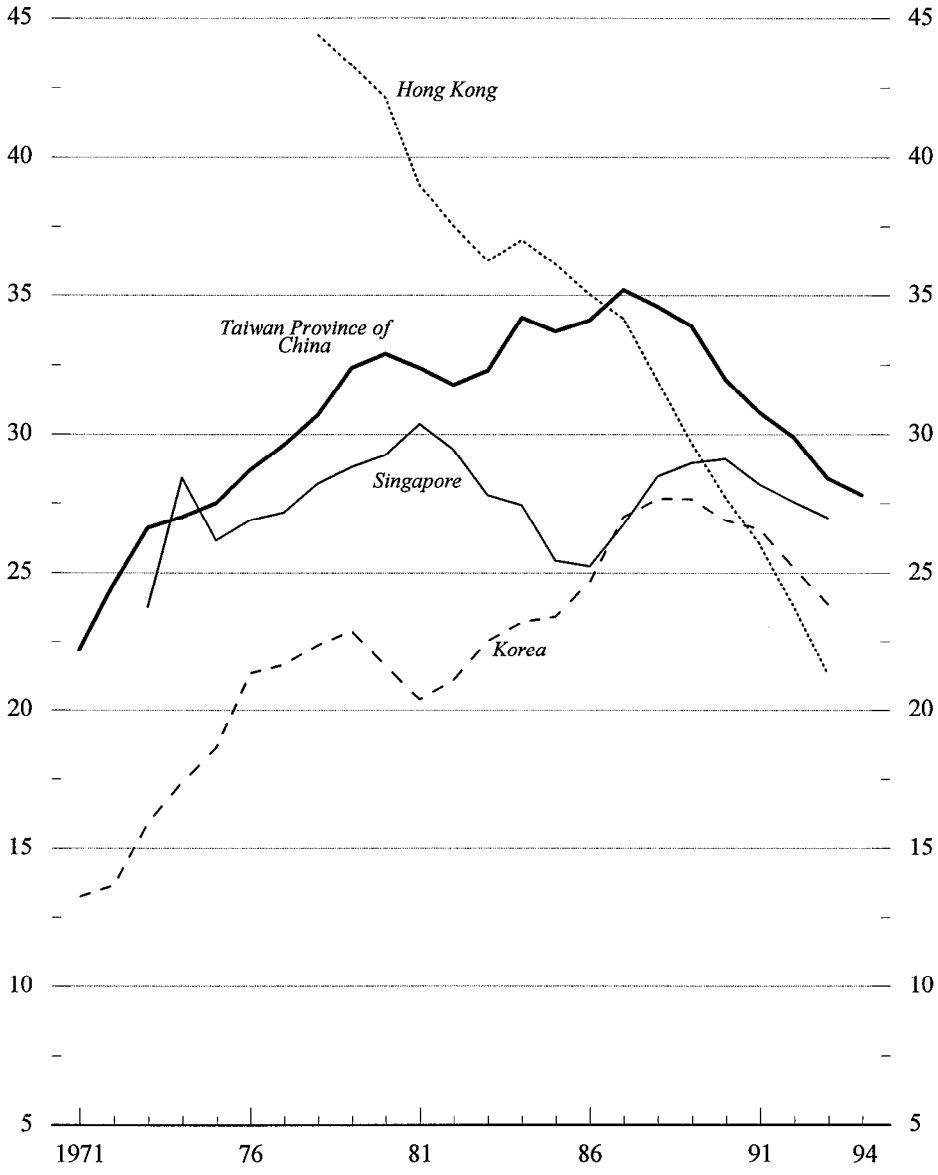
(Thousands)



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

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.

The fact that the measured output of manufactures grew more slowly than that of services over the period 1970-94 may reflect a variety of influences. In addition to some shift in the pattern of consumers' expenditure, the demand for manufactures may have been depressed by other factors, such as changes in the structure of net exports and a decline in the rate of investment in advanced economies. Finally, certain activities previously conducted "in-house" by manufacturing firms may have been hived-off to specialist subcontractors, and hence reclassified as part of service output. 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

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.

time for 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.[14]

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).[15] 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).

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

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[13]Note that a few individual countries have experienced a significant deterioration in their manufacturing trade balance owing to the discovery of oil and gas, and this contributed to a decline in manufacturing employment. This phenomenon is referred to as the "Dutch-disease" in the literature.

[14]See also, in this context, the UNCTAD's Trade and Development Report (1995).

[15]In 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.

important--they account for more than 60 percent of deindustrialization in all the different groupings of the advanced economies.

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

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 relatively 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".[16]

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".

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[16]It 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.

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--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.

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).[17] 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.

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

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[17]It 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.

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 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.[18]

VI. Conclusions

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.

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.

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

A SIMPLE MODEL OF DEINDUSTRIALIZATION

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.

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

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

$$Y = Y_a + Y_i + Y_s \qquad \textbf{(1)}$$

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

$$Y_a = bL \qquad \textbf{(2)}$$

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

$$Y_s = cY \qquad \textbf{(3)}$$

Labor Productivity

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

$$\begin{aligned} y_a &= y^o e^{\lambda\alpha t} \\ y_i &= y^o e^{\lambda\alpha t} \\ y_s &= y^o e^{\alpha t} \end{aligned} \tag{4}$$

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.

Output per worker in each sector is as follows

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

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

$$L = L_a + L_i + L_s \tag{6}$$

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

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

which implies that

$$y = \frac{y^0 e^{\alpha t}}{c+(1-c)e^{\alpha(\lambda-1)t}} = \frac{y_s}{c+(1-c)e^{-\alpha(\lambda-1)t}} \quad (8)$$

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

$$\frac{y}{y_s} \rightarrow \frac{1}{c} \quad (9)$$

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

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

$$P_a = \frac{L_a}{L} \qquad P_i = \frac{L_i}{L} \qquad P_s = \frac{L_s}{L} \quad (10)$$

It can be shown that

$$P_a = \frac{b}{y^o} e^{-\lambda\alpha t} \qquad P_s = \frac{c}{c+(1-c)e^{-(\lambda-1)\alpha t}} \quad (11)$$

The share of industrial employment is given by

$$P_i = 1 - P_a - P_s \tag{12}$$

and hence

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

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

$$P_a \to 0$$
$$P_i \to 0$$
$$P_s \to 1$$

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

Differentiating equation (12), we obtain

$$\frac{dP_i}{dt} = -\frac{dP_a}{dt} - \frac{dP_s}{dt} \tag{14}$$

which, from (11), can be written

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

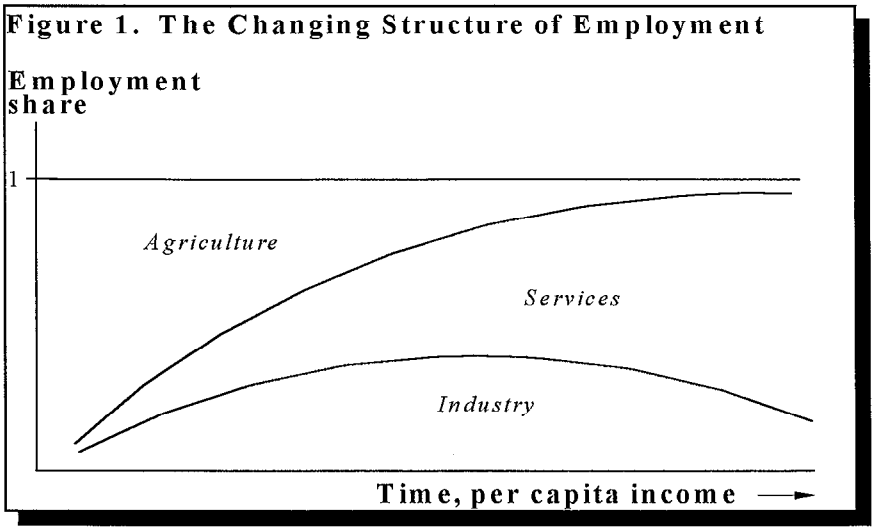
Hence $\frac{dP_i}{dt} > 0$ if and only if

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

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.

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.

Figure 1. The Changing Structure of Employment

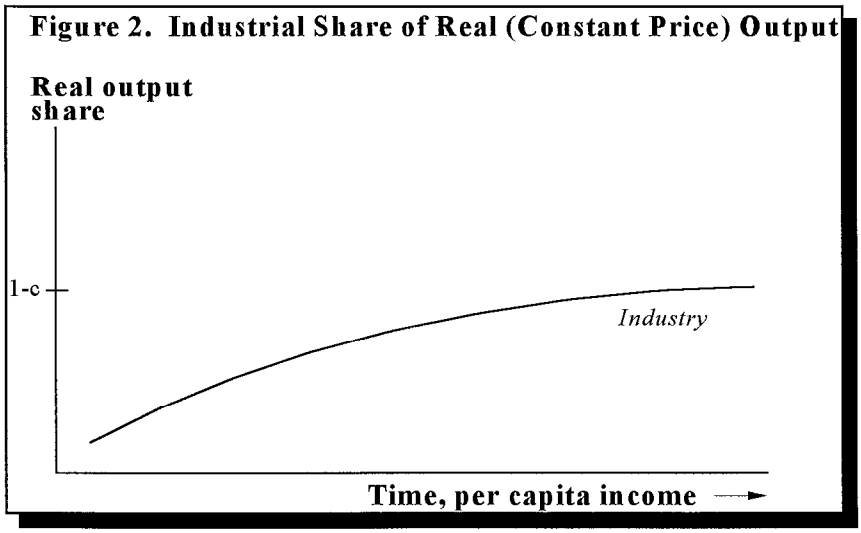


It can be shown that the share of industry in real output is given by

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

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.

Figure 2. Industrial Share of Real (Constant Price) Output



THE DETERMINANTS OF DEINDUSTRIALIZATION

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.

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

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.[19]

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.

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[19]Fish 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.

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

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 indicates 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	82.48	129.26	-25.12	104.29	-87.03	-112.11
	(83.01)	(140.10)	(155.18)	(210.44)	(171.90)	(218.89)	(193.54)
LGDPSQ	-3.93	-4.21	-6.94	1.28	-5.57	4.39	5.85
	(4.72)	(7.70)	(8.43)	(11.26)	(9.16)	(11.47)	(10.11)
Overall trade balance	0.61*	0.51*	0.44*	0.36*	0.44*	0.43*	0.31*
	(0.18)	(0.17)	(0.11)	(0.12)	(0.13)	(0.11)	(0.09)
$\bar{R}^2$	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. LGDPSQ 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.

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.[20] 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*	134.04*	127.47*	135.92	126.45*	136.42*	130.84*	126.83*
	(33.41)	(33.30)	(32.50)	(33.56	(27.82)	(28.58)	(27.87)	(28.46)
LGDPSQ	-10.03*	-7.40*	-7.03*	-7.45	-6.71*	-7.30*	-6.99*	-6.73*
	(1.81)	(1.82)	(1.77)	(1.83	(1.56)	(1.56)	(1.52)	(1.55)
Overall trade balance	0.44*		0.30*	0.42	0.40*		0.30*	0.40*
	(0.06)		(0.06)	(0.06)	(0.05)		(0.06)	(0.05)
Total exports		0.28*				0.27*		
		(0.07)				(0.06)		
Total imports		-0.32*				-0.31*		
		(0.06)				(0.06)		
Exports to South		1.29*	1.11*			1.15*	0.99*	
		(0.38)	(0.33)			(0.41)	(0.37)	
Imports from South		-2.98*	-3.38*	-2.84**		-0.67	-0.98	-0.05
		(0.82)	(0.69)	(0.70)		(0.89)	(0.82)	(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.

[20]The limits are two standard errors on each side of the estimate.

North-South Trade

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.

One way of testing this proposition is to include explicit variables for North-South exports and imports.[21] 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.

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.

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[21]The 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	107.71	107.99	-65.14	99.26	-89.20	-116.02
	(79.45)	(136.36)	(147.43)	(206.41)	(174.84)	(225.88)	(189.51)
LGDPSQ	-3.77	-5.56	-5.88	3.29	-5.23	4.49	6.13
	(4.52)	(7.49)	(8.00)	(11.03)	(9.32)	(11.83)	(9.90)
Overall trade balance	0.77*	0.58*	0.49*	0.39*	0.45*	0.43*	0.34*
	(0.20)	(0.17)	(0.10)	(0.12)	(0.14)	(0.12)	(0.09)
Imports from South	14.51	6.96	5.92	4.89	-2.99	-0.17	-1.56
	(9.21)	(4.67)	(3.44)	(3.45)	(4.40)	(1.06)	(1.20)
$\overline{R}^2$	0.681	0.479	0.524	0.289	0.288	0.321	0.364

Notes: See Tables A1 and A2.

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

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	11.60	73.04	-63.42	153.49	23.16	-6.73
	(65.80)	(119.53)	(139.22)	(201.79)	(162.96)	(227.60)	(204.80)
LGDPSQ	-2.47	-0.39	-3.91	3.23	-8.34	-1.49	0.24
	(3.74)	(6.56)	(7.56)	(10.79)	(8.69)	(11.95)	(10.73)
Overall trade balance	0.43*	0.50*	0.44*	0.38*	0.45*	0.43*	0.33*
	(0.14)	(0.15)	(0.10)	(0.11)	(0.13)	(0.11)	(0.09)
Unemployment	-1.59*	-1.25*	-0.72	-0.47	-0.28	-0.29	-0.20
	(0.45)	(0.43)	(0.30)	(0.29)	(0.15)	(0.21)	(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

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

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)
LGDPSQ	-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
$\overline{R}^2$	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.

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

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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