Explaining Deindustrialization: How Affluence, Productivity Growth, and Globalization Diminish Manufacturing Employment[1]

Christopher Kollmeyer
University of Aberdeen

This study analyzes why the world's most economically advanced countries have deindustrialized over the last few decades. Previous research focuses on three causal factors: (1) rising consumer affluence and its propensity to increase demand for services more than for manufactured goods, (2) faster productivity growth in the manufacturing sector relative to other sectors, and (3) expanding trade linkages between the North and the South of the global economy. The relative importance of these factors, however, is not fully understood, because previous research has not tested all of these explanations simultaneously nor considered the indirect channels through which global trade may cause deindustrialization. This study tests the three factors with two-way fixed-effects regression models and panel data on 18 OECD countries from 1970 to 2003. The results indicate that each factor makes significant contributions to deindustrialization, and that global trade exerts both direct and indirect effects on employment patterns in economically advanced countries, but that the single greatest factor comes from the steadily rising affluence of consumers in these countries.

In the mid-20th century, social scientists began predicting the arrival of a postindustrial society, in which economic activity would center on the provision of services rather than the production of physical goods (Clark

[1] I am grateful for helpful comments and insightful suggestions that I received from Bill Bielby and several *AJS* referees. Earlier versions of this article were presented at the meetings of the American Sociological Association in New York, August 11–14, 2007, and the meetings of the Society for the Advancement of Socio-Economics in Trier, Germany, June 30–July 2, 2006. Direct correspondence to Christopher Kollmeyer, Department of Sociology, University of Aberdeen, Aberdeen AB24 3QY, Scotland, United Kingdom. Email: c.kollmeyer@abdn.ac.uk

0002-9602/2009/11406-0002$10.00

1957; Bell 1973). As these scholars predicted, the percentage of the workforce employed in the manufacturing sector has steadily declined across the world's most economically advanced countries. In the United States, for example, jobs in the manufacturing sector shrank from a peak of 28% of the national workforce in 1965 to just over 12% of the national workforce today (OECD 2005*c*). This phenomenon, generally known as *deindustrialization*, has been the subject of numerous social scientific studies.[2] This is partly because scholars and policy makers alike associate it with serious socioeconomic problems, such as rising income inequality and severe community decline, but also because it has altered many aspects of everyday social life.

What are the primary causes of this phenomenon? The explanations originally offered by Clark (1957) and later popularized in sociology by Bell (1973) link deindustrialization with efficiency gains made by manufacturing firms (enabling them to produce more goods with fewer workers) and with rising levels of affluence among consumers (leading them to spend more of their additional incomes on services). Since the 1980s, however, many scholars have focused their attention on globalization and its capacity to enable manufacturing firms to outsource their routine production jobs to low-wage regions of the world economy (e.g., Bluestone and Harrison 1982; Ross and Trachte 1990; Wood 1994, 1995).

However, despite its considerable and far-reaching effects on society, and despite its centrality to many core concerns of sociology, the causes of deindustrialization are not fully understood. This is largely because previous studies have not tested the aforementioned explanations simultaneously. It is well known that, when using regression techniques, the omission of an important explanatory variable can yield erroneous results. Thus, previous research on deindustrialization cannot be seen as definitive, because it has either ignored one or more of these explanations altogether (Wood 1994, 1995; Rowthorn and Ramaswamy 1997, 1999; Alderson 1999; Kucera and Milberg 2003; Rowthorn and Coutts 2004; Whitford 2005; Brady and Denniston 2006) or failed to test all three simultaneously (Saeger 1997). It is my hope that the present study will fill this gap in our understanding of deindustrialization, which currently stands as one of the most far-reaching socioeconomic transformations of the late 20th century.

In what follows, this study provides a comprehensive analysis of the determinants of deindustrialization. After reviewing the existing litera-

[2] *Deindustrialization* does not necessarily denote a decline in manufacturing output. In this study and elsewhere, it refers to a decline in the manufacturing sector's share of total national employment. If labor productivity increases rapidly, deindustrialization can occur even as manufacturing output increases or remains constant.

ture's explanations for this phenomenon, I offer new theoretical insights into how globalization likely promotes deindustrialization *directly* (by fostering trade containing highly unequal quantities of labor inputs), but also *indirectly* (by intensifying those domestic factors already contributing to the decline of relative manufacturing employment). Next, with panel data from 18 countries in the OECD (Organization for Economic Cooperation and Development) spanning a 34-year period, I simultaneously test these explanations for deindustrialization with a series of two-way fixed-effects regression models. The results indicate that trade globalization indeed contributes to deindustrialization, both through direct and indirect channels, but that growing affluence appears to account for the largest portion of deindustrialization in the OECD countries in my data set.

Trend to be explained.—Using a series of box plots, figure 1 illustrates the trend of declining relative employment in the manufacturing sector for 18 OECD countries from 1970 to 2003.[3] For any given year, the corresponding box plot depicts the range of relative manufacturing employment found across these 18 countries. Moving across the collection of box plots from left to right, the distribution drifts noticeably downward, with the line marking the median falling by about a third—from about 26% of total employment in 1970 to about 15% of total employment in 2003. Although the decline varies from country to country, the general trend clearly indicates a wide-ranging and ongoing contraction in relative manufacturing employment across the sample. (App. fig. A1 shows these trends for each country separately.)

EXISTING EXPLANATIONS FOR DEINDUSTRIALIZATION

A review of the social science literature reveals three primary explanations for deindustrialization. It must be emphasized, however, that these explanations are not believed to be mutually exclusive. Thus, the current study does not seek to determine which explanation is correct per se, but rather to determine the relative importance of each factor.

Unbalanced Productivity Growth

Rapid productivity growth in the manufacturing sector has long been identified as a primary cause of deindustrialization. In his now-classic study on the relationship between economic development and employment patterns, Clark (1957) argued that productivity gains made in the man-

[3] The 18 OECD countries used in this study are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States.

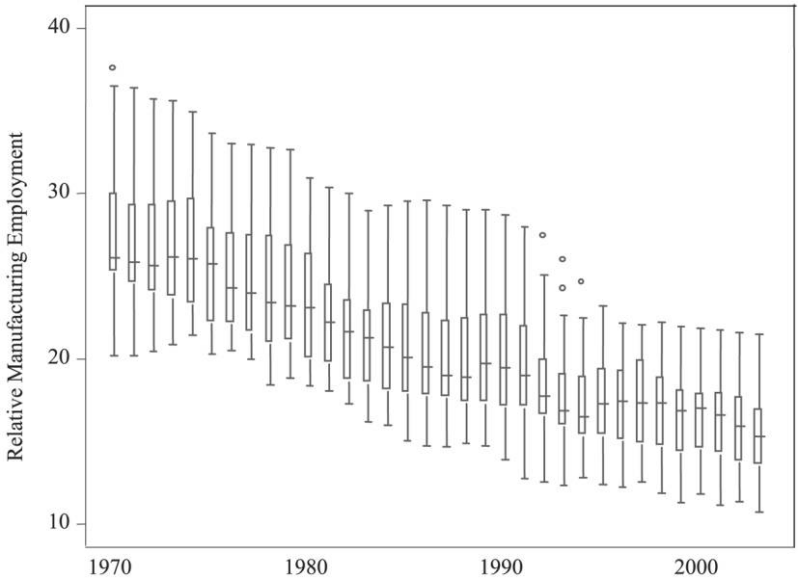

FIG. 1.—Box plots of relative manufacturing employment (as percentage of total employment) in 18 OECD countries, 1970–2003. The boxes represent the middle 50 percentiles of the distribution, and the lines extending from them represent the highest and lowest quartiles.

ufacturing sector normally exceed those made in the service sector, and that this relatively stable phenomenon should manifest as a slow decline in the manufacturing sector's share of total national employment. The basic premise of this argument is that productivity growth, defined as yearly increase in the output of goods or services per worker, inversely affects the prevailing demand for labor. This occurs because highly productive firms, through the use of labor-saving technologies and logistical strategies, can maintain their existing levels of output each year with fewer and fewer workers. At the macrolevel of the economy, this means that if one sector consistently outpaces other sectors in productivity growth, and if the pattern of demand among these sectors remains constant, then employment growth should contract in the dynamic sector, where demand for labor is shrinking, and expand in the less-dynamic sector, where the demand for labor remains more robust. Importantly, since the production of goods often entails standardized and repetitive processes, manufacturing firms can often enhance their labor productivity through the use of automation, mechanization, and other labor-saving technologies. But this occurs less frequently in the service sector, where many business functions cannot easily be mechanized. For example, a

meal at a nice restaurant is prepared basically the same way today as it was decades ago.

This argument has been confirmed by numerous empirical studies (Baumol, Blackman, and Wolff 1985, 1989; Rowthorn and Wells 1987; Krugman and Lawrence 1993; Rowthorn and Ramaswamy 1997, 1999; Rowthorn and Coutts 2004). Most notably, Rowthorn and his colleagues generate considerable support for Clark's original argument. They use panel data from OECD countries to test whether unbalanced productivity growth or global trade patterns account for the largest portion of manufacturing's declining share of total national employment (Rowthorn and Ramaswamy 1997, 1999; Rowthorn and Coutts 2004). They conclude that "the most important factor that accounts for deindustrialization is the systematic tendency for productivity in the manufacturing sector to grow faster than in services. North-South trade has played very little role in deindustrialization" (Rowthorn and Ramaswamy 1997, p. 22).

The basic premise of this argument, however, has recently been questioned by Nordhaus (2005, 2006). Analyzing data from 67 subsectors of the American economy from 1942 to 2001, he finds that the aforementioned negative relationship between productivity and employment growth does not hold for the manufacturing sector. Instead, he finds that rising productivity in the manufacturing sector actually spurs employment growth. This anomaly arises, Nordhaus claims, because intense international competition forces down market prices for manufactured goods, which in turn stimulates demand for these products. Purportedly, this creates a situation in which highly productive firms shed some jobs due to their rising productivity growth but create even more jobs due to the growing demand for their competitively priced products.

Growing Affluence of Consumers

Another prominent explanation for deindustrialization focuses on the possibility that growing affluence alters the spending patterns of consumers, shifting them away from manufactured goods and toward services. In what became known as Engel's law, the 19th-century statistician Ernst Engel found that poor families typically spend a larger portion of their incomes on food than wealthy families do. This occurs, Engel argued, because poor families must strictly prioritize their budgets, first spending their incomes on food, and then spending any remaining amounts on nonnecessities, which disproportionately tend to be manufactured goods and services. A century later, Clark (1957) extended this logic, suggesting that a country's level of affluence affects its relative demand for agricultural products, manufactured goods, and services. Based on an analysis of cross-national data, he concluded that "as real income per head in-

creases, it is quite clear that the relative demand for agricultural products falls all the time, and that the relative demand for manufactures first rises, and then falls in favour of services" (p. 493).

This purported correlation between growing affluence and the demand for services makes intuitive sense. Since manufactured goods are often highly durable, multiple purchases of the same product can quickly become redundant. But since many services are more ephemeral—a meal at a restaurant, for example, still leaves the customer hungry the next day—they can be purchased repeatedly without significantly diminishing in utility.

More recent studies provide empirical support for Clark's more theoretical argument. Drawing on statistical models, several researchers find that real per capita income has an inverted-U-shaped effect on relative manufacturing employment (Rowthorn and Wells 1987; Krugman and Lawrence 1993; Rowthorn and Ramaswamy 1997, 1999; Alderson 1999; Rowthorn and Coutts 2004). Here the general finding is that, for low- and moderate-income countries, incremental increases in real per capita income first increase relative manufacturing employment, but beyond a certain threshold of affluence, additional increases cause manufacturing's share of total national employment to decline. For wealthy countries, this implies that growing affluence should lead consumers to spend greater portions of their newfound incomes on services, an outcome that in turn promotes deindustrialization.

Economic Globalization

Since the 1980s, numerous scholars have implicated globalization in the deindustrialization of economically advanced countries (Bluestone and Harrison 1982; Bluestone 1984; Ross and Trachte 1990; Revenga 1993; Wood 1994, 1995; Alderson 1997, 1999; Saeger 1997; Whitford 2005; Brady and Denniston 2006). In an early analysis of this subject, Fröbel, Heinrichs, and Kreye (1980) introduced a prominent framework for understanding the relationship between globalization and changes in employment patterns occurring around the world. At the center of their analysis is the claim that, for much of the industrial age, world trade patterns followed a "classic international division of labor," in which less-developed countries (the South) specialized in producing and extracting raw materials and the economically advanced countries (the North) specialized in manufacturing these raw materials into finished goods. Organized in this way, the world economy created vibrant and growing manufacturing sectors in Northern countries.

In the late 1960s, however, this long-standing pattern in world trade began to change, creating in the process what Fröbel and his colleagues

called a "new international division of labor." During this time, many multinational firms sought to reduce their production costs by relocating their routine production jobs to low-wage regions of the world economy—a business strategy that became increasingly viable as technological advancements associated with the information revolution began reducing barriers associated with geographic distance. Concurrently, many firms sought to enhance their organizational "flexibility" by (1) dispersing their business operations across a worldwide network of smaller and ever-changing business units, each of which performs a specific task within a much larger chain of business activities, and (2) outsourcing certain nonessential business functions to third-party service providers, which assume these duties on a contractual basis (Reich 1991, pp. 81–170; Gereffi 1994; Dicken 1998, pp. 201–77; Held et al. 1999, pp. 184–87; Castells 2000, pp. 163–215; Whitford 2005). The combined effect of these trends, these scholars would argue, realigned the erstwhile international division of labor, leaving a rapidly industrializing South to specialize in labor-intensive and low-skilled manufacturing jobs and a deindustrializing North to specialize in high-skilled economic activities, such as strategic management, product development, marketing, and finance.

Using an array of advanced quantitative methods, recent studies find empirical support for this theoretical explanation for deindustrialization. For example, employing an econometric technique known as factor content analysis, Wood (1994, 1995) estimates how much skilled and unskilled labor a country *has used* to produce its exports, and similarly how much it *would have used* to produce its imports. The difference between these two estimates, Wood contends, arises from globalization's unequal effect on these two types of labor. (This contention assumes that global trade should reduce the demand for unskilled labor in economically advanced countries, because many routine manufacturing jobs, which were previously held by domestic workers, are now performed overseas.) Based on this methodology, he claims that the demand for unskilled labor in the North fell by nearly 22% between 1970 and 1990, a large enough reduction to account for more than half of the decline in manufacturing employment in these countries (see a similar study by Kucera and Milberg [2003]).

Wood's findings, however, have not been fully replicated by scholars using standard regression techniques (Alderson 1997, 1999; Rowthorn and Ramaswamy 1997, 1999; Saeger 1997; Rowthorn and Coutts 2004). In general, these studies conclude that globalization does contribute to deindustrialization, but not at the magnitudes suggested by Wood (1994, 1995). These findings are important because regression analysis, with its ability to test several explanations at once, seems more appropriate than factor content analysis for answering this research question. However, despite

its many strengths, this body of research has at least two overarching shortcomings. These are discussed below.

LIMITATIONS OF PREVIOUS RESEARCH

Omitted Variable Bias

Previous quantitative research into the determinants of deindustrialization likely suffers from omitted variable bias. To fully understand how the aforementioned three factors contribute to deindustrialization, they must be considered and analyzed together. If this is not done, and some of the factors are correlated with one another, regression techniques will yield inaccurate parameter estimates. Previous research into deindustrialization is susceptible to this problem, because it has either ignored one or more of the explanations altogether or failed to test all three simultaneously, as stated above. Seeking to overcome this methodological problem, the present study tests all three explanations for deindustrialization simultaneously.

Indirect Effects of Global Trade

Previous research also fails to consider the indirect channels through which globalization may affect the worldwide distribution of manufacturing jobs. Here the primary concern is that global trade promotes deindustrialization not only directly, as many scholars have already demonstrated, but also indirectly, by altering the internal dynamics of Northern economies. This could plausibly happen in two ways: (1) by making Northern consumers more affluent and (2) by making Northern economies more prone to unbalanced productivity growth.

The first scenario has already been suggested by development scholars (Emmanuel 1972; Amin 1977). The structure of North-South trade, these scholars argue, boosts living standards in the North more than in the South. This purportedly occurs because Southern workers, as compared to their Northern counterparts, typically lack sufficient political power to transform productivity gains into higher wages. Consequently, some of the new wealth created by rising productivity, according to this argument, bypasses Southern workers and flows back to the North, where it manifests as higher corporate profits, higher wages, lower consumer prices, or some combination of the three. If this indeed occurs, then North-South trade should increase the overall affluence of Northern consumers, which, as noted above, should stimulate demand for services more than for manufactured goods. Such an outcome, of course, would promote deindustrialization.

Second, besides its potential to increase the affluence of Northern consumers, North-South trade may also intensify the occurrence of unbalanced productivity growth in Northern economies. As Southern countries develop competitive advantages based on their access to low-cost labor, Northern manufacturers will likely respond by outsourcing their routine production jobs to low-cost subcontractors in the South, while redoubling their attention to the more challenging domestic jobs that remain. As this global division of labor deepens, the productivity of Northern manufacturers should increase, mainly because they will have outsourced most of their labor-intensive jobs to the South, but also because they will have invested more in labor-saving technologies as a means of overcoming higher domestic labor costs. In this indirect manner, rising levels of global trade should accelerate deindustrialization by heightening unbalanced productivity growth in Northern economies, an idea that Rowthorn and Ramaswamy (1999, p. 33) briefly mention but never empirically test. To depict more clearly the hypothesized relationships comprising these direct and indirect effects, figure 2 illustrates the causal factors influencing deindustrialization with a path diagram.

DATA AND METHODS

Having identified the primary explanations for deindustrialization, as well as the limitations of previous studies on this subject, I now propose a research strategy for empirically testing the causal relationships depicted in figure 2.

Measurements and Data

Dependent variable.—The dependent variable, *relative manufacturing employment*, measures the percentage of a country's workforce employed in the manufacturing sector. Declining values for this variable indicate rising levels of deindustrialization. Figures are derived from the OECD's (2005*c*) STAN (structural analysis) database, which compiles internationally compatible data on the number of workers employed in various sectors of the economy. The manufacturing sector is defined as categories 15–37 from the third revision of the international standard industrial classification (ISIC) scheme.

Key explanatory variables.—The first set of explanatory variables measures a country's per capita income. The variable *national affluence* equals a country's gross domestic product (GDP) divided by its total population, with GDP expressed in U.S. dollars at prices and purchasing parities (PPP) from the year 2000. Following other researchers (e.g., Alderson 1999;

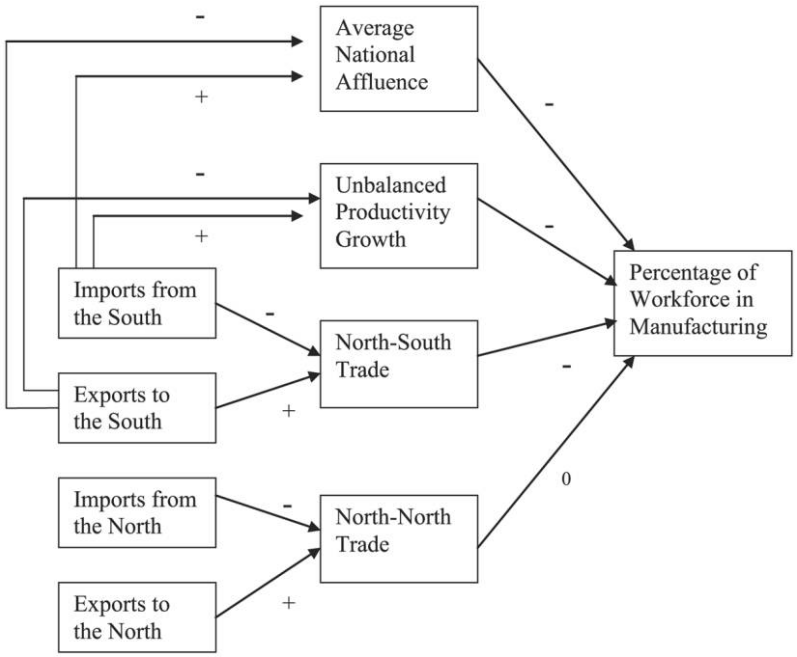

FIG. 2.—Factors hypothesized to affect relative manufacturing employment in economically advanced countries. At the aggregate level, North-North trade is expected to have little effect on deindustrialization, since imports should displace as many jobs as exports create. However, for individual countries running a trade imbalance, North-North trade can affect the prevailing level of manufacturing employment. For this reason, the effects for North-North trade are included in the model.

Rowthorn and Coutts 2004), I include a squared term for this variable, which allows for the possibility that relative manufacturing employment rises across modest levels of per capita income but then falls once a country becomes more affluent. Furthermore, I include a cubed term as well, because a scatter plot suggests that per capita income's effect on relative manufacturing employment tails off across the highest levels of national affluence in the data set. Data come from the OECD's (2006*a*) *Annual National Accounts*, volume 1: *Comparative Tables*.

The second set of explanatory variables measures the magnitude by which productivity gains in the manufacturing sector outpace those made by the service sector. For any given year, the variable *unbalanced productivity growth* equals that year's real increase in value added per worker in the manufacturing sector minus that year's real increase in value added per worker in the service sector. Yearly changes are recorded accumulatively, with values for the current year added to the sum of previous

years since 1970. Measured this way, this variable captures both yearly ebbs and flows and the cumulative effects of unbalanced productivity growth. I also include a squared term for this variable because, as for national affluence, a scatter plot suggests that unbalanced productivity growth's effect on relative manufacturing employment tails off for the highest levels of unbalanced productivity growth in the data set. To create this variable, I gathered data on the size of the workforce in various sectors from the OECD's (2005*c*) STAN database and data on real value added for various sectors from the United Nations' (2006) National Accounts Main Aggregates Database. Again, using ISIC revision 3 codes, the manufacturing sector is defined as categories 15–37; the service sector is defined as categories 50–95.

The next set of explanatory variables captures North-South trade's effect on deindustrialization. To allow for the possibility that imports from the South eliminate more jobs than exports to the South create, North-South trade flows are disaggregated into imports and exports, something that has not been done by most other researchers (e.g., Rowthorn and Wells 1987; Rowthorn and Ramaswamy 1997, 1999; Alderson 1999; Rowthorn and Coutts 2004). The resulting two variables are *imports from the South* and *exports to the South*. Here I define the South with the OECD's regional classification scheme, which categorizes all of the world's countries into six geographic regions: Africa, Asia (which includes the Middle East), Central and South America, Europe, North America, and Oceania. Drawing on this classification scheme, I define the South as Africa, Asia, Central and South America, and Oceania, and I define the North as Europe and North America. I then make adjustments to these broad regional categories by moving Mexico and Turkey (from North America and Europe, respectively) to the South, and by moving Australia and New Zealand (from Oceania) and Israel, Japan, and South Korea (from Asia) to the North. This geographic division represents the North-South divide of the global economy. From here, I include only categories 5–8 from the standard international trade classification (SITC) scheme in the trade figures. This step eliminates services, agricultural products, raw materials, and other nonmanufactured goods from the measurement of North-South trade. To facilitate international comparison, values for imports and exports are expressed as a percentage of GDP for all countries. Data come from the International Trade by Commodities Database (OECD 2002, 2005*b*), which reports the annual monetary value of imports and exports at the national, regional, and global levels.

Another set of explanatory variables captures the effects of North-North trade. Again, trade flows are disaggregated into their constituent parts, creating the variables *imports from the North* and *exports to the North.* These variables are calculated with a two-step process. First, for each

country in the data set, worldwide imports and worldwide exports in manufactured goods are obtained from the International Trade by Commodities Database (OECD 2002, 2005*b*). These values are then subtracted from the corresponding values for imports from the South and exports to the South, calculated as described above. The resulting figures represent the value of North-North trade in manufactured goods. To facilitate international comparison, these values are expressed as a percentage of GDP.

A final explanatory variable, *net outflow of direct investment*, measures the yearly value of those investments in which firms acquire managerial interests in foreign-based manufacturing operations. The figures are recorded as net values, which reduces the outflows of direct investment by the inflows of direct investment coming from other countries. The idea behind the use of net values, of course, is that outflows reduce the availability of domestic manufacturing jobs, but inflows do the opposite. However, unlike North-South trade, which can manifest as unequal exchange, outflows and inflows of direct investment should reduce and increase domestic jobs at similar rates, thereby making two separate measurements unnecessary. To facilitate international comparison, these values are expressed as a percentage of GDP. Data come from the International Direct Investment by Industrial Sector Database (OECD 2005*a*).

Control variables.—The main control variable, *unemployment*, accounts for what Rowthorn and Wells (1987) call the "failure effect" (see also Alderson 1999; Brady and Denniston 2006). According to this argument, imbalances in the macroeconomy—perhaps caused by poor economic performance or the unintended consequences of market regulations—can prevent the service sector from absorbing all of the displaced manufacturing workers. Purportedly, these circumstances lead industrial decline to generate rising unemployment rates as well as increased service-sector employment. To account for cross-national variation in this phenomenon, the model controls for rates of unemployment. Data are taken from *Labour Force Statistics—Summary Tables* (OECD 2006*b*). A second control variable, which sought to account for discontinuities caused by the reunification of the two German states in 1990, was originally included but eventually dropped, because it became statistically insignificant after controls for serial correlation and groupwise heteroscedasticity were added.

Statistical Estimation

To assess the various explanations for deindustrialization against empirical evidence, I assemble a data set comprising repeat observations of 18 OECD countries from 1970 to 2003. The resulting panel data contain a maximum of 612 separate observations ($n = 18$; $t = 34$), although some

observations are missing data for certain explanatory variables.[4] The 18 OECD countries used in the study, listed above (n. 3), are the same 18 countries used by other studies of deindustrialization (Alderson 1999; Brady and Denniston 2006).

Modeling with panel data.—The use of panel data, such as those assembled here, can enhance the power of statistical models, since each variable now varies across two dimensions (countries and years, in this case) rather than just one dimension, as is the case with either cross-sectional or time-series data. This additional dimension in the data set, however, introduces certain statistical complications that must be addressed. Social scientists generally recognize that, when used with panel data, standard applications of ordinary least squares (OLS) regression will generate biased and inefficient parameter estimates as well as inaccurate standard errors. For OLS regression to yield proper results, the error processes must be independent and homoscedastic. But since panel data rely on repeat observations of the same unit across various points in time, observations for particular units are by definition structurally related to one another. If left unaddressed, this situation will cause OLS regression to transfer the effects of unmeasured, unit-specific factors onto the error term, an outcome that creates heterogeneity bias. In the present study, for example, there are likely time-invariant but unmeasured differences occurring across countries, arising from such factors as variation in national industrial policies or variation in bureaucratic practices for measuring the size of the manufacturing workforce.

The fixed-effects (FE) and random-effects (RE) models are two commonly used statistical procedures for dealing with heterogeneity bias (see Frees 2004; Baltagi 2005).[5] However, for three reasons, the FE model seems better suited to the purposes of this study. First, the FE model better captures changes occurring across time, rather than across coun-

[4] Data on international trade are missing from Switzerland's 1991–2003 figures and from New Zealand's 1991–2003 figures; data on foreign direct investment (FDI) are missing for numerous country-years.

[5] The FE and RE models represent alternative means of overcoming problems associated with panel data. These models differ from each other, and from OLS regression, in their use of dummy variables to account for heterogeneity bias. To control for possible unmeasured, time-invariant effects, the FE model creates unique intercepts for each country by introducing country-specific dummy variables. This allows it to capture the dynamics of societal changes occurring over time. Conversely, the RE model treats country-specific effects as random occurrences rather than fixed outcomes. In practical terms, this means that the heterogeneity bias is addressed by introducing a country-specific disturbance term along with the error term for the entire model. Since this modification violates a basic assumption of the OLS regression, namely, that errors are independent, the RE model must be estimated with generalized least squares or maximum likelihood procedures.

tries, because it uses country-specific intercepts to control for heterogeneity bias. This aspect of the FE model matches well with the present study, since I seek to understand why the world's most economically advanced countries have more or less uniformly deindustrialized, not why some of these countries have retained larger manufacturing sectors than others. Second, the econometric theory underpinning these two models suggests that the RE model is most appropriate for data representing a random sample of a much larger population. This criterion, however, conflicts with the present data, since they encompass almost the entire population of economically advanced countries. Finally, even when the RE model is preferred on theoretical grounds, it should not be used when the country-specific random effects are correlated with one or more of the model's independent variables. Results from a Hausman test, assessing a null hypothesis that the country-specific random effects are uncorrelated with independent variables, was rejected ($P > \chi^2 = .0501$). This suggests that a RE model should not be used for this study. For these three reasons, I use the FE approach for handling the potentially confounding influences arising from unmeasured, country-specific effects in my data and model.

Additionally, the basic FE model can be modified to account for unmeasured effects occurring across time but remaining constant across countries. These period effects can arise, for example, from a slump in the global economy or from the growing popularity of outsourcing nonessential business functions to third-party service providers. Either of these outcomes could alter the demand for manufacturing workers in similar ways across different countries. To account for these unmeasured, time-specific effects, I introduce dummy variables for each five-year period in the data set, with the period 1970–74 as the reference category. This specification creates a two-way FE model, which effectively accounts for unmeasured heterogeneity arising from both country- and time-specific factors.

The inclusion of country- and time-specific effects may not resolve all the possible complications associated with panel data. Further complications may arise from serial correlation, spatial correlation, and groupwise heteroscedasticity. This is especially true when the data's time dimension is substantial and when the countries making up the panel units vary considerably in size—both of which characterize my data set. Fortunately, these complications can be identified with postestimation tests available with Stata. After running these tests, it appears that these complications are present in my data.[6] To address this situation, I fit the full

[6] Three postestimation tests were conducted with the full two-way FE model. (1) The Wooldridge test, performed with the *xtserial* command, assesses a null hypothesis that the residuals in the specified model do not exhibit first-order serial correlation within

two-way FE model with generalized least squares (GLS). Accomplished with Stata's *xtgls* command, this estimation procedure allows me to control for first-order serial correlation, spatial correlation, and groupwise heteroscedasticity. A drawback of GLS estimators, however, is that they do not provide *R*-squared measures.

Two final steps are taken to improve the accuracy of the model. First, since regression analysis can be sensitive to observations lying far from the true regression line, outliers can unduly affect the estimation of the model. To identify potentially problematic outliers, I employ the Hadi robust outlier detection algorithm available with Stata. This procedure identifies seven potentially problematic outliers, which were excluded from the data set before the parameters were estimated.[7] Second, I lag all explanatory variables by one year. This procedure is often undertaken (e.g., by Alderson 1999) because cause-and-effect relationships between shifting macroeconomic conditions and firm-level employment decisions are often subjected to time delays. The substantive results, however, are not changed by adopting this step.

Modeling indirect effects.—As discussed above, one can reasonably argue that North-South trade generates both direct and indirect effects on deindustrialization. Given this situation, assessing the determinants of deindustrialization with a single-equation regression model is not advisable, because such models cannot account for the hypothesized indirect effects within the causal process. This shortcoming, however, can be overcome by supplementing the single-equation regression model with additional equations that capture the hypothesized indirect effects. Using this technique, I mathematically depict the determinants of deindustrialization with the following three equations:

$$\begin{aligned} RME = {} & b_0 + b_1(NA_{it}) + b_2(NA_{it}^2) + b_3(NA_{it}^3) + b_4(UPG_{it}) \\ & + b_5(UPG_{it}^2) + b_6(IMS_{it}) + b_7(EXS_{it}) + b_8(IMN_{it}) \\ & + b_9(EXN_{it}) + CV + \varepsilon_{it}; \end{aligned} \tag{1a}$$

panels. This null hypothesis was rejected, suggesting the presence of first-order serial correlation. (2) A modified version of the Breusch-Pagan test, performed with the *xttest2* command, assesses a null hypothesis that the residuals in the specified model are contemporaneously independent across panels. This null hypothesis was also rejected, suggesting the presence of spatial correlation. (3) A modified version of the Wald test, performed with the *xttest3* command, assesses a null hypothesis that the residuals in the specified model have a common variance across panels. This null hypothesis was also rejected, suggesting the presence of groupwise heteroscedasticity.

[7] Norway 1999–2003 and Belgium 1998–99 were identified as potentially problematic outliers. Estimating the full mode after eliminating these observations causes the coefficients for imports from the South and exports to the South to decrease slightly and the coefficient for unbalanced productivity growth to increase slightly.

$$NA = b_0 + b_{10}(IMS_{it}) + b_{11}(EXS_{it}) + CV + \varepsilon_{it}; \quad (1b)$$

$$UPG = b_0 + b_{12}(IMS_{it}) + b_{13}(EXS_{it}) + CV + \varepsilon_{it}, \quad (1c)$$

where RME = relative manufacturing employment, NA = national affluence, UPG = unbalanced productivity growth, IMS = imports from the South, EXS = exports to the South, IMN = imports from the North, EXN = exports to the North, and CV = control variables.

Before estimating these equations, two possible complications associated with multiple-equation models should be considered. One complication arises when the multiple-equation model contains feedback loops in the causal process. When this occurs, variables embedded within the circular patterns of causation, often called "problematic variables," will be correlated with one or more of the disturbance terms in the model, an outcome that causes standard regression techniques to yield biased and inefficient parameter estimates. To work around this problem, researchers typically use instrument variable (IV) estimation, such as two-stage least squares (2SLS) or three-stage least squares (3SLS) estimation, to replace the problematic variables with suitable proxies. Fortunately, the model under consideration contains only unidirectional patterns of causation, and thus IV estimation is not necessary. This means that each equation can be estimated separately, using standard regression techniques such as those described above.

Another complication arises when the disturbance terms of the individual equations are correlated with one another. If this occurs, parameter estimates generated from standard regression techniques will be inefficient. The presence of this complication can be detected with a Breusch-Pagan test. Using this test, I assess a null hypothesis that the disturbance terms across equations (1a)–(1c) are independent. The results of this test fail to reject the null hypothesis convincingly (χ^2 [3] = 6.05; P = .105). To investigate the situation further, I calculate a correlation matrix of the disturbance terms generated by an equation-by-equation application of least squares regression. This correlation matrix indicates that equations (1b) and (1c), which measure the indirect effects, are mildly correlated (r = .091), but that the main equation, (1a), is wholly independent of the other two (r = .00 with [1b] and r = .00 with [1c]). Combined, the results from the Breusch-Pagan test and the correlation matrix of the disturbance terms suggest that I can estimate each equation separately, using the FE-GLS estimator described above, without unduly affecting the results. Nonetheless, to demonstrate the robustness of my results, I also estimate the equations simultaneously by applying the 3SLS approach to my FE

model.[8] The resulting parameter estimates, shown in appendix table A1, vary somewhat from those calculated by the FE-GLS estimator, but their substantive meaning remains the same.[9]

RESULTS

Domestic Causes of Deindustrialization

Table 1 shows the results from three regression models, each capturing some portion of the direct effects causing deindustrialization. The results are reported as unstandardized parameter estimates, with the corresponding standard errors in parentheses. Model 1 isolates the two domestic factors believed to be associated with deindustrialization: (1) the tendency for growing affluence in wealthy countries to spur demand for services more than manufactured goods and (2) the propensity for productivity gains in the manufacturing sector to exceed those made by other sectors of the economy. As anticipated, the coefficients for these variables are statistically significant, and they exhibit the expected signs.

The results for national affluence's effect on manufacturing employment deserve particular attention. Here the results indicate that the coefficient for national affluence is positive, the coefficient for national affluence squared is negative, and the coefficient for national affluence cubed is again positive. This pattern of change suggests that the relationship between national affluence and relative manufacturing employment moves through three distinct phases, with each phase being determined by a country's prevailing level of per capita income. For countries with low to modest levels of national affluence, incremental increases in per capita income tend to spur employment in the manufacturing sector. This positive relationship prevails until countries reach a certain threshold of per capita income. At that point, the nature of this relationship reverses, creating a new causal pattern in which additional increases in per capita income make relative manufacturing employment contract rather than expand. This finding, of course, is consistent with Clark's (1957) original

[8] I use 3SLS regression instead of 2SLS regression because it better accounts for contemporaneous correlation among the disturbance terms by estimating all three equations simultaneously. It should be noted that 3SLS uses a GLS estimating method that controls for heteroscedasticity but not for serial correlation. To mathematically identify the set of equations, thereby rendering them estimable, 3SLS requires the use of excluded instruments. Following Gerber (1998), I use one-year lags of the endogenous variables (relative manufacturing employment, national affluence, and unbalanced productivity growth) as excluded instruments.

[9] Compared to the FE-GLS model, the FE-3SLS model generates substantive results in which the relative effects of national affluence and unemployment are a bit larger, while the relative effect of unbalanced productivity growth is a bit smaller.

TABLE 1
FE-GLS Regression Estimates of Relative Manufacturing Employment for 18 OECD Countries, 1970–2003

	Model 1 Domestic Causes	Model 2 Global Causes	Model 3 Combined Causes
National affluence	3.171***		2.555***
	(.267)		(.275)
(National affluence)^2	−.154***		−.124***
	(.012)		(.012)
(National affluence)^3	.002***		.002**
	(.000)		(.000)
Unbalanced productivity growth	−10.192***		−10.070***
	(.875)		(.882)
(Unbalanced productivity growth)^2	2.516		2.302***
	(.266)		(.267)
Imports from the South		−.828***	−.674***
		(.103)	(.063)
Exports to the South		.192***	.230***
		(.079)	(.041)
Imports from the North		−.058*	−.033**
		(.025)	(.010)
Exports to the North		.062*	.030**
		(.024)	(.010)
Net outflow of direct investment		−.011	
		(.021)	
Constant	12.38***	24.15***	15.94***
	(2.05)	(.272)	(2.06)
Wald χ^2	16,930***	2,257***	15,826***
N observations	566	397	566

Note.—Numbers in parentheses are SEs. Controls for fixed effects, period effects, and unemployment are included in all models.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

claim that consumers in affluent countries tend to disproportionately spend their newfound wealth on services, which slowly causes manufacturing's share of total national employment to shrink (see also Alderson 1999; Rowthorn and Coutts 2004). The unanticipated finding, however, is that the intensity of this negative relationship is not constant. Instead, it appears that its intensity increasingly wanes as affluent countries reach even higher levels of per capita income. This new finding implies that rising levels of per capita income alone could never completely deindustrialize a country.

The results from model 1 reveal a nonlinear relationship between un-

balanced productivity growth and relative manufacturing employment as well. Here the coefficient for unbalanced productivity growth is negative, but the coefficient for unbalanced productivity growth squared is positive. This pattern of change indicates that the relationship between these two variables follows a concave up-curve, in which disproportionately robust productivity growth in the manufacturing sector causes relative manufacturing sector employment to shrink, albeit at increasingly smaller and smaller rates. This finding implies that unbalanced productivity growth alone, like rising levels of per capita income, could never completely deindustrialize a country.

In sum, the results from model 1 support the contention that increasingly affluent consumers and consistently unbalanced productivity growth are important determinants of deindustrialization. They also suggest, however, that the influences generated by these factors progressively slow down as countries reach very high levels of economic development.

Global Causes of Deindustrialization

Model 2, shown in table 1, isolates the global economic factors purportedly associated with deindustrialization. Results from this model support the view that expanding trade links between the North and the South of the global economy contribute to deindustrialization. The specifics of this relationship become clearer when looking at the individual coefficients for the variables constituting North-South trade. Expressed in absolute values, the coefficient for imports from the South ($b = -0.828$) is more than three times larger than the coefficient for exports to the South ($b = 0.192$). The imbalance between these two coefficients implies that North-South trade, rather than generating counterbalancing effects on domestic manufacturing employment, actually displaces more than four times as many jobs as it creates. This relationship, however, does not hold for North-North trade. Instead, with opposite signs but similar magnitudes ($b = -0.058$ for imports from the North and 0.062 for exports to the North) it appears that trade among economically advanced countries creates and displaces manufacturing jobs at similar rates.

Several scholars identify an outflow of direct investment from the North as being an important mechanism by which globalization generates deindustrialization (see Bluestone and Harrison 1982; Alderson 1999). These scholars predict that, after controlling for other aspects of globalization, measures of FDI and deindustrialization will be positively correlated. But the results in model 2 suggest otherwise. While the "capital flight" argument makes intuitive sense—as one easily imagines how opening new factories overseas would reduce the number of jobs available to domestic manufacturing workers—the results presented here indicate that this pro-

cess has not played a meaningful role in deindustrialization. Specifically, the coefficient for net outflow of direct investment, being statistically insignificant and having a magnitude of nearly zero, indicates that FDI flows and deindustrialization are not structurally linked. Although this goes against much of the literature, it does corroborate recent work by Brady and Denniston (2006), who also find little meaningful relationship between FDI and deindustrialization. This outcome likely occurs because FDI flows often stay within the North, where they should generate almost perfectly offsetting effects on deindustrialization, and because Northern firms often develop overseas production capacities by hiring subcontractors, rather than by directly acquiring ownership in factories. It is important to note that the practice of using subcontractors in the South, although clearly bound up with globalization, does not constitute FDI.

Direct and Indirect Effects

Model 3, shown in tables 1 and 2, offers a more comprehensive analysis by simultaneously testing each variable, except FDI, which was excluded due to its statistical insignificance. Under this combined model, the size and statistical significance of most coefficients exhibit little change from the previous two models. There are, however, two noteworthy differences. First, the coefficients for North-South trade, while still statistically significant, have declined from their sizes in the previous models. Now the ratio between these two coefficients suggests that imports from the South displace three times (rather than four times) as many jobs as exports to the South create. Second, the coefficients for national affluence have declined somewhat from their earlier levels.

When combined, the three models presented in table 2 capture both the direct and indirect determinants of deindustrialization. The first model in this table, model 3, has just been discussed. The other two models test for the possibility that global trade indirectly promotes deindustrialization by intensifying those domestic factors already causing relative manufacturing employment to decline. In particular, model 4 assesses the relationship between North-South trade and national affluence in the countries in my sample. The results of this model are consistent with the expectations depicted in figure 2. More specifically, they indicate that the coefficient for imports from the South ($b = 0.910$) is statistically significant, with a positive sign, and that the coefficient for exports to the South ($b = -0.061$) is statistically insignificant, with a negative sign. Combined, these two parameter estimates suggest that North-South trade increases real per capita incomes of Northern countries and, in the process, indirectly promotes deindustrialization by heightening national affluence beyond levels that would prevail in the absence of global trade.

TABLE 2

FE-GLS Regression Estimates of Direct and Indirect Effects on Relative Manufacturing Employment for 18 OECD Countries, 1970–2003

	Direct Effects	Indirect Effects	
	Model 3 (Y_1)	Model 4 (Y_2)	Model 5 (Y_3)
National affluence	2.555***		
	(.275)		
(National affluence)^2	−.124***		
	(.012)		
(National affluence)^3	.002***		
	(.000)		
Unbalanced productivity growth	−10.070***		
	(.882)		
(Unbalanced productivity growth)^2	2.302***		
	(.267)		
Imports from the South	−.674***	.910***	.066***
	(.063)	(.104)	(.005)
Exports to the South	.230***	−.061	−.001
	(.041)	(.070)	(.003)
Imports from the North	−.033**		
	(.010)		
Exports to the North	.030**		
	(.010)		
Unemployment	−.455***	−.105***	.008***
	(.014)	(.006)	(.001)
Period indicators:			
1975–79	−.577***	.961***	.030*
	(.097)	(.165)	(.012)
1980–84	−1.265***	2.31***	.061***
	(.132)	(.197)	(.014)
1985–89	−1.456***	4.08***	.137***
	(.162)	(.215)	(.015)
1990–94	−1.766***	5.44***	.189***
	(.191)	(.240)	(.016)
1995–99	−1.950***	7.16***	.209***
	(.218)	(.280)	(.017)
2000–2003	−1.834***	8.99***	.204***
	(.249)	(.305)	(.020)
Constant	15.94***	20.74***	.979***
	(2.06)	(.286)	(.058)
Wald χ^2	3,355***	6,168***	1,455***

Note.—N observations = 566. Numbers in parentheses are SEs. Dependent variables are shown in the column headings; Y_1 = relative manufacturing employment; Y_2 = national affluence; Y_3 = unbalanced productivity growth. Controls for fixed effects are included in all models.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

Model 5 examines the relationship between North-South trade and unbalanced productivity growth. Again, the results of this model are consistent with expectations. The coefficient for imports from the South ($b = 0.066$) is positive and statistically significant, and the coefficient for exports to the South ($b = -0.001$) is negative and statistically insignificant. Combined, these results suggest that North-South trade heightens unbalanced productivity growth in Northern economies, which indirectly contributes to deindustrialization by increasing the number of manufacturing jobs that become redundant.

Relative Causes of Deindustrialization

Since many of the explanatory variables are measured on different scales and include nonlinear effects, and since the total effects are modeled through three separate equations, it is not readily apparent from table 2 how much each factor contributes to deindustrialization. To help answer this important question, I use the regression coefficients from models 3, 4, and 5 along with the actual data to estimate the relative importance of each explanatory variable. The results of these calculations are shown in table 3 for the Group of Seven (G-7) countries and the data set as a whole. The figures represent the total effects attributable to the factors listed in the heading of the table, unless the figures are enclosed in parentheses, in which case they represent direct effects only.

Based on these estimates, it appears that rising national affluence has played the largest role in deindustrialization. For the 18-country average, rising national affluence accounts for about 34% of the observed decline in relative manufacturing employment, North-South trade accounts for about 24%, and unbalanced productivity growth accounts for just over 15%. Changes in unemployment and period effects account for almost 15% and 13% of the decline, respectively. While the relative importance attributed to North-South trade is consistent with previous studies, the relative importance attributed to unbalanced productivity growth is not. In their influential study, Rowthorn and Ramaswamy (1997, p. 12) claim that "deindustrialization appears to reflect mainly the impact of differential productivity growth between manufacturing and services." The above estimates contradict this prominent argument, while lending some support to Nordhaus's (2005, 2006) more recent research, which finds that globalization has altered the previously negative relationship between labor productivity and manufacturing employment.

The estimates shown in table 3 also illustrate the importance of capturing indirect effects when measuring the determinants of deindustrialization. When indirect effects are introduced into the calculations, the portions of deindustrialization attributable to national affluence and un-

TABLE 3

EXPLAINING DEINDUSTRIALIZATION: TOTAL AND DIRECT EFFECTS FOR G-7 AND OECD-18 COUNTRIES, 1970–2003

	Percentage-Point Drop in Relative Manufacturing Employment, 1970–2003	Attributable % of Change*					
		National Affluence	Unbalanced Productivity Growth	North-South Trade	North-North Trade	Unemployment	Period Effects
OECD-18 average ...	−12.4	34.3	15.2	24.4	−2.0	14.9	13.2
		(42.4)	(18.8)	(12.7)			
Canada	−9.4	33.5	12.9	35.7	−1.9	6.4	13.5
		(44.5)	(17.0)	(20.5)			
France	−12.3	30.0	12.8	18.9	−.7	25.1	14.0
		(35.8)	(15.2)	(10.7)			
Germany	−17.5	26.0	9.7	19.4	−1.2	31.4	14.6
		(33.6)	(12.7)	(8.9)			
Italy	−4.8	33.7	22.5	15.6	−2.1	13.5	16.7
		(36.1)	(23.6)	(12.1)			
Japan	−8.6	38.9	7.3	14.7	−.4	19.8	19.6
		(45.2)	(8.7)	(7.1)			
United States	−12.1	40.2	12.9	30.5	.8	3.2	12.4
		(50.3)	(17.4)	(15.9)			
United Kingdom	−19.3	32.5	16.0	28.8	−1.0	9.3	14.4
		(38.8)	(18.6)	(19.9)			

NOTE.—Numbers in parentheses represent direct effects; all others represent total effects.

* Percentages are rounded. All rows sum to 100%.

balanced productivity growth decline by several percentage points, while the portion attributable to North-South trade increases by the same amount. If indirect effects are not considered, meaning that the estimates are determined from model 3 only, it then appears that unbalanced productivity growth has a larger effect on relative manufacturing employment than North-South trade.

CONCLUSION AND DISCUSSION

Drawing on literature from across the social sciences, this article has sought to determine why the world's most economically advanced countries have more or less uniformly deindustrialized over the last few decades. Previous research on this subject focuses on three causal factors: (1) rising consumer affluence and its propensity to increase demand for services more than for manufactured goods, (2) faster productivity growth in the manufacturing sector relative to other sectors of the economy, and (3) expanding trade linkages with low-wage countries in the global South. However, since previous studies have not tested these explanations simultaneously, nor considered global trade's indirect effects on deindustrialization, our understanding of the causes of deindustrialization has remained incomplete. To address this gap in the literature, this study simultaneously tests all three explanations for deindustrialization against the actual experiences of 18 OECD countries from 1970 to 2003. The results indicate that each factor significantly contributes to deindustrialization and that global trade exerts indirect as well as direct effects on employment patterns in the North, but that the greatest effect seems to come from the steadily rising affluence of Northern countries.

Many of these findings were anticipated by previous research, but some important ones were not. In a series of prominent studies, Rowthorn and his colleagues identify unbalanced productivity growth as the primary cause of deindustrialization (see esp. Rowthorn and Ramaswamy 1997). The findings presented here, however, suggest that unbalanced productivity growth plays a smaller role in deindustrialization than Rowthorn and his colleagues suggest. The discrepancy between their findings and mine likely arises from differences in measuring key theoretical concepts. Although they discuss rising affluence and unbalanced productivity growth as separate causes of deindustrialization, Rowthorn and his colleagues lump these two factors together under the name "normal internal growth." They then measure this variable through changes in real per capita income. This allows them to differentiate between domestic and global causes of deindustrialization, but it does not allow them to untangle the separate effects associated with growing affluence and unbalanced

productivity growth. Thus, given the specification of their model, their conclusion tacitly assumes that productivity gains made by the manufacturing sector are the primary engine of the economy's overall growth.

This assumption, however, seems untenable. In many economically advanced countries, the service sector has begun to make sizable productivity gains, mainly by discovering ways to adopt the logistic and managerial strategies used in the manufacturing sector. Wal-Mart, for example, deftly employs a computerized tracking system to manage its globally sourced inventory and to enforce strict workplace discipline on its employees (see, e.g., Lichtenstein 2005). This has enabled it to achieve sizable productivity gains year after year. With these practices becoming standard operating procedures across the service sector (Head 2003), the gap in productivity growth between manufacturing and services should decline.

Additionally, the nature of the relationship between productivity growth and manufacturing employment may be changing. My findings lend tentative support to Nordhaus (2005, 2006), who suggests that globalization has altered the erstwhile relationship between productivity growth and manufacturing employment in the United States. More specifically, he claims that intense international competition, brought about by globalization, drives firms with low productivity growth out of the market, thereby enabling firms with high productivity to expand their market share. Such a sequence of events implies that, at least in highly competitive markets, productivity growth may actually encourage employment growth more than hinder it. A better understanding of this relationship will require additional research.

Most important, my results shed considerable light on the relative causes of deindustrialization. Consistent with the claims of many social scientists, the transformation to a postindustrial economy appears to have arisen primarily from internal economic changes. With or without globalization, the OECD countries were going to experience a considerable move toward postindustrialism during the last decades of the 20th century. In fact, according to my results, more than half of the deindustrialization occurring in these countries is associated with levels of national affluence and unbalanced productivity growth that would have prevailed in the absence of globalization. However, my results also suggest that these domestic effects begin to wane as countries become ever more economically advanced. This means that manufacturing sector employment, even in the most affluent and productive countries, should not vanish entirely. This domestically induced portion of deindustrialization, as other scholars note, should be seen as the outcome of positive economic development.

Globalization accounts for another sizable portion of deindustrialization. Here my results suggest that surging levels of North-South trade account for over 24% of the deindustrialization experienced by OECD

countries and for just over 30% of the deindustrialization experienced by the United States. This portion of deindustrialization arose not from normally occurring changes within the domestic economy, but rather from national governments' liberalization of trade regulations just as new technological developments made global production systems possible.

It is possible, however, that globalization's role in deindustrialization extends beyond the intensification of North-South trade flows. Neither the present study nor earlier ones adequately explain what lies behind the sizable period effects. According to my results, these period effects account for over 13% of the deindustrialization experienced by the OECD countries. This means that, between the early 1970s and early 2000s, some cross-national phenomenon caused manufacturing sector employment to decline across the OECD countries, yet this phenomenon was not captured by the model's explanatory variables. Several plausible explanations exist for the magnitude of these period effects. For example, they could represent the common upgrading of human capital in all Northern countries, which may serve to orient workers and the general economy toward the service sector. Or they could represent some qualitative change associated with globalization, which the North-South trade variables in my model failed to detect. This latter explanation, however, seems unlikely.

The practice of outsourcing could account for a considerable portion of the period effects. Increasingly, activities once performed by manufacturing firms themselves, ranging from cleaning the factory floors to designing products, are performed by third-party subcontractors. Although these subcontractors work under the aegis of the manufacturing firms that hire them, the government records their employees as service-sector workers. Under this guise, deindustrialization manifests more as a reallocation of duties along an increasingly complex commodity chain rather than an actual reduction in the level of manufacturing activity. Yet this phenomenon has real consequences for the affected employees. Particularly for less-skilled workers, contract employment in the service sector typically provides less remuneration and less job stability than traditional employment in the manufacturing sector. Unfortunately, reliable panel data on outsourcing is not available.

If outsourcing does account for most of the observed period effects, then perhaps globalization's role in deindustrialization should be reinterpreted. As many social scientists note, the vertically integrated and highly bureaucratic manufacturing firm of the postwar era has changed its organizational form over the last few decades. Seeking to become more flexible and more cost-efficient, many manufacturing firms have outsourced certain functions to third-party firms with lower costs. Given the extensiveness of this phenomenon, it is conceivable that globalization and outsourcing are interrelated aspects of this broader organizational restruc-

turing, in which the activities making up the commodity chain are disaggregated across more and more independent firms. The key difference in this process, however, is that some jobs are relocated overseas (globalization), while others are relocated within the domestic economy (outsourcing). In the model used here, the jobs affected by globalization would be detected by the North-South trade variables, but the jobs affected by outsourcing would be detected by the period-effect variables. If globalization and outsourcing are indeed related processes, and if outsourcing indeed accounts for most of the observed period effects, then the larger process of organizational restructuring accounts for more than a third of the observed decline in relative manufacturing employment. Given the feasibility of this scenario, it is imperative that future research consider how these organizational restructurings have affected employment patterns across the OECD countries.

APPENDIX

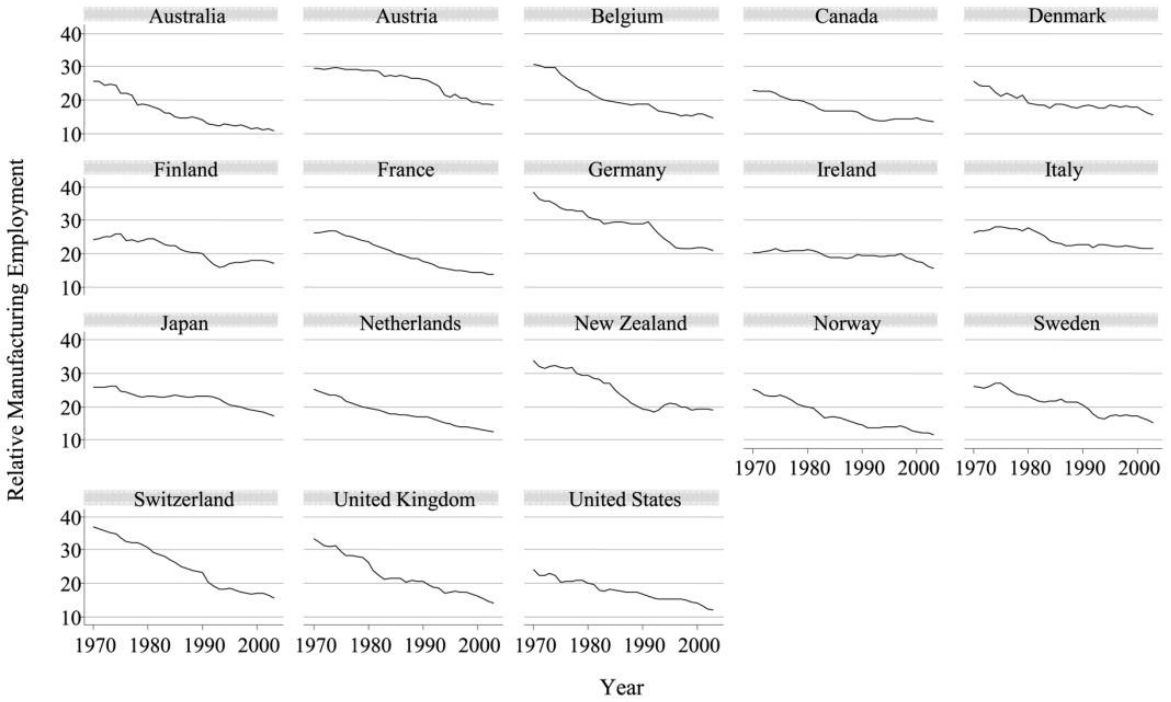

FIG. A1.—Relative manufacturing employment (as percentage of total employment) in 18 OECD Countries, 1970–2003

TABLE A1
FE-3SLS Regression Estimates of Direct and Indirect Effects on Relative Manufacturing Employment for 18 OECD Countries, 1970–2003

	Direct Effects (Y_1)	Indirect Effects (Y_2)	Indirect Effects (Y_3)
National affluence	25.819***		
	(4.159)		
(National affluence)^2	−1.096***		
	(.181)		
(National affluence)^3	.015***		
	(.002)		
Unbalanced productivity growth	−8.049*		
	(3.893)		
(Unbalanced productivity growth)^2	1.487*		
	(1.015)		
Imports from the South	−.997***	.890***	.075***
	(.326)	(.112)	(.005)
Exports to the South	.337*	.049	−.015*
	(.134)	(.088)	(.008)
Imports from the North	−.272**		
	(.097)		
Exports to the North	.430***		
	(.111)		
Unemployment	−.600***	−.285***	.015***
	(.121)	(.029)	(.002)
Constant	−158.05***	15.84***	1.00***
	(30.23)	(.308)	(.025)
R^2	.60	.93	.83

Note.—N observations = 566. Numbers in parentheses are SEs. Dependent variables are shown in the column headings; Y_1 = relative manufacturing employment; Y_2 = national affluence; Y_3 = unbalanced productivity growth. Controls for fixed effects and period effects are included in all models.

* $P < .05$.
** $P < .01$.
*** $P < .001$.

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