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20-15 Trade Surplus or Deficit? Neither Matters for Changes in Manufacturing Employment Shares

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ABSTRACT

Many countries have launched industrial policy programs to improve their manufacturing competitiveness based on the idea that countries with larger trade surpluses or smaller deficits in manufacturing will have higher shares of manufacturing employment. And as countries try to generate a recovery from the COVID-19 crisis, these programs are being enlarged. But while the higher productivity in manufacturing that these programs generate may initially increase manufacturing output and expand trade surpluses in manufacturing, it will also reduce the manufacturing jobs required to manufacture those goods for domestic spending and generating the larger trade balances. As a result, the impact on employment is likely to be substantially smaller than might be expected. Improved productivity implies that goods can be manufactured more cheaply using fewer workers, so unless there is high enough demand at home and abroad for the lower-priced or new products that productivity growth generates, any additional jobs created could be substantially lower than might be expected. This is not just a theoretical possibility. Using data from a sample of 60 countries, this paper shows that between 1995 and 2011, on average countries with trade surpluses in manufacturing experienced declines in manufacturing employment shares that were slightly larger than the declines in countries with manufacturing trade deficits. Additionally, the declines in manufacturing employment shares were as large in countries where the manufacturing trade balance moved in a positive direction as in those where it declined. This suggests that even if industrial policies generate larger trade surpluses in manufacturing, they may not succeed in reversing the trend declines in manufacturing employment shares that have persisted in many countries for several decades.

JEL Codes: F00, F1, F14,F16, F66, 01, O47, 04, P52

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INTRODUCTION

Over the past three decades, the share of employment in manufacturing has declined in many countries, often with detrimental effects on workers and communities. International trade deficits are sometimes seen as the major source of this deindustrialization and enhanced international competitiveness in manufacturing as the way to reverse it.[1]

Technological rivalry, trade frictions, and national security concerns about China have further renewed interest in industrial policies that enhance US technological competitiveness. Several members of Congress from both parties have proposed funding ambitious new programs.[2] US industry has also called for new policies. The US semiconductor industry, for example, has proposed a $37 billion program for chip plant construction and research, and in the US Senate there is bipartisan support for a bill with similar objectives (Fitch and O'Keeffe 2020).

These programs are in part a reaction to similar initiatives in other countries. Even before the COVID-19 crisis, many countries had launched programs to increase their manufacturing production by investing in new technologies. These include Germany's National Industrial Strategy 2030, the United Kingdom's Innovate UK, France's Industry of the Future, China's Made in China 2025, and India's Make In India. And in response to the COVID-19 crisis, other countries are taking additional efforts to stimulate their manufacturing production.[3] Such policies often have goals that include enhancing national security, combating climate change, maintaining technological leadership, and promoting economic growth, but they are also usually justified by the claim that they will increase manufacturing employment and make growth more inclusive.

This paper does not evaluate these policies in terms of their broader objectives but instead focuses on the question of whether they are likely to reverse the declining share of employment in manufacturing in most countries.

1 Studies suggest that, while trade played some role, the dominant reason for the declining share of manufacturing in US employment has been a combination of relatively rapid productivity growth and relatively unresponsive demand (Lawrence and Edwards 2013). Michael Hicks and Srikant Devaraj (2015, 2017), for example, conclude that 88 percent of the manufacturing job loss between 2000 to 2010 can be attributed to relatively rapid productivity growth in manufacturing. Several studies do find substantial displacement due to China; for example, Daron Acemoglu et al. (2016) find that "the China shock" displaced about a million US manufacturing employment opportunities between 2000 and 2010. But US manufacturing employment fell by 5.8 million over the same period so Chinese imports would account for only 17 percent of the decline. Moreover, focusing only on Chinese imports overlooks other ways in which trade added US manufacturing jobs. Indeed, Robert Feenstra and Akira Sasahara (2018) suggest that increased US exports added almost as many manufacturing jobs as were lost to China.

2 As noted by Thomas Duesterberg (2020), Senators Charles Schumer and Todd Young seek a new federal "directorate for technology" and multibillion-dollar programs to support the semiconductor, 5G, and medical products industries, among others. Democrats such as Senators Sherrod Brown and Elizabeth Warren and Representative Alexandria Ocasio-Cortez "think industrial policy can re-engineer the economy to solve problems such as income inequality and climate change," and Republican Senators Marco Rubio and Josh Hawley "see it as a way to reverse America's industrial decline and meet the growing challenge from China."

3 For example, Japan—which once encouraged Japanese companies to participate abroad in global supply chains—has launched a $9 billion program to help companies increase production in Japan (Kodachi 2020).

Policies that attempt to promote manufacturing employment by enhancing productivity and improving technological capabilities face a dilemma that is often ignored in policy discussions: the generally negative association between manufacturing productivity growth and employment (Lawrence and Edwards 2013, Lawrence 2017). Faster productivity growth implies that manufactured goods can be made more cheaply partly by using fewer workers, but unless demand is very responsive to the lower prices that productivity growth generates—technically, unless demand is elastic—the association between higher productivity growth and manufacturing employment is likely to be negative. In addition, to the degree that policies emphasize improving high-tech capabilities, they are likely to disproportionately increase the demand for highly skilled and educated workers and could exacerbate rather than reduce income inequality along the lines of skill (Rodrik 2016).

Measures such as those of the Trump administration that seek to close the US economy by increasing trade protection and discouraging offshoring need to deal with another version of this dilemma. To the degree that they succeed in diverting demand to domestic production they might achieve a one-time increase in employment in some industries, although these increases could come at the expense of jobs in other industries by raising their input costs. But after these gains have occurred, as productivity in these industries increases, unless demand is sufficiently responsive, the declines in employment in these industries is likely to resume.

One way out of the dilemma may be not to close the economy but to sell more on the world market (Matsuyama 2009). Although faster productivity growth may reduce manufacturing jobs because domestic spending is insufficiently responsive, by improving their international competitiveness some countries could gain a bigger share of the global market for manufactured products (albeit by displacing more manufacturing jobs in their trading partners).

But would a larger trade surplus in manufactured products generated by higher productivity actually reverse the decline in manufacturing employment in countries with relatively high incomes? To help answer this question, this paper uses data on 60 countries that account for more than 90 percent of global manufacturing production to examine the historic relationship between national trade balances in manufacturing and manufacturing employment. Perhaps surprisingly, the results of this examination cast doubt on the proposition that larger trade surpluses will reverse declines in the share of manufacturing employment.

One major finding is that between 1995 and 2011,[4] the declines in the share of manufacturing employment in countries with the largest manufacturing trade surpluses were actually slightly larger than the declines in countries with the largest manufacturing trade deficits. The trade surplus countries were able to increase their domestic production of manufactures by more than the trade deficit countries, but this effect on employment was offset by larger declines in domestic spending on manufacturing and more rapid increases in relative value

4 The basis for the selection of this time period is explained in section 2. An analysis using data from 2005 to 2015 reaches similar conclusions.

added per worker. Similarly, countries where the manufacturing trade balance moved in a positive direction experienced declines in manufacturing employment that were similar to those where the manufacturing trade balance declined.

Section 1 illustrates how manufacturing employment shares in most countries that have run large trade surpluses in manufacturing have the same inverted U or humped shape as countries with trade deficits. It then explains why this outcome is predicted by the economic theory of structural change in an open economy. Section 2 argues that value added data rather than the more commonly used gross trade and final expenditure data are more appropriate for analyzing the determinants of the demand for manufacturing employment. Section 3 uses the manufacturing value added data developed by the World Trade Organization (WTO) and Organization for Economic Cooperation and Development (OECD) to explore the association between levels and changes in net exports of manufacturing value added and manufacturing employment. It shows that declines in domestic spending on manufacturing value added and higher relative value added per worker in manufacturing tend to offset increases in manufacturing value added trade balances. Consequently, the declines in manufacturing employment in trade surplus and deficit countries have been fairly similar. Section 4 draws policy implications and concludes.

Later in this paper, measures of the trade balance in manufacturing value added are used as indicators, but in figure 1 countries that have averaged the largest (gross) manufacturing trade surpluses and deficits as a share of GDP in 1960–2010 (using data from the 43-country GGDC 10-Sector Database[5]) have been selected and their manufacturing employment shares in total employment plotted against time.[6] As the figure shows for both surplus and deficit groups, as countries develop, the share of manufacturing in employment tends to follow a humped shape (although it is not perfectly smooth). The similarities in the profiles suggest that trade performance does not permanently impact the shape of the curve, pointing to the need for explanations that emphasize common features of structural change rather than unique national attributes. Explanations for the declines in the share of US manufacturing employment that emphasize US trade policies and US trade deficits in manufacturing overlook the pervasive nature of manufacturing employment declines in many countries, including those with the largest trade surpluses in manufacturing.

5 Groningen Growth and Development Center (GGDC) 10-Sector Database, https://www.rug.nl/ggdc/.

6 The data for the countries in figure 1 do not all start in 1960. The most complete available data have been used.

Figure 1
Manufacturing employment as share of total employment in top ten economies with largest average manufacturing trade surplus/deficit as share of GDP, 1960-2010

a. Top ten deficit economies

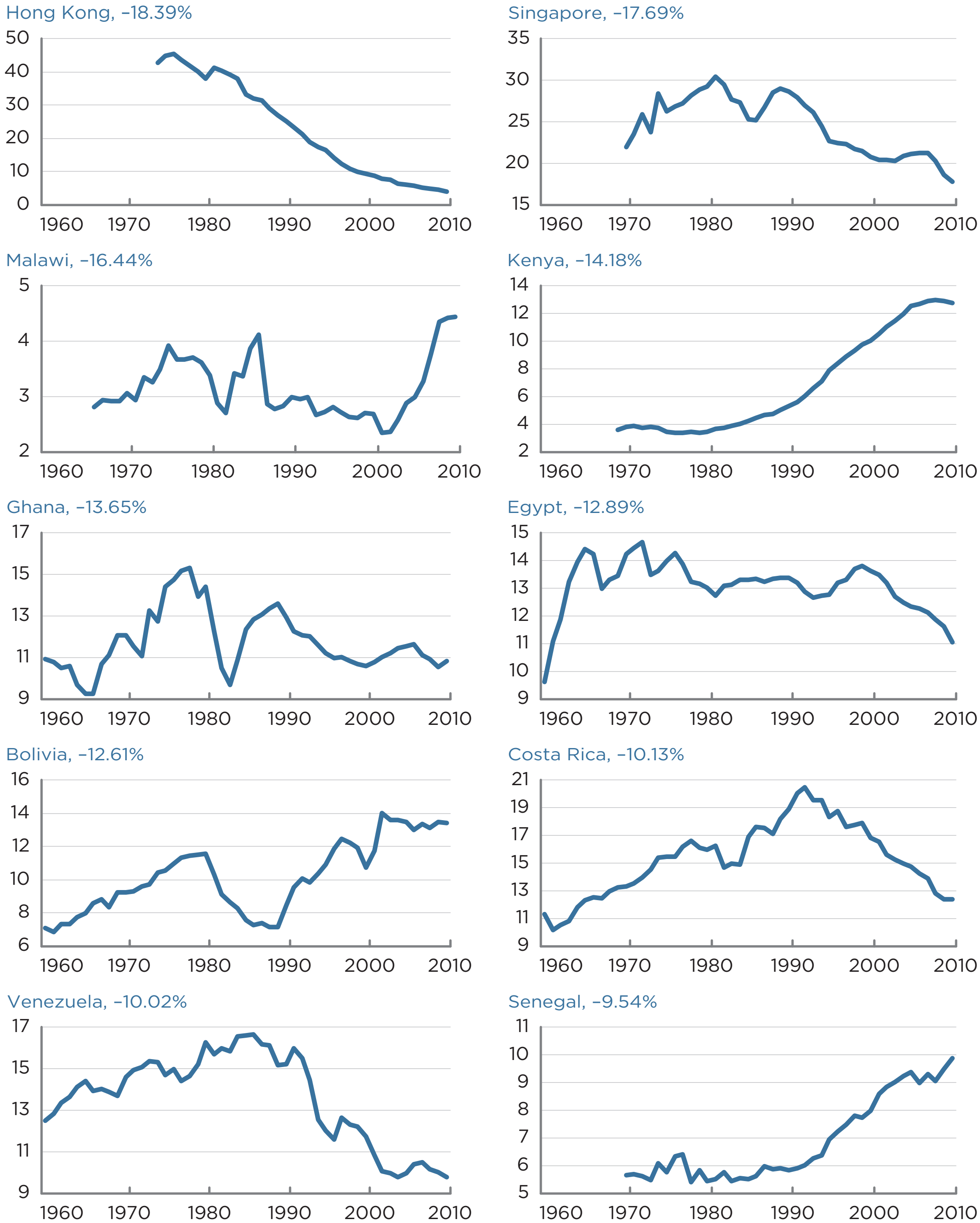
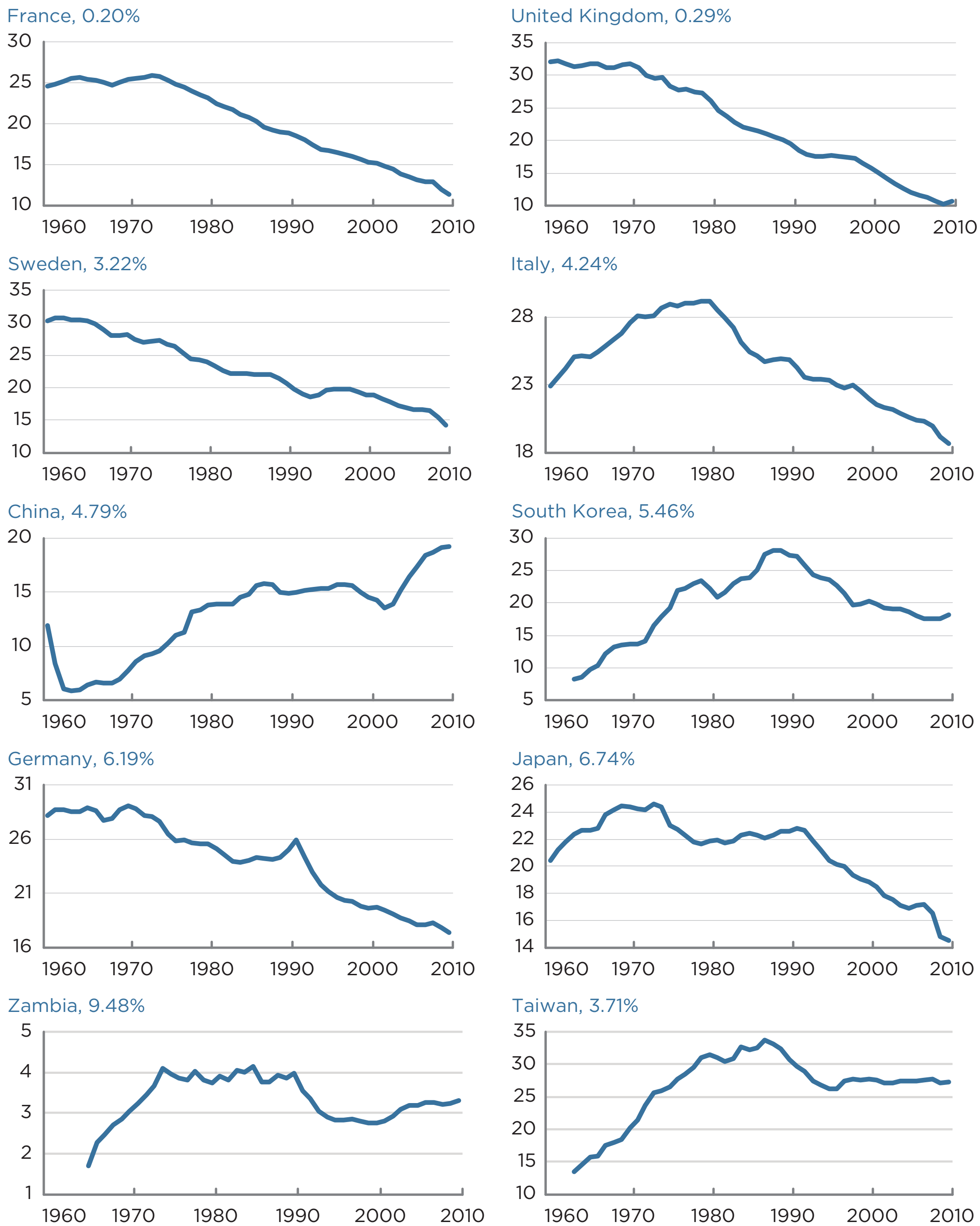


Figure continues

Figure 1 (continued)
Manufacturing employment as share of total employment in top ten economies with largest average manufacturing trade surplus/deficit as share of GDP, 1960-2010

b. Top ten surplus economies



Note: Manufacturing employment data for the countries do not all start in 1960. The most complete available data have been used. Average manufacturing trade surplus/deficit as percent share of GDP (shown above each graph) is the 1960–2010 average.

Source: Author's calculations based on trade data from UN Comtrade database and manufacturing employment shares from the Groningen Growth and Development Center (GGDC) 10-Sector Database (Timmer, de Vries, and de Vries 2015), International Labor Organization Department of Statistics, and The Conference Board International Comparisons of Manufacturing Productivity and Unit Labor Costs database.

1. WHY THE HUMP?

The common experience of a hump-shaped profile in the manufacturing employment share can be explained by a theory that integrates sector technological change, demand, and trade performance. It is best described in two stages: first structural change in a closed economy and then the impact of trade.

Consider an economy with three sectors—agriculture, manufacturing, and services—in which there is structural change in employment due to differences in productivity growth; agriculture has the most rapid productivity growth and services the slowest. Assume, in addition, that demand is relatively unresponsive to prices—i.e., inelastic—in all three sectors[7] (e.g., Ngai and Pissarides 2007).

Two forces will impact manufacturing employment in such a closed economy: a positive force that stems from demand spillovers from agriculture and a negative force that results from productivity growth in manufacturing itself. First, if there is rapid productivity growth in agriculture, the prices of agricultural goods will decline relative to those of manufactures and services. Since the demand for agricultural products is inelastic, consumers spend less of their money on agricultural goods and more on manufactured goods and services. The combination of lower spending and higher productivity in agriculture reduces employment in agriculture and increases demand and employment in manufacturing and services. Second, productivity growth in manufacturing tends to reduce the price of manufactured goods relative to services, and this leads to less spending on manufactures and more on services. Again the combination of lower spending and higher productivity in manufacturing reduces manufacturing employment.

In the early stages of development when the agricultural sector is large, the positive spillovers from agriculture dominate the negative impact of manufacturing productivity and the share of manufacturing employment increases. Over time, however, the spillovers from agriculture decline because the share of the economy in agriculture gets smaller, and eventually the negative impact of relatively rapid manufacturing productivity growth exceeds the positive impact of the spillover from agriculture. Manufacturing employment thus peaks and thereafter the dominant source of structural change is the employment shift from manufacturing to services. The predictions of the closed economy model are particularly relevant because it refutes the argument that by retreating into self-sufficiency, countries could permanently avoid declining shares in manufacturing employment.

When international trade is added to the model the implications of manufacturing productivity growth for manufacturing employment could be different. Faster productivity growth in manufacturing will still reduce manufactured goods prices relative to domestic services and reduce domestic spending on manufactured goods and the labor required to produce them. However, if the economy is small relative to the global market and foreign demand is very elastic, increased productivity growth in manufacturing could increase manufactured goods exports and more than offset the negative

7 There is considerable support for the assumption that sector demand is inelastic. See Boppart (2014); Comin, Lashkari, and Mestieri (2015); Herrendorf, Rogerson, and Valentinyi (2013); and Swiecki (2017).

employment effects of reduced domestic spending (Matsuyama 2009). In the early stages of development, a country with a growing comparative advantage in manufacturing could therefore have stronger manufacturing employment growth because of both positive spillovers from agriculture and increased net export growth in manufactures. Conversely, if productivity growth in agriculture (or mining) tended to increase a country's comparative disadvantage in manufacturing, employment losses due to trade could increase and the country would reach lower peaks in manufacturing employment than if it had remained closed.[8]

As the country's share in the world market becomes larger, however, the net export response to faster manufacturing productivity growth is likely to dissipate (Uy, Yi, and Zhang 2013). One reason is that the demand for exports will become less responsive to additional declines in export prices as a country's shares in foreign markets increase. This can be understood by imagining the extreme case when the home country supplies the whole world market for manufactures and faces a world demand that is inelastic at home and abroad. Over time the employment impact of faster domestic productivity growth that operates through trade will have a hump of its own. In addition, the faster the country grows compared with the rest of the world, the larger the negative impact of its domestic spending relative to the employment impact of its net exports.

Figure 1 provides support for the theory. Several of the surplus countries in the sample, such as Sweden, the United Kingdom, and France, have incomes that are sufficiently high that they have passed their peak employment shares. When their incomes were relatively low, they moved along the upward slope of curve and their trade surpluses raised their manufacturing employment shares and allowed them to reach higher peaks. But, the theory suggests, for the manufacturing employment share to continue to increase, the trade effect needs to be larger than the effect of domestic spending. Eventually, the impact of faster productivity growth reduces the labor content of both domestic spending and the trade surplus. The result is that the share of employment moves along the downward slope of the hump.[9] In the case of other surplus countries such as Italy, South Korea, and Japan the data illustrate the full humped experience. The graphs also show how some low-income countries with deficits such as Senegal, Bolivia, and Kenya are still on the upward slope of the hump, while others such as Venezuela, Costa Rica, and Egypt have also followed the hump-shaped path.

2. VALUE ADDED MEASURES

Trade data are typically reported as trade in the commodities of many industries rather than trade in industry value added. Similarly, expenditure data indicate the values of spending on goods and services sold as finished products rather than the value added in the industries in which they were produced. However, demand for workers in manufacturing industries reflects demand for value added

8 This is sometimes called the Dutch disease because of the impact of Dutch natural gas discoveries on Dutch manufacturing.

9 Although the manufacturing employment share in China was still rising in in 2010—the last year shown in figure 1—the share peaked around 2015 and has been declining since (Lawrence 2019).

in manufacturing alone. To measure this demand it is necessary to subtract the nonmanufacturing inputs from the gross measures of manufactured goods in final expenditure and trade and to add the manufacturing value added in trade and expenditure on nonmanufactured goods and services.

For example, the value of an automobile—which may be reported as an export or a domestic purchase of a "manufactured product"—includes the value added not only in the automobile and other manufacturing industries but also in the industries that produce the raw materials (e.g., iron, glass, and rubber) and services (e.g., distribution, transportation, banking, and advertising), all of which are reflected in the final purchase price. Similarly, the value of final sales of services reflects the use of manufactured goods (e.g., computers and other equipment) to provide these services; and the value of final sales of food—an "agricultural product"—reflects the value of manufactured goods (e.g., tractors, trucks, and irrigation pipes) used in agriculture. These manufacturing value added estimates are based on input-output tables that measure the industry sources of value added in trade and final spending on goods and services.

Obtaining these estimates becomes even more complicated when some manufacturing value added is imported as intermediate inputs from other countries. To estimate the demand for domestic value added, imported value added needs to be subtracted to determine the value added measure that creates a demand for domestic manufacturing labor.

Fortunately, the joint OECD-WTO project on Trade in Value Added (TiVA) has linked the input-output matrices of the countries that account for over 90 percent of global manufacturing output and provides data on the value added by each country to both final demand and exports from 36 sectors. The TiVA analysis originally covered 61 countries using data and classification methods for selected years between 1995 and 2011.[10]

The data cover countries with per capita incomes that in 2018 averaged $36,000 (in 2017 purchasing power parity dollars).[11] They range from Cambodia with a per capita income of $4,100 to Luxemburg with an income of $104,700. As 38 of the countries have incomes above $30,000 and 49 above $20,000, the sample is relatively heavily weighted with upper-income countries. Given the typical hump-shaped profile described in section 1, most of these countries are likely to have passed their peak manufacturing employment shares. This makes the sample particularly appropriate for analyzing the sources of changes in manufacturing demand in countries on the downward slope of the curve.

10 The TiVA data are available at https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm (accessed on June 21, 2016). A more recent version of the data (2005–15) is available for 64 countries, but the estimates differ because of data revisions and different classification methods. As a result, the two versions give slightly different results even for the same years. The 2005–15 data yield qualitatively similar results to those reported here, but to ensure consistency in comparisons over time, this analysis uses the 1995–2011data.

11 These income data are from The Conference Board Total Economy Database, https://www.conference-board.org/data/economydatabase/index.cfm?id=27762 (accessed in July 2019).

3. RELATIONSHIPS AMONG THE VARIABLES THAT LINK TRADE BALANCE TO MANUFACTURING EMPLOYMENT, 1995–2011

GDP (Y) is defined as the sum of spending on consumption (C), investment (I), and by the government (G) plus the trade balance ($X - M$): $Y = C + I + G + (X - M)$. Similarly, value added in manufacturing is the sum of manufacturing value added in national spending on consumption (Cm), investment (Im), and by the government (Gm) and in exports (Xm) minus imports (Mm): $Ym = Cm + Im + Gm + (Xm - Mm)$. In what follows, these variables are used to explore three relationships: (1) between trade balances in manufacturing value added and manufacturing employment shares, (2) between trade balances in manufacturing value added and changes in manufacturing employment shares, and (3) changes in trade balances in manufacturing value added and changes in manufacturing employment shares.

Trade Balances and Manufacturing Employment Shares: Average Relationships

Table A1 in the appendix uses TiVA data for 60 countries for the period 1995 to 2011 to provide the averages of the components that define manufacturing value added (MVA) production as a share of GDP.[12] These include the MVA trade balance in goods and services ($Xm - Mm$), MVA in domestic spending ($Cm + Im + Gm$), and domestic production of MVA ($Cm + Im + Gm + [Xm - Mm]$). The table also reports MVA in domestic investment (Im) and domestic consumption (Cm), average per capita incomes (in 2017 purchasing power parity dollars), relative value added per worker in manufacturing (i.e., the ratio of value added per worker in manufacturing to value added per worker in the whole economy), and the share of manufacturing in total employment. The 60 countries are ranked by the ratio of their net exports of manufacturing value added to GDP (the first column).

Table 1 shows results for the countries divided into two groups: first, those with net trade surpluses and trade deficits on average over 1995–2011, and second, the top and bottom ten countries as ranked by their average manufacturing trade balances.

The data in table A1 reveal some interesting characteristics. In the top ten ranked by their net trade balances in manufacturing value added are five Asian economies (Singapore, Korea, Taiwan, Malaysia, and Thailand) and five European economies (Ireland, Finland, Germany, the Czech Republic, and Sweden). The important role of trade in the share of MVA production in GDP can be seen by the fact that seven of these countries are also in the top 15 when the countries are ranked by share of MVA production in GDP.

Figure 2 shows the close relationship between MVA trade balances and the share of MVA production in GDP. Fitting a linear trend line to capture the association between the production and net trade columns in table A1 gives a coefficient that is very close to unity and is statistically significant (.934).

12 Brunei Darussalam is in the TiVA data but is not included here because annual data on its manufacturing employment share are not readily available. In addition, annual data are not available for all years (so reported averages for 1995–2011 use data for only seven years: 1995, 2000, 2005, and 2008–11).

Table 1
Measures of manufacturing value added (MVA), 1995–2011 average values

Grouping	*Net trade in MVA as share of GDP*	*Production of MVA as share of GDP*	*Spending on MVA as share of GDP*	*Consumption of MVA as share of GDP*	*Investment in MVA*	*Share of manufacturing employment in total employment*	*Per capita income (2017 PPP US dollars)*	*Relative value added per worker in manufacturing*
Average of 60 countries	–0.003	0.181	0.184	0.114	0.063	0.162	29,563	1.12
Surplus country average	0.034	0.219	0.185	0.109	0.070	0.181	32,592	1.21
Deficit country average	–0.032	0.152	0.183	0.119	0.058	0.148	27,247	1.02
Top ten (largest surplus) country average	0.059	0.245	0.186	0.104	0.075	0.189	34,810	1.30
Bottom ten (largest deficit) country average	–0.059	0.135	0.195	0.120	0.067	0.137	21,769	0.99

Definitions:
Net trade = *Xm – Mm*
Production = *Cm + Im + Gm + (Xm – Mm)*
Spending = *Cm + Im + Gm*
Consumption = *Cm*
Investment = *Im*

Relative value added per worker in manufacturing calculated as MVA per worker in manufacturing divided by MVA per worker in the whole economy = *(MVA/Lm)/(GDP/L)*

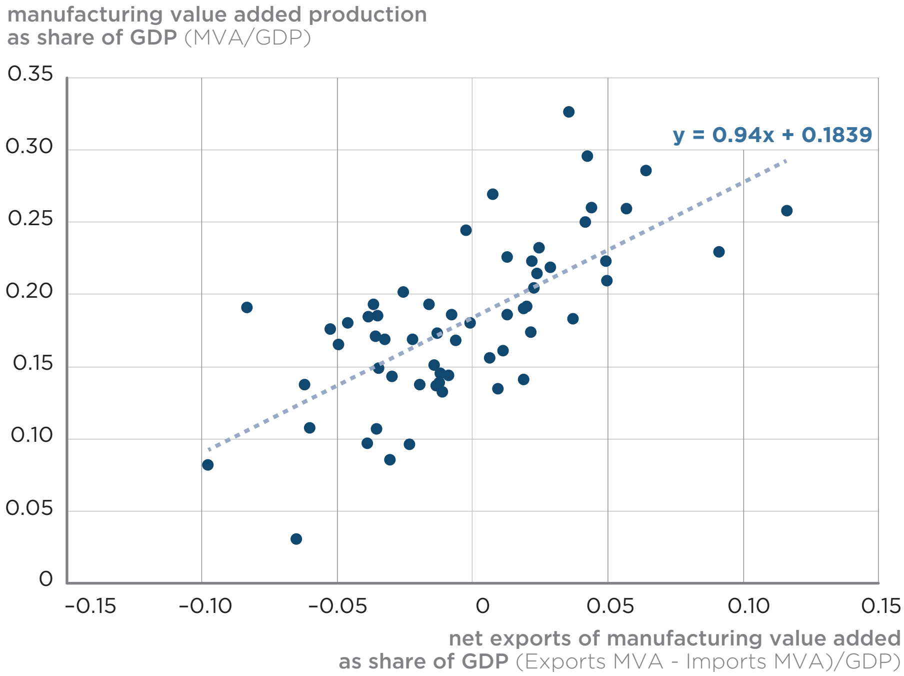
Source: Appendix table A1.

This indicates that each 1 percent increase in the ratio of MVA trade balance to GDP is associated with about a 1 percent increase in the share of MVA production in GDP.

In addition to trade, however, the composition of national spending helps explain the high share of manufacturing production in several countries. Final spending on investment (plant, equipment, and inventories) is far more intensive in manufacturing value added than final spending on consumption (Lawrence 2019). Consequently, what stands out as another source of the high MVA share in Asian countries' GDP is the level of investment spending. China, the country with the highest share of manufacturing in GDP in the sample, is the leader in this respect, with 15.6 percent of its GDP spent on manufacturing value added in investment—almost three times the average of the countries in the sample (box 1). Shares of manufacturing value added that stem from investment are also high in Vietnam (11.2 percent), Thailand (10.4 percent), Korea (10.3 percent), Malaysia (10 percent), and Taiwan (7.8 percent), all significantly higher than the sample average of 6.3 percent. On the other hand, the shares of spending on manufacturing value added in consumption in China (12.4 percent), Taiwan (11.8 percent), and Korea (11.4 percent) are close to the 11.4 percent average of all the countries in the sample.

Most theories of economic growth predict a close association between investment and growth, and thus the high share of investment and hence manufacturing in these Asian economies is closely related to their rapid growth. This association would also hold in reverse: If growth in these countries slows, investment and the share of manufacturing in value added is likely to decline (Lawrence 2019).

Figure 2
Domestic production of manufacturing value added versus net exports of manufacturing value added as shares of GDP (average 1995–2011)



Source: Appendix table A1.

The relationships between the variables that connect the trade balance to manufacturing employment emerge clearly when the countries are grouped into two categories.

Surplus versus Deficit Countries. In the sample reported in table A1, 26 countries had trade surpluses in manufacturing value added that averaged 3.4 percent of GDP and 34 had deficits that averaged −3.2 percent of GDP (see table 1). The share of MVA in overall spending averaged about 18 percent of GDP. The shares of GDP in manufacturing output, however, were very different: On average the surplus countries produced 21.9 percent of their GDP in manufacturing and the deficit countries just 15.2 percent. While the average manufacturing employment share of 18.1 percent in surplus countries was higher than the 14.8 percent in deficit countries, the difference was much smaller than the difference in value added production shares.[13]

As shown in the final column of table 1, MVA per worker relative to overall value added per worker in countries with trade surpluses was 21 percent higher than in the deficit countries and this offset some of the employment impact of the relatively higher manufacturing output shares in surplus countries. Assuming international convergence of the prices of manufactured goods, the association

13 Data on the employment share in manufacturing are from The Conference Board International Labor Comparisons program, July 2018, https://www.conference-board.org/ilcprogram/productivityandulc (accessed on March 29, 2019) and the International Labor Organization (ILO) Department of Statistics, https://www.ilo.org/shinyapps/bulkexplorer15/?lang=en&segment=indicator&id=SDG_0922_NOC_RT_A (accessed in August 2020).

Box 1
The United States and China: Comparing sources of manufacturing demand

On average between 1995 and 2011, the United States had a trade deficit in manufacturing value added equal to 1.2 percent of GDP (table A1). This represented the difference between 13.9 percent of GDP accounted for by manufacturing production and 15.1 percent of GDP accounted for by manufacturing value added (MVA) in US final expenditures. To a considerable extent, America's relatively low spending share on manufacturing value added was due to its low investment share, which increased demand for manufacturing value added by just 3.7 percent of GDP (in contrast to the sample average of 6.3 percent). US MVA consumption accounted for 11.3 percent of GDP, in line with the sample average of 11.4 percent.

Over this period, had the United States maintained its level of MVA spending at 15.1 percent of GDP but produced all of the value added domestically, its manufacturing output would have been 8.6 percent larger. In 2015 (the most recent TiVA data available), US MVA in domestic spending and the trade deficit were equal to 14.7 and 2.2 percent of GDP, respectively. Manufacturing production was thus 12.5 percent of GDP. The US employment share in manufacturing in full-time equivalent employees was 12.075 million (9.1 percent of total employment) in 2015, suggesting that with balanced trade in MVA and the same dollar level of spending on MVA, US manufacturing production would have been larger by 14.7/12.5, or 17.6 percent. This implies that employment in manufacturing would have been 2.12 million larger and the employment share in manufacturing would have been 10.7 percent rather than 9.1 percent. Of course these data represent after-the-fact outcomes, and the ultimate outcome would have been sensitive to how the trade deficit was eliminated.

China's average trade surplus in manufacturing value added in 1995–2011 was 3.5 percent of GDP and the focus of considerable attention and controversy. But the primary source of China's very high share of manufacturing production, which averaged 32.6 percent of GDP, was primarily due to MVA of 29.1 percent of GDP that resulted from its domestic spending. This high spending share in turn reflected the value added in the country's extraordinarily high share of investment spending, which accounted for MVA of 15.6 percent of GDP. Chinese consumption spending, by contrast, was actually quite typical of the countries in the sample, accounting for MVA equal to 12.4 percent of GDP—not all that different from the sample average of 11.4 percent.

By 2015, China's share of GDP accounted for by production and its MVA trade surplus had declined to 30.7 and 4.0 percent of GDP, respectively. Thus, had China been self-contained (or had balanced trade) but maintained the same nominal level of domestic spending on manufacturing value added at 30.7 percent, its manufacturing value added and manufacturing employment would have been 30.7/34.7, or 11.5 percent smaller. According to The Conference Board, in 2015 the share of employment in Chinese manufacturing was 18.5 percent; without its trade surplus the share would have been 16.3 percent.

In sum, while much of the focus has been on trade balances, for both the United States and China by far the most important source of the demand for manufacturing output and employment has been their domestic spending and the most important source of the difference in their domestic spending has been their different investment rates.

between relatively higher productivity in manufacturing and manufacturing trade surpluses is consistent with the basic Ricardian model of trade, which predicts comparative advantage on the basis of relative productivity.

Top Ten versus Bottom Ten. The second grouping in table 1 reports the average data for the ten countries with the largest trade surpluses in manufacturing value added and the ten with the largest trade deficits. Those in the top ten tend to be significantly richer, with per capita incomes of $34,810 (2017 PPP), compared with $21,769 for the bottom ten.

On average the top ten have trade surpluses equal to 5.9 percent of GDP while those in the bottom ten have deficits of −5.9 percent. Again, both groups spent similar shares of their GDP on manufacturing value added, but the share of MVA production in GDP is 24.5 and 13.5 percent for the top and bottom ten, respectively. Relative MVA per worker in the top ten is 30 percent higher than in the bottom ten, explaining why the differences in manufacturing employment shares of 18.9 versus 13.7 percent, respectively, are much narrower than the differences in manufacturing production shares.

Simple regressions confirm both that larger trade balances in manufacturing are associated with higher shares of manufacturing value added in GDP and that higher MVA per worker in manufacturing is associated with large trade balances in MVA. As shown in figure 2, the average share of MVA in GDP over the period 1995-2011 has been plotted against the average trade balance in MVA and the line fitted to these data shows a strong linear relationship between production (i.e., MVA) and the trade balance. Figure 3 similarly shows the strong linear relationship between the trade balance in manufacturing value added and relative MVA per worker.

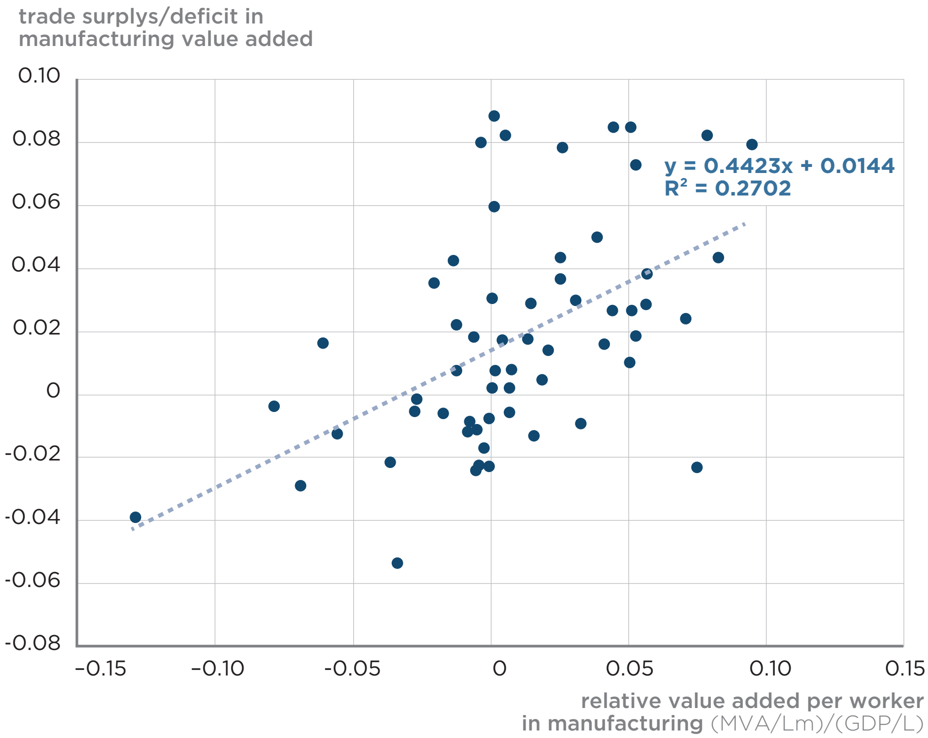
In sum, on average deficit and surplus countries have similar shares of spending on manufacturing value added, but as shown in figure 4, countries with larger trade surpluses have lower shares of spending on MVA (left panel) and higher shares of relative MVA per worker (right panel).

Trade Balances and Changes in Manufacturing Employment Shares

Table A2 in the appendix ranks countries by the size of their average net trade balance in manufacturing to GDP between 1995 and 2011 and shows the relationships between *changes* in the share of manufacturing employment in total employment in percentage points and *changes* in the underlying determinants of the demand for manufacturing employment. These underlying variables are changes in net trade in MVA, in spending on MVA, and in MVA production, all expressed as a share of GDP. Changes in the share of manufacturing employment in total employment are also reported in percentage points. The change in relative MVA per worker is obtained by subtracting changes in the manufacturing employment share from changes in the manufacturing output share.

Table A2 shows that, while the 60 countries in the sample had divergent experiences in changes in their trade balances as a share of GDP, only 3 (Argentina, Cambodia, and Vietnam) did not experience a decline in MVA spending as a share of GDP, and on average the declines were 5 percent of GDP. Similarly, the employment share declined in 52 of the 60 countries, and the average decline was 4.0 percentage points.

Figure 3
Change in trade balance in manufacturing value added versus relative value added per worker in manufacturing (average 1995–2011)



Source: Table 3.

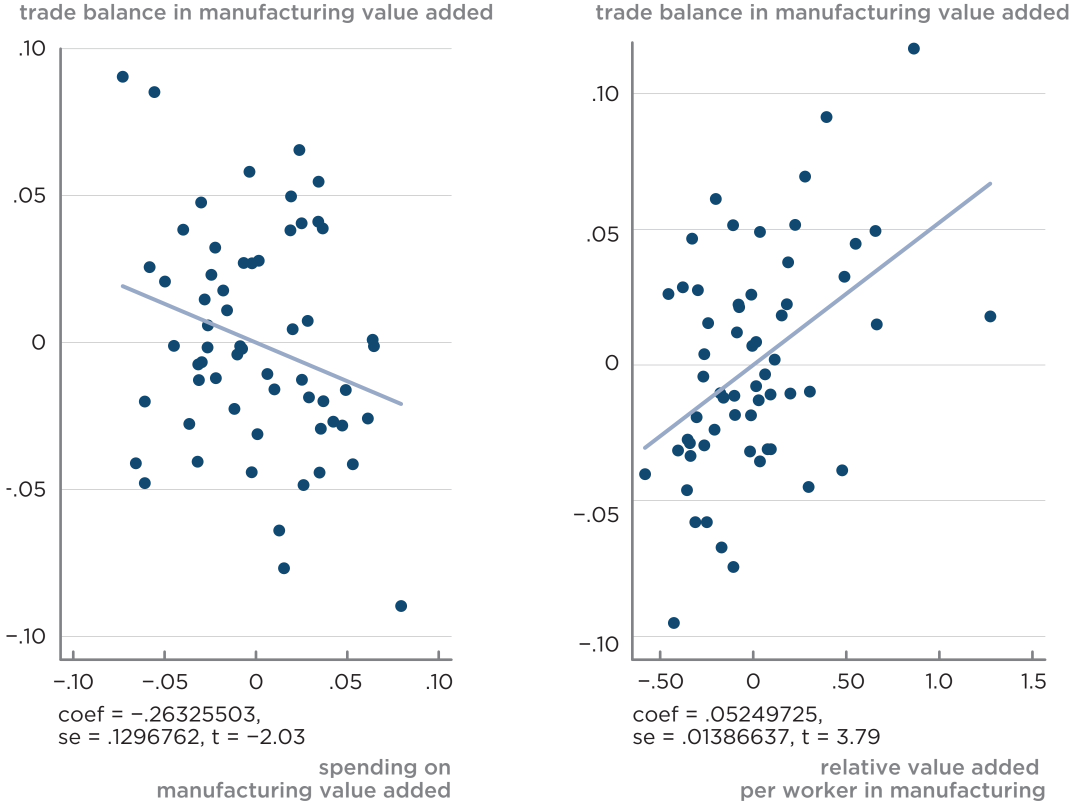
Table 2 reports the averages of two country groups: (1) those that on average had trade surpluses or deficits in 1995–2011, and (2) the ten countries with the largest average trade surpluses and the ten with the largest average trade deficits.

The surplus and deficit countries increased their MVA net trade balances between 1995 and 2011 by 3 and 1 percent of GDP, respectively. This implies overall that the countries in the rest of the world that are excluded from the sample experienced declines in their net trade in manufacturing value added. However, some of the differences in the changes in net trade balances of surplus and deficit countries were offset by differences in the declines of spending on MVA, with the result that manufacturing production as a share of GDP fell by only 1.1 percentage points less in surplus than in deficit countries.

Despite the differences in the size of average manufacturing trade surpluses and in the changes in trade balances, the declines in shares of manufacturing employment were very similar. Indeed, because of their relatively greater increases in relative MVA per worker, the 4.4 percentage point decline in the share of manufacturing employment in the surplus countries was actually 0.6 percentage points greater than the 3.8 percentage point decline in the deficit countries. Clearly large trade balances in manufacturing trade do not necessarily imply smaller declines in manufacturing employment.

Figure 4
Partial plots from regression of trade balance in manufacturing value added as a function of spending and relative value added per worker in manufacturing

a. Domestic spending on manufacturing value added **b. Relative value added per worker in manufacturing**



Source: Appendix table A1.

A similar and even starker picture emerges when as reported in table 2 countries at the extremes are considered in greater detail. The ten countries with the largest MVA trade surpluses experienced average increases in their MVA net trade equal to 4.6 percent of their GDP. This compares with an average 2.1 percentage point increase in the MVA net trade in the bottom ten trade deficit countries. However, the declines in spending on manufacturing value added were larger in the top surplus countries: −5.7 percent of GDP compared with −3.5 percent of GDP for the ten countries with the largest deficits. This meant that the decline in MVA production of around 1 percent of GDP was almost identical in both groups. However, because MVA per worker in manufacturing relative to overall output per worker grew more rapidly in the trade surplus countries, their shares of manufacturing employment actually declined by 0.5 percentage point more than those with large deficits.

These numbers highlight the two sources of convergence in the changes in manufacturing employment shares in trade surplus and deficit countries. Trade surplus countries tended to have larger declines in domestic spending on manufacturing value added and larger increases in relative MVA per worker.

Table 2
Changes in determinants of manufacturing employment share, 1995–2011 average values
Countries ranked by average net trade in MVA as share of GDP

Grouping	Average net trade in MVA as share of GDP	Change in net trade in MVA as share of GDP	Change in spending on MVA as share of GDP	Change in production of MVA as share of GDP	Change in relative value added per worker in manufacturing[a]	Change in manufacturing employment share in total employment	Per capita income *(2017 PPP US dollars)*
Average of 60 countries	−0.003	0.019	−0.050	−0.031	0.009	−0.040	29,563
Surplus country average	0.034	0.030	−0.055	−0.025	0.019	−0.044	32,592
Deficit country average	−0.032	0.010	−0.046	−0.036	0.002	−0.038	27,247
Top ten (largest surplus) country average	0.059	0.046	−0.057	−0.011	0.027	−0.038	34,810
Bottom ten (largest deficit) country average	−0.059	0.021	−0.035	−0.014	0.019	−0.033	21,769

MVA = manufacturing value added
a. Calculated as MVA per worker in manufacturing divided by MVA per worker in the whole economy.
Source: Appendix table A2.

Table A2 shows that, in the ten countries with the largest average trade surpluses between 1995 and 2011, the net trade balance in MVA increased by an average of 4.6 percentage points of GDP. Only two of the ten (Taiwan and Thailand) did not experience a decline in their manufacturing employment shares.

What is striking again are the pervasive declines in the domestic shares of MVA spending in the ten countries, such that half of those with large trade surpluses experienced declines in the share of manufacturing production in GDP. The spending declines on MVA as a share of GDP were especially large in Singapore (−11.4 percentage points), Malaysia (−9.1), the Czech Republic (−8.9), and Ireland (−7.3). Singapore and Korea also stand out for the very rapid relative productivity growth in manufacturing so that despite their large trade surpluses, they experienced large declines in their manufacturing employment shares.

Similarly, while Germany's trade surplus in MVA as a share of GDP increased by 3.8 percentage points, this was almost fully offset by the decline in its domestic spending and its relatively rapid relative growth in MVA per worker. Germany's employment share in manufacturing fell by 4.9 percentage points.

In sum, these data all reinforce the conclusion that the countries that had larger trade surpluses also had larger declines in their domestic spending and larger increases in their relative value added per worker in manufacturing that reduced the manufacturing employment effects of their surpluses.

Changes in Trade Balances and in Manufacturing Employment Shares

A third relationship that is revealing is between changes in the net export surplus in manufacturing value added and changes in the share of manufacturing employment. For this analysis the countries are ranked according to changes in their net MVA exports between 1995 and 2011. Two-thirds of the sample (39 of the 60 countries) had positive changes, and a third experienced declines. In the

Table 3
Changes in determinants of manufacturing employment share, 1995–2011 average values
Countries ranked by changes in net trade in MVA as share of GDP

Grouping	Average net trade in MVA as share of GDP	Change in net trade in MVA as share of GDP	Change in spending on MVA as share of GDP	Change in production of MVA as share of GDP	Change in relative value added per worker in manufacturing	Change in manufacturing employment share in total employment	Per capita income *(2017 PPP US dollars)*
Average of 60 countries	−0.003	0.019	−0.050	−0.031	0.009	−0.040	29,563
Countries with positive changes in net trade	0.002	0.037	−0.054	−0.017	0.024	−0.041	28,337
Countries with negative changes in net trade	−0.012	−0.017	−0.042	−0.058	−0.018	−0.040	31,841
Top ten countries with average changes in net trade	0.020	0.079	−0.079	0.000	0.035	−0.035	22,398
Bottom ten countries with average changes in net trade	−0.010	−0.027	−0.040	−0.066	−0.019	−0.047	40,370

MVA = manufacturing value added
Source: Appendix table A3.

entire sample, on average net exports of manufacturing increased by 1.9 percent of GDP. On average this performance allowed these countries to achieved nearly balanced MVA trade over the period.

Despite their balanced MVA trade, their manufacturing employment shares fell by 4.0 percentage points. This decline was mainly driven by a decline in the share of spending on manufacturing of 5 percent of GDP, a decline in the MVA production share by 3.1 percent of GDP, and an increase in relative MVA per worker of 0.9 percent. This example shows vividly how spending patterns and productivity rather than trade dominated the average manufacturing employment experience over the period.

Table 3 reports averages for two groups of countries. The first compares countries with positive changes in net MVA exports with those with negative changes. As the shaded column shows, on average the declines in manufacturing employment shares in both groups are virtually identical at −4.0 percentage points. Although trade performance increased output in the countries with positive changes, they had larger declines in domestic spending and much faster relative productivity growth in manufacturing. Indeed, relative output per worker in manufacturing in the deficit countries actually grew more slowly than in the rest of their economy.

The second group compares the top and bottom ten countries ranked by the changes in their MVA trade balances as a share of GDP. The manufacturing employment share declined by 1.2 percentage points less in the countries with the largest trade balance increases than in those with the largest decreases (−3.5 vs. −4.7 percentage points), but this difference was far less than the 10.6 percentage point difference in their trade performance (7.9 vs. −2.7 percentage points). Again, part of the explanation was the greater declines in spending in the countries with positive net exports (−7.9 vs. −4.0 percentage points) and relatively faster increases in manufacturing output per worker (3.5 vs. −1.9 percentage points).

Table A3 reports country-level details for the countries with the largest increases in net trade balances in manufacturing from 1995 to 2011. With the exception of Cambodia (by far the poorest country in the sample), all of the top ten countries experienced declines in domestic spending that on average were as large as the increases in their trade balances. For Cambodia, theory suggests that small countries will be price takers in world markets and, with a comparative advantage in manufacturing, could experience a rising share of manufacturing employment, and that is precisely what happened in Cambodia during the period (Matsuyama 2009). In all the remaining countries, however, both spending and manufacturing employment declined, and most experienced relatively rapid productivity growth in manufacturing value added.

In sum, manufacturing trade balances are not determined in a vacuum. This analysis points to a major role for levels and changes in MVA per worker in manufacturing compared with developments in value added per worker in the rest of the economy. As figure 3 shows, when relative value added per worker in manufacturing is high, countries are likely to have a comparative advantage in manufacturing and thus run a trade surplus in manufacturing. But with higher value added per worker, the job content of any given trade balance is likely to be lower. This helps explain why despite their relatively higher shares of manufacturing output, changes in employment shares of countries with manufacturing trade surpluses may be comparable to those of countries with deficits. Similarly, rapid growth in relative manufacturing productivity is likely to lead to lower prices for domestic goods, and while this could mean more net exports, it could also lead to larger reductions in domestic spending and the employment associated with it.

4. CONCLUSIONS AND POLICY IMPLICATIONS

This analysis has examined sources of the demand for manufacturing workers in 60 countries between 1995 and 2011 and decomposed that demand into the three components of the identity that domestic production equals domestic spending minus the trade balance. Since these components are all endogenous variables (i.e., consequences), their relative magnitudes will not be constant but rather contingent on the (exogenous) factors that generate them. Nonetheless, the predictions of the open economy model in which the primary source of change once countries have developed is relative productivity growth in manufacturing are confirmed in this analysis.

Countries with trade surpluses in manufacturing have larger shares of manufacturing output in GDP and, although less than proportional to their output shares, relatively higher employment shares in manufacturing. But their surpluses did not prevent declines in their shares of manufacturing employment, declines that were as large as in countries with trade deficits. On balance, even though their relatively faster productivity growth in manufacturing tended to boost their trade surpluses, it also reduced their domestic spending on manufacturing value added and the manufacturing employment shares associated with given shares of domestic spending and net MVA exports.

As noted in the introduction, in many countries industrial policies have been designed to enhance national technological capabilities, in part motivated by the view that this would increase manufacturing employment. But the experience of the countries analyzed here raises serious questions about whether such policies are effective. To be sure, technological improvements may raise output per worker, but in the face of relatively inelastic demand, higher productivity can also reduce the labor content of domestic spending as well as the labor needed to achieve a given level of net exports.

Investments in manufacturing technologies could raise average living standards, and since such investments generally emphasize the development of sophisticated technologies, they are also likely to increase the relative demand for skilled workers. This implies that they should not be viewed as policies that will necessarily increase manufacturing employment and make growth more inclusive. The jobs of the future are increasingly likely to be in services. For some workers this may mean loss of income and painful adjustments. For other workers, however, it may provide the opportunity to acquire new skills in high-productivity, high-paying services jobs (e.g., in marketing, finance, and health care) and to work under less arduous conditions than those that prevail in assembly-line work.

There are some who see a retreat into self-sufficiency as the key to restoring manufacturing employment growth. Under certain circumstances there could be one-time increases from protective measures. But eventually, since domestic demand for manufactures is inelastic and the response of spending on services to higher incomes is larger than the response of spending on goods, eventually the share of employment in manufacturing will return to a downward path. Closing the economy to boost manufacturing employment is like walking up an escalator moving downward: You may temporarily reach higher elevations but eventually you will resume the decline.

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APPENDIX

Table A1
Measures of manufacturing value added (MVA), 1995–2011 average values, full sample
Countries ranked by average net trade in manufacturing value added as share of GDP; shading indicates top and bottom ten economies

	Country	*Net trade in MVA as share of GDP*	*Production of MVA as share of GDP*	*Spending on MVA as share of GDP*	*Consumption of MVA as share of GDP*	*Investment in MVA as share of GDP*	*Manufacturing employment share in total employment*	*Per capita Income (2017 PPP US dollars)*
1	IRL: Ireland	0.116	0.258	0.142	0.090	0.047	0.139	44,738
2	SGP: Singapore	0.091	0.229	0.138	0.053	0.074	0.167	61,365
3	KOR: Korea	0.064	0.286	0.222	0.114	0.103	0.181	26,005
4	TWN: Taiwan	0.057	0.259	0.202	0.118	0.078	0.253	33,687
5	FIN: Finland	0.050	0.210	0.160	0.102	0.054	0.163	39,542
6	DEU: Germany	0.049	0.223	0.174	0.111	0.058	0.221	41,835
7	MYS: Malaysia	0.044	0.260	0.216	0.106	0.100	0.198	19,947
8	THA: Thailand	0.042	0.295	0.253	0.137	0.104	0.142	12,189
9	CZE: Czech Republic	0.042	0.250	0.208	0.121	0.083	0.272	26,274
10	SWE: Sweden	0.037	0.183	0.146	0.091	0.051	0.153	42,514
11	**CHN: China**	**0.035**	**0.326**	**0.291**	**0.124**	**0.156**	**0.154**	**6,550**
12	CHL: Chile	0.029	0.219	0.191	0.117	0.068	0.131	17,575
13	SVK: Slovak Republic	0.024	0.232	0.208	0.125	0.076	0.267	21,048
14	HUN: Hungary	0.024	0.215	0.191	0.116	0.067	0.243	22,058
15	JPN: Japan	0.023	0.204	0.181	0.110	0.071	0.180	38,023
16	SVN: Slovenia	0.022	0.223	0.201	0.122	0.072	0.292	27,483
17	RUS: Russia	0.021	0.174	0.153	0.106	0.039	0.182	19,284
18	CHE: Switzerland	0.020	0.192	0.172	0.094	0.073	0.149	54,126
19	NLD: Netherlands	0.019	0.141	0.122	0.084	0.034	0.132	47,018
20	AUT: Austria	0.019	0.190	0.172	0.099	0.065	0.184	43,719
21	ITA: Italy	0.013	0.186	0.173	0.111	0.059	0.214	39,404
22	PHL: Philippines	0.013	0.226	0.213	0.143	0.065	0.089	4,911
23	BEL: Belgium	0.011	0.161	0.150	0.091	0.052	0.172	41,501
24	DNK: Denmark	0.009	0.135	0.125	0.078	0.043	0.143	45,492
25	IDN: Indonesia	0.007	0.269	0.262	0.166	0.089	0.127	41,325

Table continues

Table A1 (continued)
Measures of manufacturing value added (MVA), 1995–2011 average values, full sample
Countries ranked by average net trade in manufacturing value added as share of GDP; shading indicates top and bottom ten economies

	Country	***Net trade in MVA as share of GDP***	***Production of MVA as share of GDP***	***Spending on MVA as share of GDP***	***Consumption of MVA as share of GDP***	***Investment in MVA as share of GDP***	***Manufacturing employment share in total employment***	***Per capita Income*** *(2017 PPP US dollars)*
26	ISR: Israel	0.006	0.156	0.150	0.097	0.047	0.153	29,789
27	ARG: Argentina	–0.001	0.180	0.181	0.119	0.056	0.143	17,251
28	ROU: Romania	–0.003	0.244	0.247	0.170	0.074	0.215	13,895
29	BRA: Brazil	–0.006	0.168	0.175	0.133	0.039	0.142	13,430
30	POL: Poland	–0.008	0.186	0.194	0.127	0.060	0.201	17,845
31	CAN: Canada	–0.009	0.144	0.153	0.096	0.052	0.137	41,685
32	FRA: France	–0.011	0.132	0.143	0.100	0.040	0.161	38,451
33	NZL: New Zealand	–0.012	0.145	0.157	0.100	0.051	0.116	32,504
34	**USA: United States**	**–0.012**	**0.139**	**0.151**	**0.113**	**0.037**	**0.124**	**51,005**
35	IND: India	–0.013	0.173	0.186	0.088	0.087	0.118	3,408
36	ISL: Iceland	–0.014	0.137	0.150	0.106	0.034	0.130	44,738
37	ESP: Spain	–0.014	0.151	0.165	0.107	0.056	0.164	33,771
38	MEX: Mexico	–0.016	0.193	0.209	0.141	0.048	0.168	17,482
39	GBR: United Kingdom	–0.020	0.137	0.157	0.116	0.036	0.132	38,205
40	ZAF: South Africa	–0.022	0.169	0.191	0.129	0.059	0.156	11,610
41	NOR: Norway	–0.023	0.096	0.119	0.070	0.040	0.138	66,226
42	TUR: Turkey	–0.025	0.202	0.227	0.149	0.075	0.199	15,371
43	PRT: Portugal	–0.030	0.143	0.173	0.115	0.055	0.188	28,321
44	LUX: Luxembourg	–0.030	0.086	0.116	0.062	0.048	0.087	91,204
45	MLT: Malta	–0.033	0.169	0.201	0.137	0.059	0.192	28,226
46	COL: Colombia	–0.035	0.149	0.184	0.126	0.054	0.131	10,595
47	LTU: Lithuania	–0.035	0.186	0.221	0.161	0.055	0.180	17,714
48	AUS: Australia	–0.036	0.107	0.142	0.085	0.055	0.104	42,645
49	EST: Estonia	–0.036	0.171	0.207	0.120	0.079	0.204	21,082
50	CRI: Costa Rica	–0.037	0.193	0.230	0.173	0.052	0.137	12,044

Table continues

Table A1 (continued)
Measures of manufacturing value added (MVA), 1995–2011 average values, full sample
Countries ranked by average net trade in manufacturing value added as share of GDP; shading indicates top and bottom ten economies

	Country	*Net trade in MVA as share of GDP*	*Production of MVA as share of GDP*	*Spending on MVA as share of GDP*	*Consumption of MVA as share of GDP*	*Investment in MVA as share of GDP*	*Manufacturing employment share in total employment*	*Per capita Income (2017 PPP US dollars)*
51	TUN: Tunisia	–0.039	0.184	0.223	0.131	0.088	0.190	9,329
52	SAU: Saudi Arabia	–0.039	0.097	0.136	0.063	0.066	0.067	49,327
53	BGR: Bulgaria	–0.046	0.181	0.227	0.139	0.077	0.245	13,886
54	KHM: Cambodia	–0.050	0.165	0.215	0.154	0.055	0.105	1,926
55	HRV: Croatia	–0.052	0.176	0.229	0.149	0.072	0.181	19,372
56	GRC: Greece	–0.060	0.108	0.168	0.114	0.051	0.128	30,680
57	LVA: Latvia	–0.062	0.137	0.199	0.129	0.063	0.152	16,359
58	HKG: Hong Kong	–0.065	0.031	0.096	0.042	0.039	0.048	43,177
59	VNM: Vietnam	–0.083	0.191	0.274	0.154	0.112	0.137	3,440
60	CYP: Cyprus	–0.098	0.082	0.180	0.125	0.046	0.115	30,197
	Average	**–0.003**	**0.181**	**0.184**	**0.114**	**0.063**	**0.162**	**29,563**

Definitions:
Net trade = $Xm - Mm$
Production = $Cm + Im + Gm + (Xm - Mm)$
Spending = $Cm + Im + Gm$
Consumption = Cm
Investment = Im

Source: Author's calculations based on Trade in Value-Added (TiVA) database; manufacturing employment shares from the Groningen Growth and Development Center (GGDC) 10-Sector Database (Timmer, de Vries, and de Vries 2015), International Labor Organization Department of Statistics, and The Conference Board International Comparisons of Manufacturing Productivity and Unit Labor Costs database; and income data from The Conference Board Total Economy Database.

Table A2

Changes in determinants of manufacturing employment share, 1995–2011 average values, full sample

Countries ranked by average net trade in MVA as share of GDP; shading indicates top and bottom ten economies

	Country	*Average net trade in MVA as share of GDP*	*Change in net trade in MVA as share of GDP*	*Change in spending on MVA as share of GDP*	*Change in production of MVA as share of GDP*	*Change in relative value added per worker in manufacturing*	*Change in manufacturing employment share in total employment*	*Per capita Income (2017 PPP US dollars)*
1	IRL: Ireland	0.116	0.050	-0.073	-0.023	0.039	-0.062	44,738
2	SGP: Singapore	0.091	0.073	-0.114	-0.041	0.053	-0.094	61,365
3	KOR: Korea	0.064	0.079	-0.038	0.041	0.095	-0.054	26,005
4	TWN: Taiwan	0.057	0.043	-0.043	-0.000	-0.014	0.013	33,687
5	FIN: Finland	0.050	-0.053	-0.018	-0.071	-0.034	-0.037	39,542
6	DEU: Germany	0.049	0.038	-0.031	0.008	0.057	-0.049	41,835
7	MYS: Malaysia	0.044	0.085	-0.091	-0.006	0.045	-0.051	19,947
8	THA: Thailand	0.042	0.078	-0.047	0.031	0.026	0.005	12,189
9	CZE: Czech Republic	0.042	0.088	-0.089	-0.000	0.001	-0.002	26,274
10	SWE: Sweden	0.037	-0.023	-0.028	-0.051	-0.001	-0.051	42,514
11	**CHN: China**	**0.035**	**0.016**	**-0.044**	**-0.027**	**-0.061**	**0.034**	**6,550**
12	CHL: Chile	0.029	0.030	-0.064	-0.035	0.031	-0.065	17,575
13	SVK: Slovak Republic	0.024	0.014	-0.064	-0.050	0.021	-0.071	21,048
14	HUN: Hungary	0.024	0.082	-0.077	0.005	0.078	-0.074	22,058
15	JPN: Japan	0.023	0.005	-0.043	-0.039	0.019	-0.057	38,023
16	SVN: Slovenia	0.022	0.019	-0.075	-0.056	0.053	-0.109	27,483
17	RUS: Russia	0.021	-0.007	-0.036	-0.044	-0.001	-0.043	19,284
18	CHE: Switzerland	0.020	0.027	-0.033	-0.007	0.051	-0.058	54,126
19	NLD: Netherlands	0.019	0.017	-0.053	-0.035	0.004	-0.039	47,018
20	AUT: Austria	0.019	0.037	-0.038	-0.001	0.025	-0.027	43,719
21	ITA: Italy	0.013	-0.012	-0.040	-0.052	-0.009	-0.043	39,404
22	PHL: Philippines	0.013	0.060	-0.079	-0.019	0.001	-0.020	4,911
23	BEL: Belgium	0.011	-0.017	-0.043	-0.059	-0.002	-0.057	41,501
24	DNK: Denmark	0.009	0.002	-0.057	-0.055	0.007	-0.062	45,492
25	IDN: Indonesia	0.007	0.008	-0.030	-0.022	-0.013	-0.010	41,325

Table continues

Table A2 (continued)

Changes in determinants of manufacturing employment share, 1995-2011 average values, full sample

Countries ranked by average net trade in MVA as share of GDP; shading indicates top and bottom ten economies

	Country	*Average net trade in MVA as share of GDP*	*Change in net trade in MVA as share of GDP*	*Change in spending on MVA as share of GDP*	*Change in production of MVA as share of GDP*	*Change in relative value added per worker in manufacturing*	*Change in manufacturing employment share in total employment*	*Per capita Income (2017 PPP US dollars)*
26	ISR: Israel	0.006	0.043	-0.077	-0.033	0.025	-0.059	29,789
27	ARG: Argentina	-0.001	0.010	0.012	0.022	0.051	-0.029	17,251
28	ROU: Romania	-0.003	0.024	-0.037	-0.013	0.071	-0.083	13,895
29	BRA: Brazil	-0.006	-0.006	-0.035	-0.041	-0.017	-0.024	13,430
30	POL: Poland	-0.008	-0.009	-0.024	-0.032	-0.008	-0.025	17,845
31	CAN: Canada	-0.009	-0.029	-0.039	-0.068	-0.069	0.001	41,685
32	FRA: France	-0.011	-0.024	-0.035	-0.059	-0.005	-0.054	38,451
33	NZL: New Zealand	-0.012	-0.002	-0.069	-0.070	-0.027	-0.043	32,504
34	**USA: United States**	**-0.012**	**-0.006**	**-0.039**	**-0.045**	**0.007**	**-0.051**	**51,005**
35	IND: India	-0.013	-0.004	-0.039	-0.043	-0.079	0.036	3,408
36	ISL: Iceland	-0.014	0.029	-0.052	-0.023	0.015	-0.038	44,738
37	ESP: Spain	-0.014	0.002	-0.055	-0.053	0.000	-0.053	33,771
38	MEX: Mexico	-0.016	-0.005	-0.029	-0.035	-0.028	-0.007	17,482
39	GBR: United Kingdom	-0.020	-0.022	-0.074	-0.096	-0.036	-0.060	38,205
40	ZAF: South Africa	-0.022	-0.012	-0.059	-0.071	-0.056	-0.016	11,610
41	NOR: Norway	-0.023	0.018	-0.060	-0.042	-0.006	-0.036	66,226
42	TUR: Turkey	-0.025	-0.039	-0.056	-0.095	-0.129	0.034	15,371
43	PRT: Portugal	-0.030	0.016	-0.059	-0.043	0.041	-0.084	28,321
44	LUX: Luxembourg	-0.030	-0.022	-0.044	-0.066	-0.004	-0.062	91,204
45	MLT: Malta	-0.033	0.080	-0.159	-0.079	-0.004	-0.075	28,226
46	COL: Colombia	-0.035	0.018	-0.022	-0.005	0.014	-0.018	10,595
47	LTU: Lithuania	-0.035	0.043	-0.034	0.009	0.083	-0.074	17,714
48	AUS: Australia	-0.036	-0.011	-0.043	-0.054	-0.005	-0.049	42,645
49	EST: Estonia	-0.036	0.085	-0.115	-0.030	0.051	-0.081	21,082
50	CRI: Costa Rica	-0.037	-0.013	-0.034	-0.047	0.015	-0.062	12,044

Table continues

Table A2 (continued)

Changes in determinants of manufacturing employment share, 1995-2011 average values, full sample

Countries ranked by average net trade in MVA as share of GDP; shading indicates top and bottom ten economies

	Country	*Average net trade in MVA as share of GDP*	*Change in net trade in MVA as share of GDP*	*Change in spending on MVA as share of GDP*	*Change in production of MVA as share of GDP*	*Change in relative value added per worker in manufacturing*	*Change in manufacturing employment share in total employment*	*Per capita Income (2017 PPP US dollars)*
51	TUN: Tunisia	-0.039	0.022	-0.071	-0.049	-0.012	-0.037	9,329
52	SAU: Saudi Arabia	-0.039	0.008	-0.007	0.001	0.007	-0.006	49,327
53	BGR: Bulgaria	-0.046	0.029	-0.023	0.006	0.056	-0.051	13,886
54	KHM: Cambodia	-0.050	0.082	0.018	0.100	0.005	0.095	1,926
55	HRV: Croatia	-0.052	0.035	-0.088	-0.052	-0.020	-0.032	19,372
56	GRC: Greece	-0.060	0.031	-0.046	-0.016	0.000	-0.016	30,680
57	LVA: Latvia	-0.062	-0.009	-0.061	-0.070	0.033	-0.103	16,359
58	HKG: Hong Kong	-0.065	-0.023	-0.028	-0.051	0.075	-0.126	43,177
59	VNM: Vietnam	-0.083	0.027	0.018	0.044	0.044	0.000	3,440
60	CYP: Cyprus	-0.098	0.008	-0.063	-0.056	0.002	-0.057	30,197
	Average	**-0.003**	**0.019**	**-0.050**	**-0.031**	**0.009**	**-0.040**	**29,563**

MVA = manufacturing value added

Sources: Author's calculations based on Trade in Value-Added (TiVA) database; manufacturing employment shares from the Groningen Growth and Development Center (GGDC) 10-Sector Database (Timmer, de Vries, and de Vries 2015), International Labor Organization Department of Statistics, and The Conference Board International Comparisons of Manufacturing Productivity and Unit Labor Costs database; and income data from The Conference Board Total Economy Database.

Table A3
Changes in determinants of manufacturing employment share, 1995–2011 average values, full sample

Countries ranked by changes in average net trade in MVA as share of GDP; shading indicates top and bottom ten economies

	Country	*Average net trade in MVA as share of GDP*	*Change in net trade in MVA as share of GDP*	*Change in spending on MVA as share of GDP*	*Change in production of MVA as share of GDP*	*Change in relative value added per worker in manufacturing*	*Change in manufacturing employment share in total employment*	*Per capita income (2017 PPP US dollars)*
1	CZE: Czech Republic	0.042	0.088	–0.089	–0.000	0.001	–0.002	26,274
2	EST: Estonia	–0.036	0.085	–0.115	–0.030	0.051	–0.081	21,082
3	MYS: Malaysia	0.044	0.085	–0.091	–0.006	0.045	–0.051	19,947
4	KHM: Cambodia	–0.050	0.082	0.018	0.100	0.005	0.095	1,926
5	HUN: Hungary	0.024	0.082	–0.077	0.005	0.078	–0.074	22,058
6	MLT: Malta	–0.033	0.080	–0.159	–0.079	–0.004	–0.075	28,226
7	KOR: Korea	0.064	0.079	–0.038	0.041	0.095	–0.054	26,005
8	THA: Thailand	0.042	0.078	–0.047	0.031	0.026	0.005	12,189
9	SGP: Singapore	0.091	0.073	–0.114	–0.041	0.053	–0.094	61,365
10	PHL: Philippines	0.013	0.060	–0.079	–0.019	0.001	–0.020	4,911
11	IRL: Ireland	0.116	0.050	–0.073	–0.023	0.039	–0.062	44,738
12	ISR: Israel	0.006	0.043	–0.077	–0.033	0.025	–0.059	29,789
13	LTU: Lithuania	–0.035	0.043	–0.034	0.009	0.083	–0.074	17,714
14	TWN: Taiwan	0.057	0.043	–0.043	–0.000	–0.014	0.013	33,687
15	DEU: Germany	0.049	0.038	–0.031	0.008	0.057	–0.049	41,835
16	AUT: Austria	0.019	0.037	–0.038	–0.001	0.025	–0.027	43,719
17	HRV: Croatia	–0.052	0.035	–0.088	–0.052	–0.020	–0.032	19,372
18	GRC: Greece	–0.060	0.031	–0.046	–0.016	0.000	–0.016	30,680
19	CHL: Chile	0.029	0.030	–0.064	–0.035	0.031	–0.065	17,575
20	ISL: Iceland	–0.014	0.029	–0.052	–0.023	0.015	–0.038	44,738
21	BGR: Bulgaria	–0.046	0.029	–0.023	0.006	0.056	–0.051	13,886
22	CHE: Switzerland	0.020	0.027	–0.033	–0.007	0.051	–0.058	54,126
23	VNM: Vietnam	–0.083	0.027	0.018	0.044	0.044	0.000	3,440
24	ROU: Romania	–0.003	0.024	–0.037	–0.013	0.071	–0.083	13,895
25	TUN: Tunisia	–0.039	0.022	–0.071	–0.049	–0.012	–0.037	9,329

Table continues

Table A3 (continued)
Changes in determinants of manufacturing employment share, 1995–2011 average values, full sample

Countries ranked by changes in average net trade in MVA as share of GDP; shading indicates top and bottom ten economies

	Country	*Average net trade in MVA as share of GDP*	*Change in net trade in MVA as share of GDP*	*Change in spending on MVA as share of GDP*	*Change in production of MVA as share of GDP*	*Change in relative value added per worker in manufacturing*	*Change in manufacturing employment share in total employment*	*Per capita income (2017 PPP US dollars)*
26	SVN: Slovenia	0.022	0.019	−0.075	−0.056	0.053	−0.109	27,483
27	NOR: Norway	−0.023	0.018	−0.060	−0.042	−0.006	−0.036	66,226
28	COL: Colombia	−0.035	0.018	−0.022	−0.005	0.014	−0.018	10,595
29	NLD: Netherlands	0.019	0.017	−0.053	−0.035	0.004	−0.039	47,018
30	**CHN: China**	**0.035**	**0.016**	**−0.044**	**−0.027**	**−0.061**	**0.034**	**6,550**
31	PRT: Portugal	−0.030	0.016	−0.059	−0.043	0.041	−0.084	28,321
32	SVK: Slovak Republic	0.024	0.014	−0.064	−0.050	0.021	−0.071	21,048
33	ARG: Argentina	−0.001	0.010	0.012	0.022	0.051	−0.029	17,251
34	SAU: Saudi Arabia	−0.039	0.008	−0.007	0.001	0.007	−0.006	49,327
35	CYP: Cyprus	−0.098	0.008	−0.063	−0.056	0.002	−0.057	30,197
36	IDN: Indonesia	0.007	0.008	−0.030	−0.022	−0.013	−0.010	41,325
37	JPN: Japan	0.023	0.005	−0.043	−0.039	0.019	−0.057	38,023
38	ESP: Spain	−0.014	0.002	−0.055	−0.053	0.000	−0.053	33,771
39	DNK: Denmark	0.009	0.002	−0.057	−0.055	0.007	−0.062	45,492
40	NZL: New Zealand	−0.012	−0.002	−0.069	−0.070	−0.027	−0.043	32,504
41	IND: India	−0.013	−0.004	−0.039	−0.043	−0.079	0.036	3,408
42	MEX: Mexico	−0.016	−0.005	−0.029	−0.035	−0.028	−0.007	17,482
43	**USA: United States**	**−0.012**	**−0.006**	**−0.039**	**−0.045**	**0.007**	**−0.051**	**51,005**
44	BRA: Brazil	−0.006	−0.006	−0.035	−0.041	−0.017	−0.024	13,430
45	RUS: Russia	0.021	−0.007	−0.036	−0.044	−0.001	−0.043	19,284
46	POL: Poland	−0.008	−0.009	−0.024	−0.032	−0.008	−0.025	17,845
47	LVA: Latvia	−0.062	−0.009	−0.061	−0.070	0.033	−0.103	16,359
48	AUS: Australia	−0.036	−0.011	−0.043	−0.054	−0.005	−0.049	42,645
49	ITA: Italy	0.013	−0.012	−0.040	−0.052	−0.009	−0.043	39,404
50	ZAF: South Africa	−0.022	−0.012	−0.059	−0.071	−0.056	−0.016	11,610

Table continues

Table A3 (continued)

Changes in determinants of manufacturing employment share, 1995–2011 average values, full sample

Countries ranked by changes in average net trade in MVA as share of GDP; shading indicates top and bottom ten economies

	Country	*Average net trade in MVA as share of GDP*	*Change in net trade in MVA as share of GDP*	*Change in spending on MVA as share of GDP*	*Change in production of MVA as share of GDP*	*Change in relative value added per worker in manufacturing*	*Change in manufacturing employment share in total employment*	*Per capita income (2017 PPP US dollars)*
51	CRI: Costa Rica	−0.037	−0.013	−0.034	−0.047	0.015	−0.062	12,044
52	BEL: Belgium	0.011	−0.017	−0.043	−0.059	−0.002	−0.057	41,501
53	GBR: United Kingdom	−0.020	−0.022	−0.074	−0.096	−0.036	−0.060	38,205
54	LUX: Luxembourg	−0.030	−0.022	−0.044	−0.066	−0.004	−0.062	91,204
55	SWE: Sweden	0.037	−0.023	−0.028	−0.051	−0.001	−0.051	42,514
56	HKG: Hong Kong	−0.065	−0.023	−0.028	−0.051	0.075	−0.126	43,177
57	FRA: France	−0.011	−0.024	−0.035	−0.059	−0.005	−0.054	38,451
58	CAN: Canada	−0.009	−0.029	−0.039	−0.068	−0.069	0.001	41,685
59	TUR: Turkey	−0.025	−0.039	−0.056	−0.095	−0.129	0.034	15,371
60	FIN: Finland	0.050	−0.053	−0.018	−0.071	−0.034	−0.037	39,542
	Average	**−0.003**	**0.019**	**−0.050**	**−0.031**	**0.009**	**−0.040**	**29,563**

MVA = manufacturing value added

Sources: Author's calculations based on Trade in Value-Added (TiVA) database; manufacturing employment shares from the Groningen Growth and Development Center (GGDC) 10-Sector Database (Timmer, de Vries, and de Vries 2015), International Labor Organization Department of Statistics, and The Conference Board International Comparisons of Manufacturing Productivity and Unit Labor Costs database; and income data from The Conference Board Total Economy Database.

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