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Premature Deindustrialization

Dani Rodrik

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Dani Rodrik*

School of Social Science
Institute for Advanced Study
Princeton, NJ 08540

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ABSTRACT

I document a significant deindustrialization trend in recent decades, that goes considerably beyond the advanced, post-industrial economies. The hump-shaped relationship between industrialization (measured by employment or output shares) and incomes has shifted downwards and moved closer to the origin. This means countries are running out of industrialization opportunities sooner and at much lower levels of income compared to the experience of early industrializers. Asian countries and manufactures exporters have been largely insulated from those trends, while Latin American countries have been especially hard hit. Advanced economies have lost considerable employment (especially of the low-skill type), but they have done surprisingly well in terms of manufacturing output shares at constant prices. While these trends are not very recent, the evidence suggests both globalization and labor-saving technological progress in manufacturing have been behind these developments. Premature de-industrialization has potentially significant economic and political ramifications, including lower economic growth and democratic failure.

Dani Rodrik
School of Social Science
Institute for Advanced Study
Princeton, NJ 08540

I. Introduction

Our modern world is in many ways the product of industrialization. It was the industrial revolution that enabled sustained productivity growth in Europe and the United States for the first time, resulting in the division of the world economy into rich and poor nations. It was industrialization again that permitted catch-up and convergence with the West by a relatively smaller number of non-Western nations – Japan starting in the late 19th century, South Korea, Taiwan and a few others after the 1960s. For countries that still remain mired in poverty, such as those in sub-Saharan Africa, future economic hopes rest in large part on fostering new manufacturing industries.

Industrialization shaped the modern world in ways beyond economic. It fostered urbanization and the creation of new social categories and habits. It created a working class and a capitalist class, trade unions, and political movements that challenged the dominance of traditional agrarian elites. These social and political developments bequeathed us today's modern states, based on mass franchise and (regulated) market economies.

This is old news for most of the advanced economies of the world, which long ago moved into a new, post-industrial phase of development. These economies have been de-industrializing for decades, a trend that is particularly noticeable when one looks at the employment share of manufacturing. In terms of output, deindustrialization has been less striking and uniform, a pattern that has been obscured by the use often of nominal rather than real values in policy discussions.

For example, in the United States manufacturing industries' share of total employment has steadily fallen since the 1950s, coming down from around a quarter of the workforce to less than a tenth today. Meanwhile, manufacturing value-added (MVA) has remained a constant share of GDP at constant prices – a testament to differentially rapid labor productivity growth in this sector. In Great Britain, to cite an example from the other end of the spectrum, deindustrialization has been both more rapid and thorough. Manufacturing's share of employment has fallen from a third in the 1970s to slightly above 10 percent today, while real MVA (at 2005 prices) has declined from around a quarter of GDP to less than 15 percent.[1] Across the developed world as a whole, real manufacturing output has held its own rather well once we control for changes in income and population.

The term deindustrialization is used today to refer to the experience mainly of these advanced economies. In this paper, I focus on a less noticed trend over the last three decades, which is an even more striking, and puzzling, pattern of deindustrialization in low- and middle-income countries. With some exceptions, confined largely to Asia, developing countries have experienced falling manufacturing shares in both employment and real value added, especially since the 1980s. For the most part, these countries had built up during the 1950s and 1960s modest manufacturing industries behind protective walls and policies of import substitution. These industries have been shrinking significantly since then. Since I control for income and demographic trends in the statistical work, these declines cannot be explained by the fact that manufacturing typically experiences an inverted U-shaped relationship over the course of development. The low-income economies of Sub-Saharan Africa have been affected nearly as much by these trends as the middle-income economies of Latin America – though there was less manufacturing to begin with in the former group of countries.

[1] These numbers come from Timmer, de Vries, and de Vries (2014), which is the principal data source I will use in the paper.

What developing countries are experiencing today is appropriately called "premature deindustrialization," a term that seems to have been first used by Dasgupta and Singh (2006). In most of these countries, manufacturing began to shrink (or is on course for shrinking) at levels of income that are a fraction of those at which the advanced economies started to de-industrialize.[2] These developing countries are turning into service economies without having gone through a proper experience of industrialization.

The conventional explanation for employment deindustrialization is based on differential rates of technological progress (Lawrence and Edwards, 2013). Typically, manufacturing experiences more rapid productivity growth than the rest of the economy. This results in a reduction in the share of the economy's labor employed by manufacturing when the elasticity of substitution between manufacturing and other sectors is less than unity ($\sigma < 1$). The output share of manufacturing, however, moves in the opposite direction (assuming, again, differential technical progress in manufacturing). To get both employment and output deindustrialization, we need to make additional assumptions: that the trade deficit in manufactures worsens or that there is a secular demand shift away from manufactures. (The math is worked out in section VII of the paper.) Since the more pronounced story in the advanced countries is employment rather than output deindustrialization, a technology-based story does reasonably well to account for the patterns there. The evidence also suggests that a particular type of technological progress, of the unskilled-labor saving type, is responsible for the bulk of the labor displacement from manufacturing (section V).

[2] See also Amirapu and Subramanian (2015), who document premature deindustrialization within Indian states.

For developing countries, however, it is less evident that the technology argument applies in quite the same way. Crucially, the mechanism briefly described above relies on adjustments in domestic relative prices. Differential technological progress in manufacturing depresses the relative price of manufacturing. In the case where $\sigma < 1$, this decline is sufficiently large that it ensures demand for labor in manufacturing is lower in the new equilibrium. The big difference in developing countries is that they are small in world markets for manufactures, where they are essentially price takers. In the limit, when relative prices are fixed, more rapid productivity growth in domestic manufacturing actually produces industrialization, not deindustrialization (in terms of both employment and output). So the culprit for deindustrialization in developing countries must be found elsewhere.

The obvious alternative is trade and globalization. A plausible story would be the following. As developing countries opened up to trade, their manufacturing sectors were hit by a double whammy. Those without a strong comparative advantage in manufacturing became net importers of manufacturing, reversing a long process of import-substitution. In addition, developing countries "imported" deindustrialization from the advanced countries, because they became exposed to the relative price trends produced in the advanced economies. The decline in the relative price of manufacturing in the advanced countries put a squeeze on manufacturing everywhere, including the countries that may not have experienced much technological progress. This account is consistent with the strong reduction in both employment and output shares in developing countries (especially those that do not specialize in manufactures).

In sum, while technological progress is no doubt a large part of the story behind employment deindustrialization in the advanced countries, in the developing countries trade and globalization likely played a comparatively bigger role.

Deindustrialization has been long been a concern in rich nations, where it is associated with the loss of good jobs, rising inequality, and decline in innovation capacity. For all these and many other reasons, it should be a much bigger problem for developing countries. Premature deindustrialization has serious consequences, both economic and political.

On the economic front, it reduces the economic growth potential and the possibilities for convergence with income levels of the advanced economies. Formal manufacturing tends to be technologically the most dynamic sector, exhibiting unconditional convergence (Rodrik 2013). Deindustrialization removes the main channel through which rapid growth has taken place in the past. On the political front, premature deindustrialization makes democratization less likely and more fragile. Mass political parties have traditionally been a by-product of industrialization. Without the discipline and coordination that an organized labor force provides, the bargains between the elite and non-elite needed for democratic transitions and consolidation are less likely to take place. I will elaborate on these questions in the final section of the paper (section VIII).

II. The inverse U-shaped curve in manufacturing: data, measures and trends

There is a variety of industrialization/deindustrialization measures in the literature. Some studies focus on manufacturing employment (as a share of total employment), while others use manufacturing output (MVA as a share of GDP). MVA shares in turn can be calculated at constant or current prices. Different measures yield different trends and results. For completeness I will use all three measures in this paper, denoting them as *manemp* (manufacturing employment share), *nommva* (MVA share at current prices), and *realmva* (MVA share at constant prices). I will focus in later sections on the real magnitudes *manemp* and *realmva* as it is not clear that changes in *nommvaI*, on their own, have any economic significance.

My baseline results are based on data from the Groningen Growth and Development Center (GGDC, Timmer, de Vries, and de Vries, 2014). These data span the period between the late 1940s/early 1950s through the early 2010s and cover 42 countries, both developed and developing. The major economies in Latin America, Asia, and sub-Saharan Africa are included alongside advanced economies. (For more details on the data set, see the Appendix.) Constant-price series are at 2005 prices.[3] For robustness checks and further analysis, I will supplement this data with two other sources. The Socio-economic Accounts of the World Input-Output Database (Timmer, 2012) provide a disaggregation of sectoral employment by three skill categories for 40, mainly advanced economies. And researchers at the Asian Development Bank have recently put together manufacturing employment and output series for a much larger group of countries using a variety of sources, including the ILO, U.N., and World Bank, though these data start from 1970 at the earliest (Felipe, Mehta, and Rhee, 2014).[4] I will combine these various sources on manufacturing with income and population data from Maddison (2009),

[3] The only exception is West Germany, for which there are no data after 1991 and constant-price series are at 1991 prices. Since all my regressions include country fixed effects, this difference in base year will be absorbed into the fixed effect for the country.

[4] I am grateful to Jesus Felipe for making these data available to me.

updated using the World Bank's World Development Indicators. The income figures are at 1990 international dollars.

Figure 1 shows the simulated relationship between the three measures of industrialization and income per capita. The figure is based on a quadratic estimation using country fixed effects and controlling for population size and period dummies. The curves are drawn for a "representative" country with the median population in the sample (of around 27 million). Period and country effects are all averaged to obtain a typical relationship for the sample and full time span covered. Both of the quadratic terms are statistically highly significant in all three manufacturing indicators (see regressions in Table 1, cols. (1)-(3) for specifications and results). The share of manufacturing first rises and then tends to fall over the course of development.

However, the turning points differ significantly. In particular, *manemp* peaks much earlier than *realmva*. The employment share of manufacturing starts to fall past an income level of around $5,500 (in 1990 US$), after having reached an estimated maximum close to 20 percent. Manufacturing output at constant prices peaks very late in the development process. The estimated income level at which it begins to fall is in fact higher than any of the incomes observed in the data set (above $70,000 in 1990 US$). As we shall see in section VI, post-1990 data indicate a much earlier decline, at less than half the pre-1990 income level. (Note that the peak shares themselves are is less meaningful in the case of output, as they depend on the base year selected for converting current prices to constant prices.)

The literature focuses on two possible explanations for why manufacturing's share eventually falls (Ngai and Pissarides, 2004; Buera and Kaboski, 2009; Foellmi and Zweimuller, 2008; Lawrence and Edwards, 2013; Nickell, Redding, and Swaffield, 2008). One is demand-based, and relies on a shift in consumption preferences away from goods and towards services. This on its own would not produce the timing difference in peaks, as a pure demand shift would have similar effects on manufacturing quantities (output and employment). The second explanation is technological, and relies on more rapid productivity growth in manufacturing than in the rest of the economy. As long as the elasticity of substitution is less than one, this produces a decline in the share of manufacturing employment, but not in the share of manufacturing output. We need a combination of supply- and demand-side reasons to explain both the decline in manufacturing's share and the later turnaround in output compared to employment. An added complication is that the effects of technology and demand shocks depend crucially on whether the economy is open to trade or not (Matsuyama, 2009). For the moment, I leave these questions aside. I will develop the analytical results linking technology, demand, and trade to deindustrialization in section VII.

As Figure 1 shows, *nommva* also peaks much earlier than *realmva*, though not so early as *manemp*. The explanation for this difference has to do with relative price changes over the course of development. The relative price of manufacturing tends to decline as countries get richer, tending to depress the share of MVA at current prices. Figure 2 displays the pattern for four of the countries in our sample. The relative price of manufacturing has more than halved in the United States since the early 1960s. Great Britain has experienced a somewhat smaller decline. In South Korea, which has grown extremely rapidly, manufacturing's relative price has come down by a whopping 250 percent. In Mexico, meanwhile, relative prices have remained more or less flat.

These trends are also consistent broadly with a technology-based explanation for the manufacturing hump. More rapid productivity growth in manufacturing reduces the relative price of manufactured goods through standard supply-demand channels. This in turn causes *nommva* to reach an earlier peak than *realmva* as shown in Figure 1.

III. Deindustrialization over time

As Figure 1 makes clear, deindustrialization is the common fate of countries that are growing. My interest here is to check whether deindustrialization has been more rapid in recent periods. For this purpose, I use a basic specification that controls for the effect of demographic and income trends (with quadratic terms for log population and GDP per capita) as well as country fixed effects. Country fixed-effects allow me to take into account any country-specific features (geography, endowments, history) that create a difference in the baseline conditions for manufacturing industry across different nations. My main focus is on trends over time, which are captured using period dummies for the 1960s, 1970s, 1980s, 1990s, and post-2000 years. (The post-2000 dummy covers the period 2000 through the final year in the sample, 2012.) The estimated coefficients on these dummies allow us to gauge the effects of common shocks felt by manufacturing in each of the time periods, relative to the excluded, pre-1960 years.

Table 1 shows two versions of the baseline results for each of our three measures of manufacturing industry, *manemp*, *nommva*, and *reamva*. Columns (1)-(3) are restricted to a common sample so that the results are directly comparable across the measures. Columns (4)-

(6) employ the largest sample possible. The common samples have 1,995 observations, while the others range from 2,128 to 2,302.

The results for *manemp* and *nonmva* are very similar across the two specifications. In both cases, we find a sizable and significant negative trend over time, larger for *manemp* than for *nonmva*. Using the estimates from the common sample, the average country in our sample had a level of *manemp* that stood 11.7 percentage points lower than in the 1950s, and 8.8 percentage points (0.117 - 0.029) lower than in the 1960s. The corresponding reductions for *nommva* are 8.5 and 7.4 percentage points, respectively.

The declines in *realmva* are smaller, and in the common sample show up significantly only for the post-1990 period. Depending on whether we use the common or largest sample, the post-2000 negative shock is 3.5-5.9 percentage points relative to the pre-1960 period.

Figures 3a, 3b and 3c provide a visual sense of the results. They plot the estimated coefficients for the period dummies, along with a 95% confidence interval around them. The figures show a steady decrease over time in manufacturing shares after controlling for income and demographic trends. The decline is most dramatic for employment; it is less pronounced, but still evident after 1990 for real MVA. Manufacturing employment and activity have gone missing in a big way.

The samples in Table 1 provide good coverage across developed and developing regions, but the number of countries is limited to 42. To make sure that the results are representative of developments other countries as well, I turn to the ADB dataset which includes a much larger group of countries (up to 87 for *manemp* and 124 for *nommva* and *realmva*). The limitation in this case is that coverage begins in 1970 (Felipe, Mehta, and Rhee, 2014). So I include dummies for the 1980s, 1990s, and post-2000 years only, with the 1970s as the excluded period. Note that the ADB data set provides two alternative series for MVA, one using U.N. sources and the other using World Bank data. I run regressions with both. The results are presented in Table 2, and are quite similar to the previous ones.

Once again, the strongest downward trend over time is for *manemp*, a reduction of 6.5 percentage points compared to the 1970s. (This matches up well with the corresponding number of 7.3 percentage points (0.117 – 0.044) from Table 1.) The decline in *nommva* is 3.0 or 5.2 points over the 1970s, depending on which series is used. Finally, the decline for *realmva* is 0.9-2.4 points.

IV. Deindustrialization in differenty country groups

We can obtain some insight about the causes of these trends by looking at deindustrialization patterns in different country groups separately. This is done in Tables 3, 4, and 5, for *manemp*, *nommva*, and *realmva*, respectively. In each table, the baseline regression is run for the following groups: (a) developed countries; (b) Latin American countries; (c) Asian countries; (d) sub-Saharan African countries; and (e) sub-Saharan African countries excluding Mauritius. Note that since there are no data for the 1950s for sub-Saharan Africa, the period dummies for that region start from the 1970s.

The results point to important regional differences. First, even though developed countries have experienced big losses in *manemp* and *nommva*, they have done surprisingly well in *realmva*. The estimated coefficients for the period dummies for *realmva* are in fact positive (but statistically insignificant) for the developed countries in recent decades (Table 5).

This is to be compared with significant negative estimates for Latin America and Africa (once Mauritius is excluded). To be clear, this does not mean that the rich nations have not experienced reductions in real manufacturing output shares in GDP. It simply means that their experience can be well explained by income and demographic trends, with little unexplained (output) deindustrialization left to account for in recent decades.

The results for Asia are even more striking. Asia is the only region for which recent period dummies are not negative for *manemp* (once again, if Mauritius is excluded from the sub-Saharan sample). And the period estimates for *realmva* are actually positive <u>and</u> statistically significant. These results suggest that Asia has not only bucked the global trend in manufacturing employment, it has managed to maintain stronger manufacturing performance than would be expected on the basis of its income and demography.

The region that has done the worst is Latin America, which has the most negative period effects for *manemp* and *realmva*. The effects for *nommva* are not as pronounced, suggesting that relative prices have not moved there against manufacturing nearly as much as in other regions. Finally, the estimates for sub-Saharan Africa depend heavily on whether Mauritius – a strong manufactures exporter – is included in the sample or not. Without Mauritius in the sample, sub-Saharan African countries emerge as large losers on all three measures of industrialization. Their output deindustrialization in recent decades looks especially dramatic in light of the strong showing for *realmava* in the 1970s (captured by a positive and significant coefficient for *dum1970s* in Table 5). Since sub-Saharan countries are still very poor and widely regarded as the next frontier of labor-intensive export-oriented manufacturing, these are disappointing findings.

The results with respect to Asia and the difference that the inclusion of Mauritius makes to the African performance strongly suggests that these variations in outcomes are related to patterns of comparative advantage, and, in particular, how well or poorly countries have done in global trade in manufactures. To test this idea, I divide our sample of countries into two groups: (a) manufactures exporters, and (b) non-manufactures exporters. I use two criteria to split the sample based on the composition of trade. The first classifies countries as manufactures exporters if the share of manufactures in exports exceeds 75 percent, the second if the share of manufactures in exports exceeds the corresponding share in imports.

The results, shown in Table 6, support the comparative-advantage hypothesis. Regardless of the criterion used, the employment loss in manufactures exporters is smaller. Whereas the period effects for *realmva* are strongly negative and significant for manufactures non-exporters, they change sign and are occasionally significant for manufactures exporters. Regressions using ADB data, with broader country coverage, produce very similar results (Table 7). The period effects for *manemp* are not distinguishable between the two groups with this sample, but the *realmva* results show even stronger asymmetries.

In sum, the geographical patterns of deindustrialization seem closely linked to globalization. Countries with a strong comparative advantage in manufactures have managed to avoid declines in real MVA shares, and employment losses, where they have occurred, have been less severe. Interestingly, on the output side it appears that the main brunt of globalization and the rise of Asian exporters has been borne by other developing countries, rather than the advanced economies. What is particularly striking is the magnitude of adverse employment effects in Latin America, which is even larger than in developed economies.

V. Employment deindustrialization by skill groups

As the results above make clear, deindustrialization shows up most clearly and in its strongest form in employment. The only countries that have managed to avoid a steady decline in manufacturing employment in recent decades (as a share of total employment) are those with a strong comparative advantage in manufacturing. The Socio Economic Accounts of the World Input-Output Database (WIOD, Timmer 2012) allow us to dig a bit deeper on the employment impacts. These data provide a breakdown of manufacturing employment by three worker types: low-skill, medium-skill, and high-skill. The data span the years 1995-2009 and include 40 countries, with the coverage biased heavily towards Europe. (For the list of countries included see the Appendix.)

I run essentially the same regression as before, with two differences. First, the dependent variable is manufacturing's share of the economy's total employment of workers of a particular skill type. Second, since the data start from 1995, I use annual dummies rather than decade dummies. (As before, there is a full set of country fixed effects.) This gives us three regressions, one for each skill type.

Figure 4 plots the estimated coefficients for the year dummies. The results are quite striking, in that virtually the entire reduction over time in employment comes in the low-skill category. Manufacturing's share of low-skill employment has come down by 4 percentage points between 1995 and 2009, a decline that is statistically highly significant. The decline in medium-skill employment is miniscule by comparison, while manufacturing's share of high-skill employment has actually slightly increased over the same period. The chart underscores in a dramatic fashion that it is low-skill workers who have borne the lion's share of the impact of recent changes in trade and technology on manufacturing.

VI. Premature deindustrialization

Our results so far suggest that late industrializers will reach peak levels of industrialization, as measured by *manemp* and *realmva*, that are quite a bit lower than those experienced by early industrializers. Let us denote these peak levels by *manemp** and *realmva**. There is evidence that suggests these peak levels are reached at lower levels of income as well. Denote that level of income by *y**. Our baseline regressions capture the downward shift in the manufacturing hump over time, but not the possibility that the curve may be moving closer to the origin as well. Figure 5 suggests that *manemp** and *y** are in fact both lower for more recent industrializers. Compare the two sets of countries at the opposite ends of the chart. Industrialization peaked in Western European countries such as Britain, Sweden, and Italy at income levels of around $14,000 (in 1990 dollars). India and many sub-Saharan African countries appear to have reached their peak manufacturing employment shares at income levels of $700.[5] (I have determined these peak levels by looking at each country individually and identifying visually the year at which *manemp* begins to decline.)

To check this more systematically, I run regressions that drop the period dummies and interact the income and income squared terms with a dummy for the post-1990 period. Using the 1990 year as a break-point is somewhat arbitrary. But it ensures a sufficient number of observations on either side, and is also useful as a demarcation of the period in which

[5] For a similar chart, see Felipe et al., 2014.

globalization gathered speed. The results are shown in Table 8. The estimated coefficients on both interaction terms are statistically highly significant for *manemp* and *realmva* alike. Moreover, the signs confirm the pattern noted in Figure 5.

Figures 6 and 7 plot the simulated industrialization levels against income for pre- and post-1990, based on the estimates in Table 8. We can see how the hump-shaped curves have moved closer to the origin in the latter period, in a particularly noticeably way for employment.[6] Using the same estimates, we can calculate *manemp** and *realmva**, and the corresponding *y** for each sub-period. These are displayed in Table 9 and show dramatic differences. To summarize, since 1990 countries have reached peak manufacturing employment at incomes that are around <u>a third</u> of the levels experienced before 1990. For MVA at constant prices, the corresponding ratio is <u>less than a half</u>.

VII. Some analytics

To see how demand, technology, and trade shape the size of the manufacturing sector, I consider a simple two-sector model. Let the economy be divided into manufacturing (*m*) and non-manufacturing (*n*), with a constant labor force fixed at unity. The share of employment in the manufacturing sector (*manemp*) is denoted by α. Production functions in the two sectors exhibits diminishing marginal returns to labor and are written as follows:

(1) $$q_m^s = \theta_m \alpha^{\beta_m}$$

(2) $$q_n^s = \theta_n (1-\alpha)^{\beta_n},$$

[6] Amirapu and Subramanian (2015) present similar charts, using <u>industrial</u> employment data from the World Development Indicators.

where q_m^s and q_n^s are the quantities supplied of manufactures and non-manufactures, respectively, θ_m and θ_n are parameters capturing the productivity of the two sectors, and β_m and β_n are technological constants between 0 and 1.

It is convenient to represent the demand side in rates of change form, with a "hat" above a variable denoting proportional changes ($\hat{y} = dy/y$):

(3) $$\hat{q}_m^d - \hat{q}_n^d = -\sigma(\hat{p}_m - \hat{p}_n),$$

where σ is the elasticity of substitution in consumption between the two goods. There are two goods-market clearing equations:

(4) $$q_m^d + x = q_m^s$$

(5) $$q_n^d = q_n^s,$$

where x stands for the net exports of the manufactured good. (For notational simplicity, I assume balanced trade in non-manufactures.) Labor is fully employed and mobile between the two sectors. This gives us our final equation, which is the labor-market equilibrium equation:

(6) $$\beta_m p_m \theta_m \alpha^{\beta_m - 1} = \beta_n p_n \theta_n (1-\alpha)^{\beta_n - 1}$$

This equation equates the value marginal product of labor in the two sectors.

Since we can only determine relative prices, let's take the non-manufactured good to be the numeraire, fixing p_n at unity. We are left with seven endogenous variables: $\alpha, q_n^d, q_n^s, q_m^d, q_m^s, p_m$ and x. We would need an additional, global market-clearing equation to determine p_m and x simultaneously. This in turn requires modeling the rest of the world as well. Here I will take a short-cut and make one of two extreme assumptions. In one case, prices are determined endogenously by developments in the home economy and net trade flows are exogenous. In the second case, the economy is sufficiently small that it remains a price take in world markets (so that x is endogenous and p_m is a parameter). These two characterizations are meant to capture the situations in the large developed and the developing countries, respectively.

Consider first the advanced economy case. Doing the comparative statics for the employment share of manufacturing, we get

(7) $$d\alpha = \psi \left[\left(\frac{\sigma-\lambda}{\sigma}\right) \hat{\theta}_m - \left(\frac{\sigma-1}{\sigma}\right) \hat{\theta}_n + \frac{1}{\sigma} \frac{dx}{q_m^d} \right],$$

where

$$\psi = \left[\frac{1}{\alpha}(1-\beta_m) + \frac{1}{1-\alpha}(1-\beta_n) + \frac{1}{\sigma}\left(\frac{\lambda}{\alpha}\beta_m + \frac{1}{1-\alpha}\beta_n\right) \right]^{-1} > 0$$

and

$$\lambda = \frac{q_m^s}{q_m^d}.$$

A lower trade surplus, or bigger trade deficit, in manufacturing (dx < 0) results in a smaller employment share in manufacturing, which is not surprising. Note that a reduction in x is formally analogous to an adverse demand shock for manufactures, such as a secular shift in demand towards services and other non-manufactures. In both cases, the manufacturing sector shrinks.

The relationship between technological progress ($\hat{\theta}_m, \hat{\theta}_n$) and α, on the other hand, depends critically on the size of the elasticity of substitution in demand between manufactures and non-manufactures. Suppose for the moment that net trade in manufactures is small so that $\lambda \approx 1$. Then if demand is inelastic ($\sigma < 1$), α is decreasing in technological progress in manufactures ($\hat{\theta}_m$) and increasing in technological progress in non-manufactures ($\hat{\theta}_n$). More rapid TFP growth in manufacturing, which is the usual case, results in employment deindustrialization. Intuitively, the technological progress-induced reduction in the relative price of manufacturing does not spur demand for manufactures sufficiently, so that the net result is a squeeze in manufactures employment. These results are reversed when demand is elastic ($\sigma > 1$). This is the same as the finding in Ngai and Pissarides (2004).

The effect of technological progress in manufacturing, however, is also mediated through λ, the ratio of supply to demand in manufacturing. This is something that has not been emphasized in the earlier literature, which typically assumes a closed economy. Consider the case where a country is a large net importer of manufactures (λ <<1). As can be seen from (7), as long as $\sigma - \lambda$ > 0 the coefficient that multiplies $\hat{\theta}_m$ is positive. This is possible even when $\sigma < 1$ and demand for manufactures is inelastic. So we have a reversal of the result that inelastic demand and rapid technological progress in manufacturing produce (employment) deindustrialization.

The intuition behind this is as follows. The lower the share of domestic supply in total consumption, the smaller the effect of TFP in domestic manufactures on relative prices. When manufacturing experiences rapid productivity growth, it experiences less decline in relative prices (compared to a country where domestic supply is a large share of domestic consumption). Consequently, domestic output and employment are larger in equilibrium. In the limit, when technological progress has no effect on domestic relative prices, manufacturing employment is always boosted by TFP growth in manufactures. This is indeed the case in our other benchmark example, a small open economy which takes its relative prices from world markets.

Before we turn to that case, however, let us also look at the output share of manufacturing and how it is affected by trade and technology. Denote the real value added share of manufacturing (*realmva*) by α_q:

$$\alpha_q = \frac{q_m^s}{q_m^s + q_n^s}\,.$$

We can now relate output-deindustrialization ($d\alpha_q$) to employment deindustrialization ($d\alpha$) as follows:

(8) $$d\alpha_q = \alpha_q(1-\alpha_q)\left[\hat{\theta}_m - \hat{\theta}_n + \left(\frac{1}{\alpha}\beta_m + \frac{1}{1-\alpha}\beta_n\right)d\alpha\right].$$

This shows that when the main shock comes from trade or demand (with $\hat{\theta}_m = \hat{\theta}_n = 0$), the two measures of industrialization always move in the same way. However, when employment deindustrialization is due to differential TFP growth in manufacturing ($\hat{\theta}_m - \hat{\theta}_n > 0$), it is possible for the output share of manufacturing to move very little, or even to increase.

To see this in greater detail, consider the case where the economy does not trade at all so that λ = 1. In this case, the output share of manufacturing must in fact rise. We can read this off readily from the demand-side relationship (3). Differential productivity growth in manufacturing depresses the relative price of manufacturing, and this implies $\hat{q}_m^d = \hat{q}_m^s > \hat{q}_n^d = \hat{q}_n^s$, and therefore $d\alpha_q$> 0. Or, substituting (7) into (8) and solving, we get:

$$d\alpha_q = \alpha_q(1-\alpha_q)\left\{\frac{\left(\frac{\sigma}{\sigma-1}\right)}{\left(\frac{\sigma}{\sigma-1}\right)-[(1-\alpha)\beta_m+\alpha\beta_n]}\right\}(\hat{\theta}_m - \hat{\theta}_n).$$

Since the term in curly brackets is positive when σ < 1, α_q must move in the same direction as differential productivity growth in manufacturing. This establishes that in an economy where trade plays a small role, rapid technological progress in manufacturing produces employment deindustrialization, but not output deindustrialization.

Let us look now at the small-open economy case. For this case, we treat price changes parametrically and take x to be endogenous. The comparative statics yields:

$$d\alpha = \left[\frac{1}{\alpha}(1-\beta_m) + \frac{1}{1-\alpha}(1-\beta_n)\right]^{-1}\left[\hat{p}_m + \hat{\theta}_m - \hat{\theta}_n\right]. \quad (9)$$

Technological progress in manufacturing now has an unambiguously positive effect on α. Technological progress in non-manufacturing has an unambiguously negative effect. And an increase in the relative price of manufacturing works just like technological progress in manufacturing. Moreover, the result does not depend on σ or its magnitude, as trade has the effect of de-linking the supply side of the economy from the demand side. For the same reason, adverse domestic demand shocks would not produce deindustrialization in the small open economy; domestic producers can sell the surplus output on world markets. As Matsuyama (2009) has previously emphasized, the relationship between productivity growth and industrialization depends crucially on whether we treat prices to be determined domestically or in the global economy.

This last set of results is important in interpreting the experience of developing countries that have experienced rapid deindustrialization. These countries tend to be small in global markets for manufacturing, so we can take treat them as price takers. What equation (9) shows is that employment deindustrialization in those countries cannot have been the consequence of differentially rapid TFP growth in manufacturing at home. That kind of technological progress would have fostered industrialization, rather than the reverse. In this respect, developing countries are quite different from the advanced countries where there is considerable evidence technological progress was the culprit.

As price takers, however, these developing countries may have "imported" deindustrialization from the abroad. As (9) shows, a decline in the relative price of manufactures on world markets ($\hat{p}_m$< 0) would have had the same effect as technological regress in manufacturing. Even with more rapid TFP growth in manufacturing, these countries would find themselves de-industrializing in employment terms.

Putting it differently, employment industrialization in the developing world requires more than differentially rapid TFP growth in manufacturing. It requires that the productivity growth differential between manufacturing and non-manufacturing also exceed the decline in manufactures' relative prices on world markets. Our empirical results suggest that only very few developing countries managed this feat consistently.

The configuration of analytical results under different assumptions about economic closure and the nature of the shocks is summarized in the table below.

Effects of trade, technology, and demand on different measures of industrialization

A. "Closed" economy (with σ < 1)

Effect on:	Technology shock: $\hat{\theta}_m - \hat{\theta}_n > 0$	Trade shock: $dx < 0$	Adverse domestic demand shock on manufacturing
manemp ($d\alpha$)	-	-	-
realmva ($d\alpha_q$)	+	-	-

B. Small open economy

Effect on:	Technology shock: $\hat{\theta}_m - \hat{\theta}_n > 0$	External price shock: $\hat{p}_m < 0$	Adverse domestic demand shock on manufacturing
manemp ($d\alpha$)	+	-	0
realmva ($d\alpha_q$)	+	-	0

VIII. Concluding remarks: economic and political consequences

Premature deindustrialization is not good news for developing nations. It blocks off the main avenue of rapid economic convergence in low-income settings, the shift of workers from the countryside to urban factories where their productivity tends to be much higher. Industrialization contributes to growth both because of this reallocation effect and because manufacturing tends to experience relatively stronger productivity growth over the medium to longer term. In fact, organized, formal manufacturing appears to exhibit unconditional convergence (Rodrik 2013), which makes it special and an engine of growth. Since low-income countries tend to start with small manufacturing sectors, the dynamic within manufacturing initially plays a small role, overshadowed by the reallocation effect. But over time, the within-manufacturing effect becomes a more potent force as the manufacturing sector becomes larger. Premature deindustrialization throws sand in the wheels of both engines (Rodrik 2013, 2014).

The consequences are already visible in the developing world. In Latin America, as manufacturing has shrunk informality has grown and economy-wide productivity has suffered. In Africa, urban migrants are crowding into petty services instead of manufacturing, and despite growing Chinese investment there are as yet few signs of a real resurgence in industry. Where growth occurs, it is driven largely by capital inflows, transfers, or commodity booms, raising questions about its sustainability.

In the absence of sizable manufacturing industries, these economies will need to discover new growth models. One possibility is services-led growth. Many services, such as IT and finance, are high productivity and tradable, and could play the escalator role that manufacturing has traditionally played. However, these service industries are typically highly skill-intensive, and do not have the capacity to absorb – as manufacturing did – the type of labor that low- and middle-income economies have in abundance. The bulk of other services suffer from two shortcomings. Either they are technologically not very dynamic. Or they are non-tradable, which means that their ability to expand rapidly is constrained by incomes (and hence productivity) in the rest of the economy.

The political consequences of premature deindustrialization are more subtle, but could be even more significant. Historically, industrialization played a foundational role in Europe and North America in creating modern states and democratic politics. Its relative absence in today's developing societies could well be the source of political instability, fragile states, and illiberal politics. I am on speculative grounds here, but it is worth considering some of the possibilities.

Political stability, as Huntington (1968) explained long ago, rests on a shaky balance between political participation and political institutionalization. When political institutions are weak, mass politics is a recipe for instability. Industrialization fosters political participation, but the development of class-based solidarity and the rise of labor-based political movements -- trade unions and political parties -- provide a countervailing stabilizing force. So early democracies in Western Europe eventually developed the political institutions that served to channel – and therefore diffuse – the demands of the working class.[7] Through its political representatives, the labor movement was able to negotiate with the new elites – the capitalist class – and reach political bargains that gave them a stake in the system. The result was social

[7] As Scott (2014, xviii) puts it, "Mass defiance, precisely because it threatens the institutional order, gives rise to organizations that try to channel that defiance into the flow of normal politics, where it can be contained."

democracy, with its social insurance programs, transfers, and regulations, and the eventual morphing of the working class into a middle class.

What enables such bargains to be struck, and prevents political instability, is coordination among the elites and non-elites. In the Acemoglu-Robinson (2009) account of how democracy comes about, for example, the elites offer non-elites political rights in return for the latter's promise not to revolt. This presumes that the parties to the bargain can present a unified front and make commitments on behalf of large numbers of political actors. Class-based politics certainly facilitates such coordination. Working-class solidarity enables discipline, organization, and convergence around a common list of political demands.

Politics looks very different when urban production is organized largely around informality, a diffuse set of small enterprises and petty services. Common interests among the non-elite are harder to define, political organization faces greater obstacles, and personalistic or ethnic identities dominate over class solidarity. Elites do not face political actors that can claim to represent the non-elites and make binding commitments on their behalf. Moreover, elites may prefer – and have the ability – to divide and rule, pursuing populism and patronage politics, and playing one set of non-elites against another.[8] Furthermore, elites themselves may be much more divided, based on clans or other loyalties. Consequently, grand political bargains become less likely. Political institutions remain fragile and personalized.

In short, premature deindustrialization may hamper both the development of middle-class values and the emergence of political settlements that allowed the consolidation of democracy in today's advanced countries.

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[8] See Makatos and Xefteris (2014) for a model in which the rich exploits the heterogeneity among the non-rich to sustain policies that are biased towards their own interests.

On the face of it, this conclusion appears to be contradicted by the spread of democracy around the world. More countries in the developing world are formally democratic today than has ever been the case. However, upon closer look, political life in many if not most of these countries is marred by civil rights abuses and popular discontent that periodically erupts in protests and riots. Governments pursue an illiberal brand of politics and are democratic only in name. For the most part, democracy in the developing world remains either a within-elite affair or takes the form of populism. Such political systems have been described and analyzed by political scientists under various headings such as "illiberal democracy" (Zakaria, 2007), "competitive authoritarianisms" (Levitsky and Way, 2010), and other types of "hybrid regimes" (Karl, 1995).[9] Diamond (2015) talks of a "democratic recession" around the world.

Whether these syndromes of democratic malfunction are really linked with the trends of premature industrialization I have identified in this paper remains to be demonstrated. The arguments I have just made are no more than hypotheses. But they seem sufficiently plausible to warrant further scrutiny.

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[9] We can see the disappointment in the tenor of articles published in the Journal of Democracy over the course of its existence. When the journal was inaugurated in 1990, the editors' introduction in the first issue was "animated by the view that democracy was experiencing a 'remarkable worldwide resurgence.'" Twenty-five year later, the journal's anniversary issue in January 2015 carried a symposium titled "Is Democracy in Decline?" (Plattner, 2015).

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APPENDIX

A. Country and variable coverage in the GGDC 10-Sector Database

Acronym	Country	Value Added in current prices	Value Added in constant prices	Employment by sector
sub-Saharan Africa				
BWA	Botswana	1964-2010	1964-2010	1964-2010
ETH	Ethiopia	1961-2010	1961-2010	1961-2010
GHA	Ghana	1960-2010	1960-2010	1960-2010
KEN	Kenya	1960-2010	1964-2010	1969-2010
MWI	Malawi	1960-2010	1966-2010	1966-2010
MUS	Mauritius	1960-2010	1970-2010	1970-2010
NGA	Nigeria	1960-2010	1960-2010	1960-2011
NGA(alt)	Nigeria (2014 GDP revision)	2010-2013	2010-2013 (in 2010 prices)	
SEN	Senegal	1960-2010	1970-2010	1970-2010
ZAF	South Africa	1960-2010	1960-2010	1960-2010
TZA	Tanzania	1960-2010	1960-2010	1960-2010
ZMB	Zambia	1960-2010	1965-2010	1965-2010
North Africa				
EGY	Egypt	1960-2013	1960-2012	1960-2012
MOR	Morocco	1970-2012	1960-2012	1960-2012
Asia				
CHN	China	1952-2011	1952-2010	1952-2011
HKG	Hong Kong	1970-2011	1974-2011	1974-2011
IND	India	1950-2012	1950-2012	1960-2010
IDN	Indonesia	1966-2012	1960-2012	1961-2012
JPN	Japan	1953-2011	1953-2011	1953-2012
KOR	South Korea	1953-2011	1953-2011	1963-2011
MYS	Malaysia	1970-2011	1970-2011	1975-2011
PHL	Philippines	1971-2012	1971-2012	1971-2012
SGP	Singapore	1970-2012	1960-2012	1970-2011
TWN	Taiwan	1951-2012	1961-2012	1963-2012
THA	Thailand	1951-2011	1951-2011	1960-2011
Latin America				

ARG	Argentina	1950-2011	1950-2011	1950-2011
BOL	Bolivia	1958-2011	1950-2011	1950-2010
BRA	Brazil	1990-2011	1950-2011	1950-2011
CHL	Chile	1950-2011	1950-2011	1950-2012
COL	Colombia	1950-2011	1950-2011	1950-2010
CRI	Costa Rica	1950-2011	1950-2011	1950-2011
MEX	Mexico	1950-2011	1950-2011	1950-2012
PER	Peru	1950-2011	1950-2011	1960-2011
VEN	Venezuela	1960-2012	1950-2012	1950-2011
North America				
USA	United States of America	1947-2010	1947-2010	1950-2010
Europe				
DEW	West Germany	1968-1991	1950-1991 (1991 prices)	1950-1991
DNK	Denmark	1970-2011	1947-2009	1948-2011
ESP	Spain	1970-2011	1947-2009	1950-2011
FRA	France	1970-2011	1950-2009	1950-2011
GBR	United Kingdom	1960-2011	1949-2009	1948-2011
ITA	Italy	1970-2011	1951-2009	1951-2011
NLD	The Netherlands	1970-2011	1949-2009	1950-2011
SWE	Sweden	1970-2011	1950-2009	1950-2011

Source: Timmer et al. (2014). See http://www.rug.nl/research/ggdc/data/10-sector-database.

B. Countries included in the Socioeconomic Accounts of the World Input-Output Database (WIOD).

Austria, Germany, Netherlands, Canada, China, Belgium, Greece, Poland, United States, India, Bulgaria, Hungary, Portugal, Japan, Cyprus, Ireland, Romania, South Korea, Czech Republic, Italy, Slovak Republic, Australia, Denmark, Latvia, Slovenia, Brazil, Taiwan, Estonia, Lithuania, Spain, Mexico, Turkey, Finland, Luxembourg, Sweden, Indonesia, France, Malta, United Kingdom, Russia.

Source: Timmer (2012), latest update available at http://www.wiod.org/protected3/data/update_sep12/SEA%20Sources_June2014.pdf.

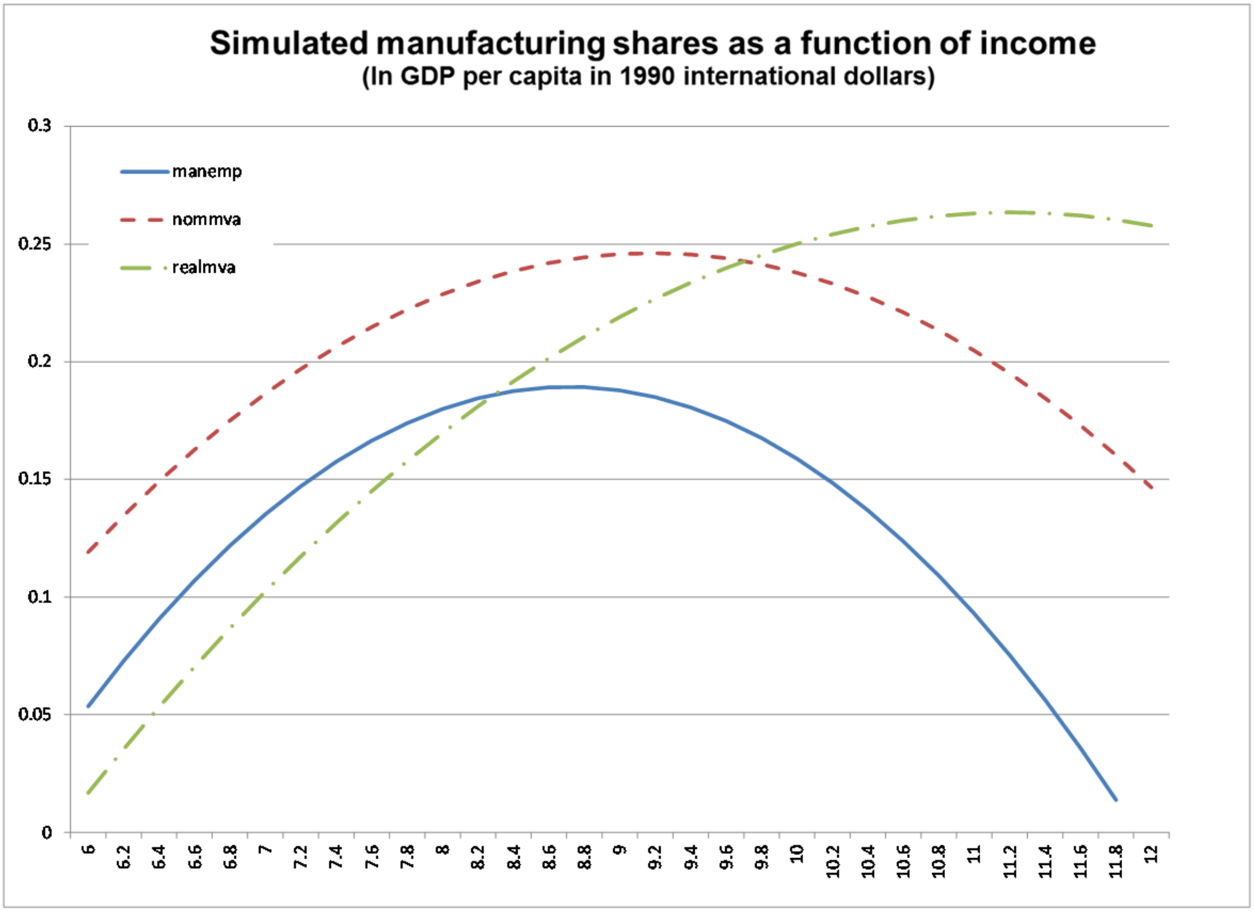

Simulated manufacturing shares as a function of income
(ln GDP per capita in 1990 international dollars)
manemp
nommva
realmva
0.3
0.25
0.2
0.15
0.1
0.05
0
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
8.4
8.6
8.8
9
9.2
9.4
9.6
9.8
10
10.2
10.4
10.6
10.8
11
11.2
11.4
11.6
11.8
12

Figure 1

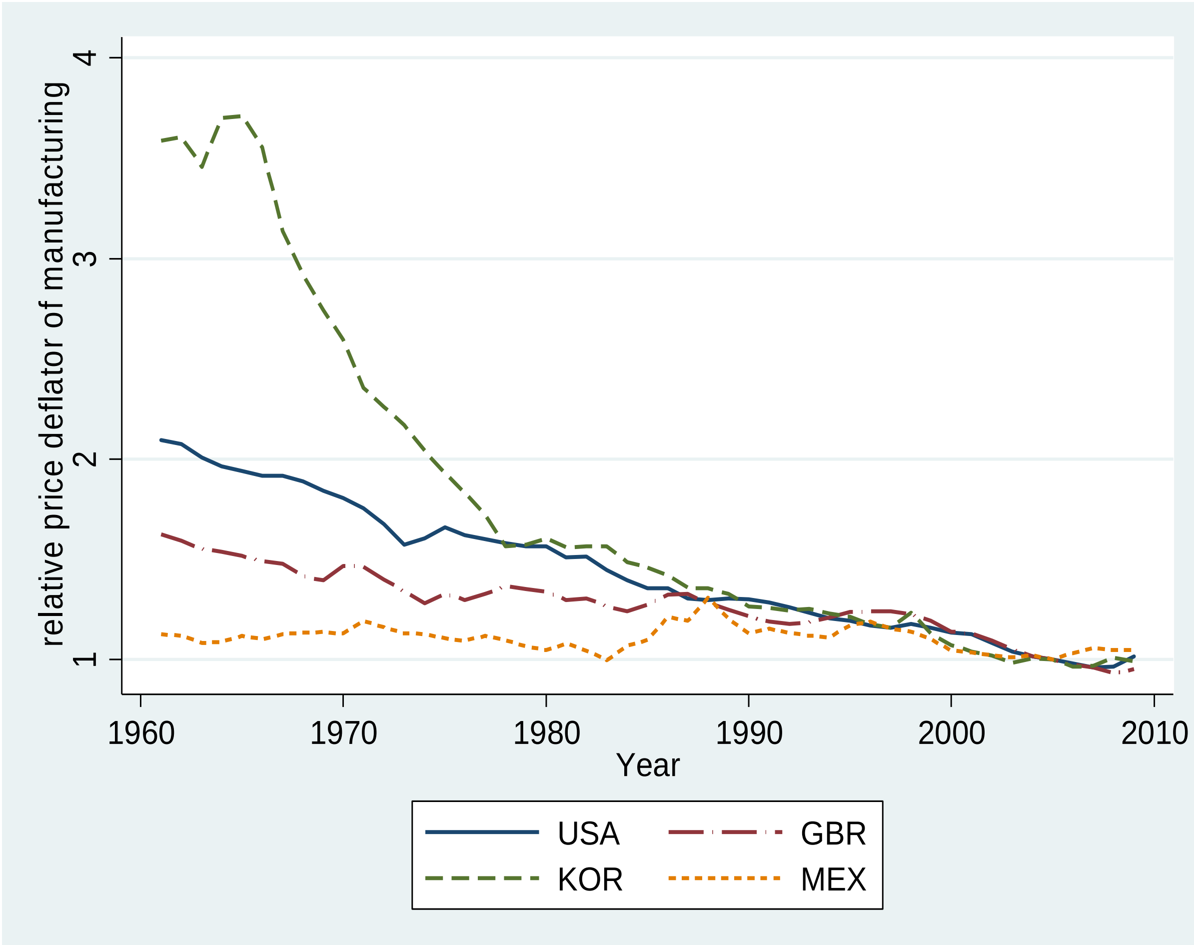

relative price deflator of manufacturing
1
2
3
4
1960
1970
1980
1990
2000
2010
Year
USA
GBR
KOR
MEX

Figure 2

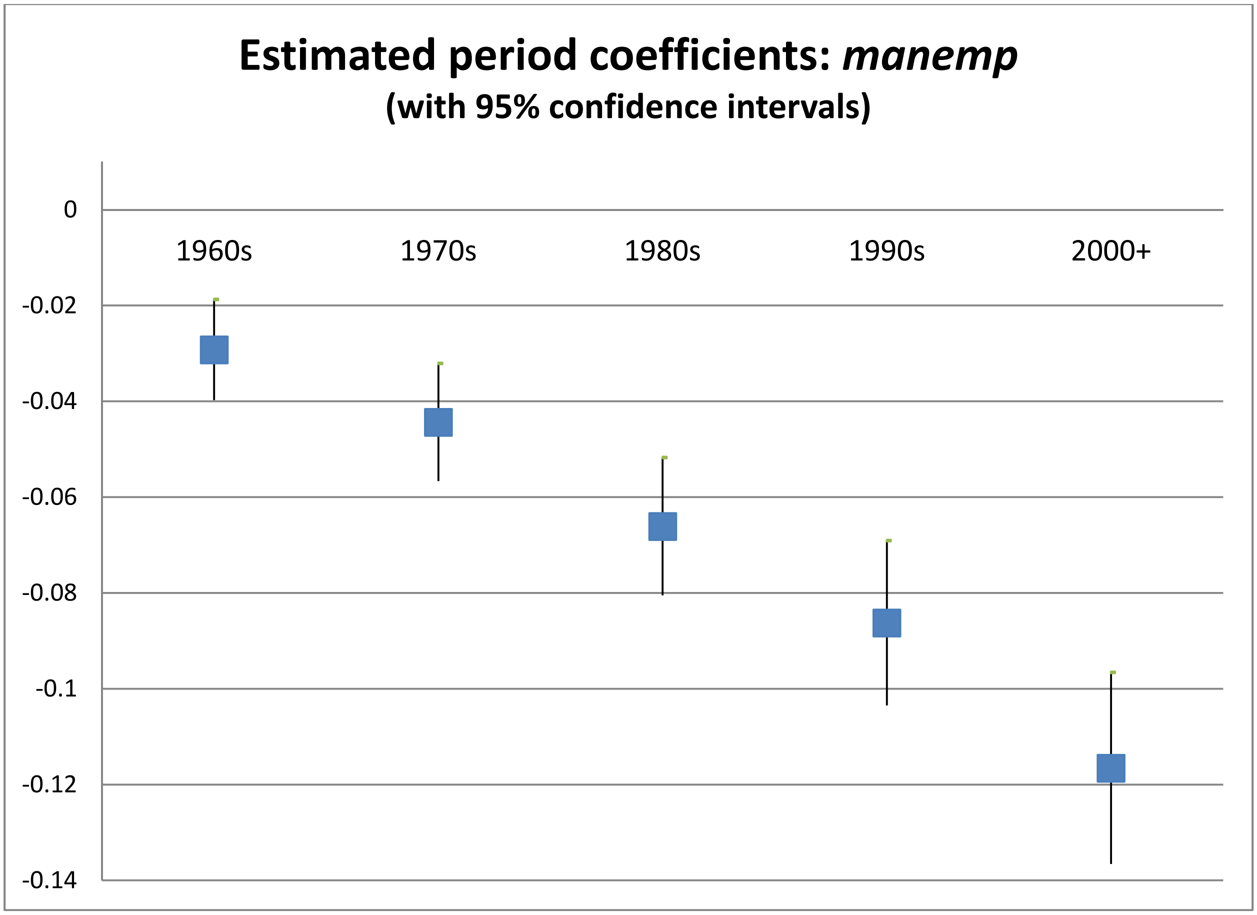

Estimated period coefficients: *manemp*
(with 95% confidence intervals)
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
1960s
1970s
1980s
1990s
2000+

Figure 3a

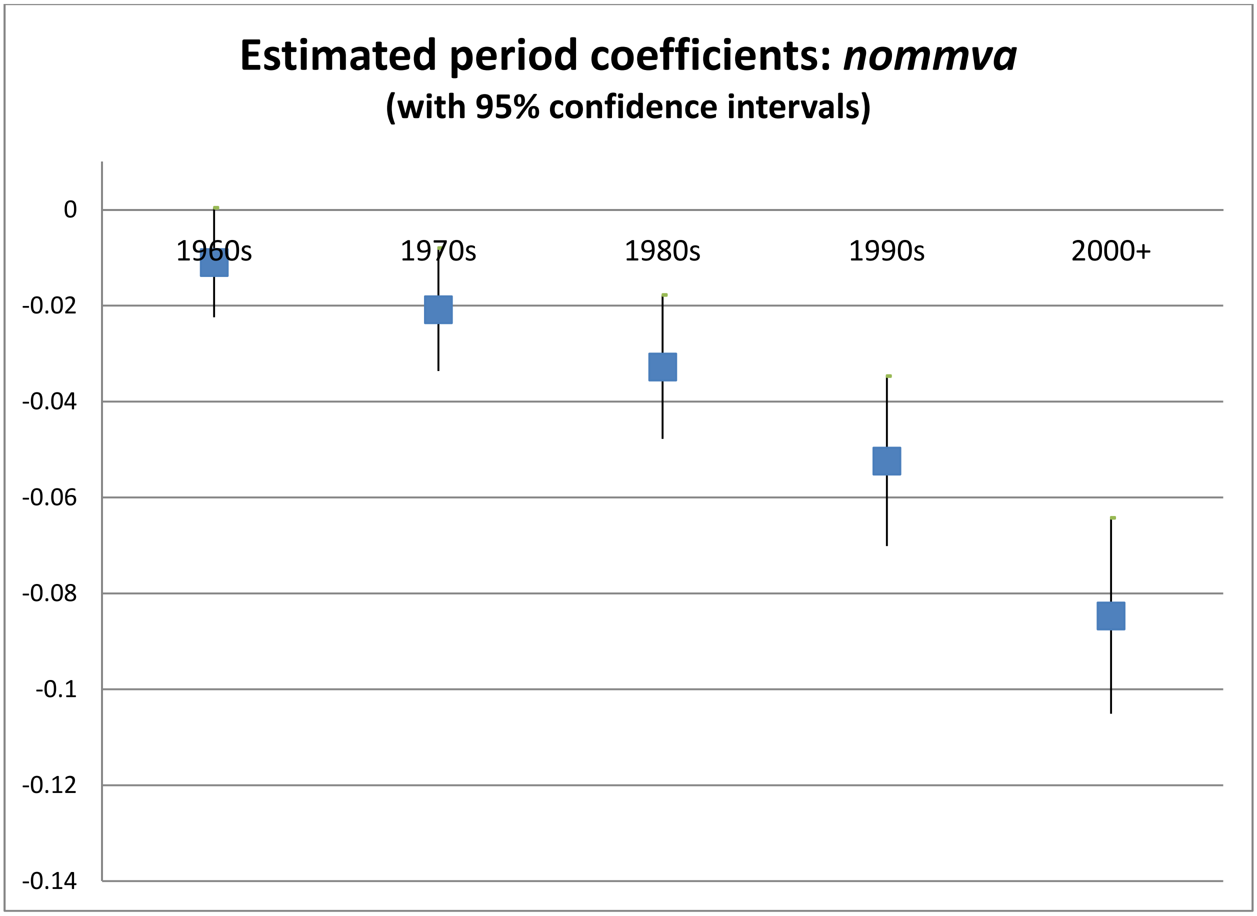

Estimated period coefficients: *nommva*
(with 95% confidence intervals)
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
1960s
1970s
1980s
1990s
2000+

Figure 3b

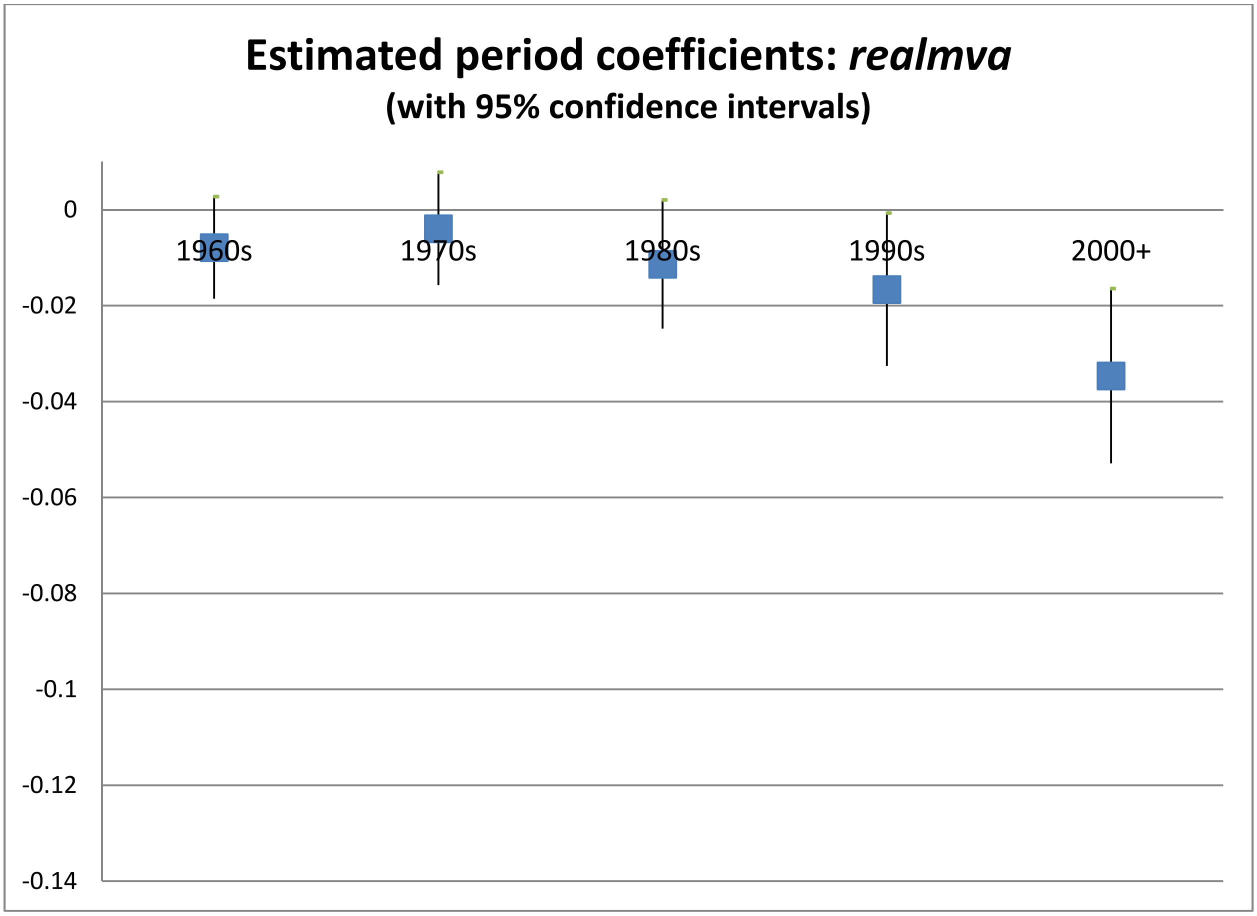

Estimated period coefficients: *realmva*
(with 95% confidence intervals)
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
1960s
1970s
1980s
1990s
2000+

Figure 3c

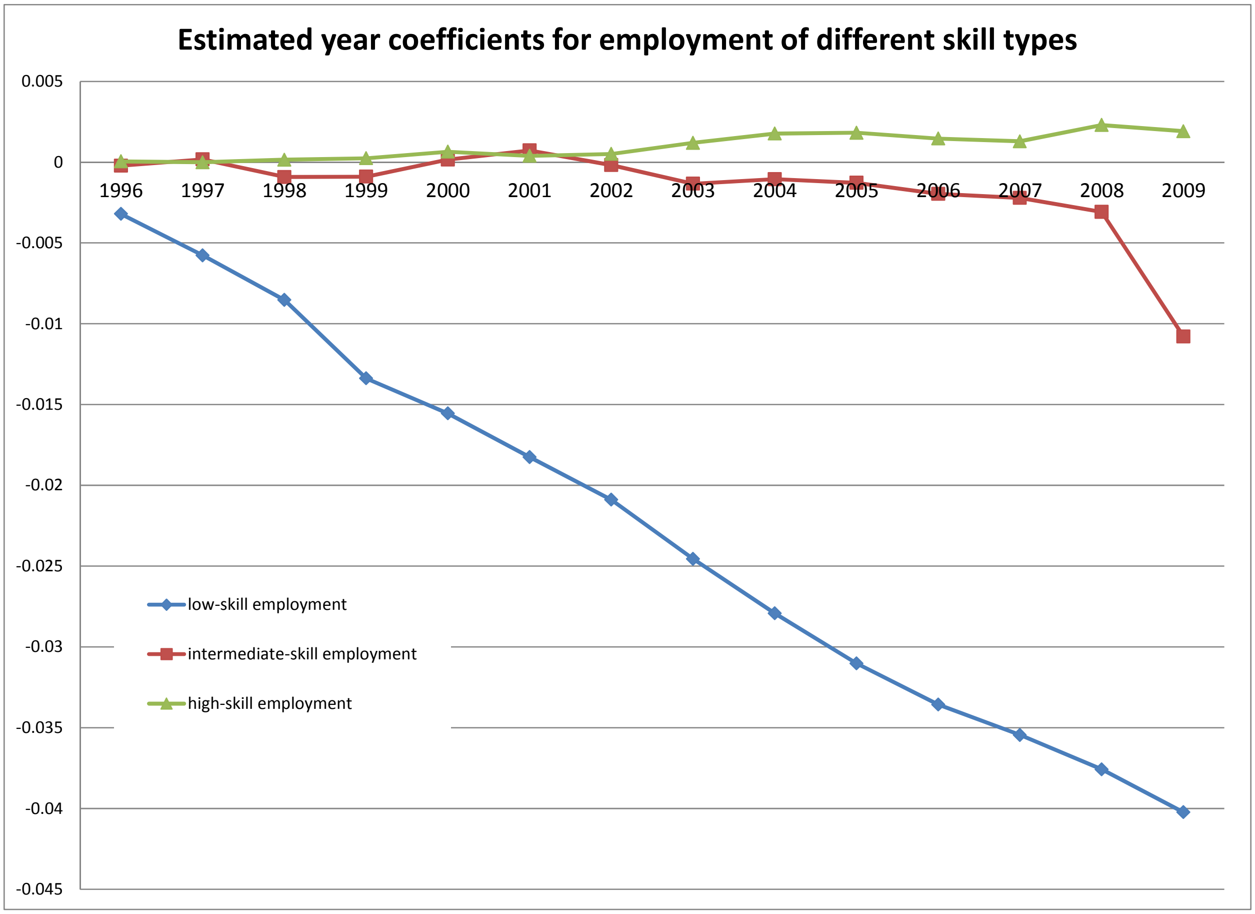
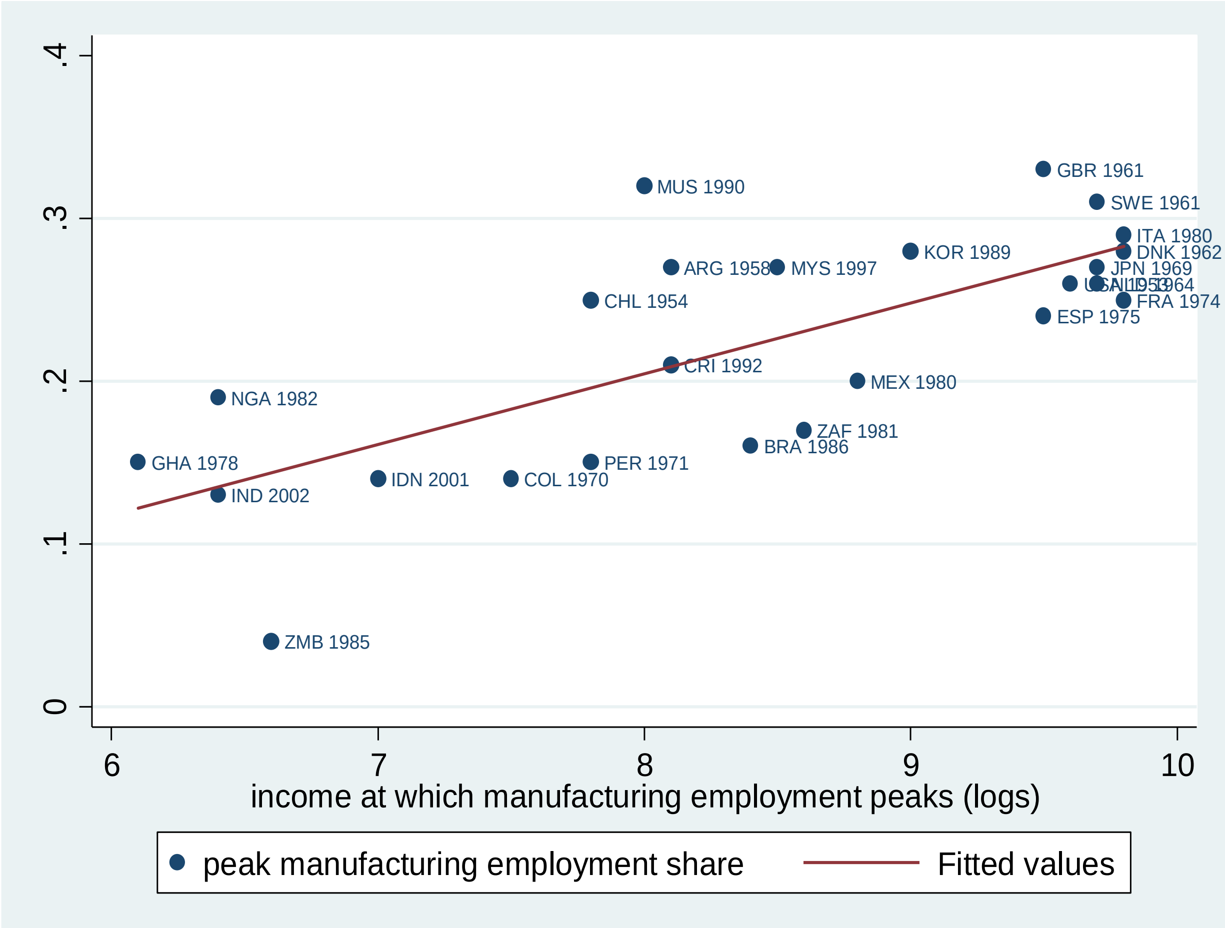

Estimated year coefficients for employment of different skill types
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
-0.035
-0.04
-0.045
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
low-skill employment
intermediate-skill employment
high-skill employment

Figure 4



.4
.3
.2
.1
0
MUS 1990
GBR 1961
SWE 1961
ITA 1980
DNK 1962
JPN 1969
USA 1953
NLD 1964
FRA 1974
ESP 1975
KOR 1989
ARG 1958
MYS 1997
CHL 1954
CRI 1992
MEX 1980
NGA 1982
ZAF 1981
BRA 1986
GHA 1978
PER 1971
IDN 2001
COL 1970
IND 2002
ZMB 1985
6
7
8
9
10
income at which manufacturing employment peaks (logs)
peak manufacturing employment share
Fitted values

Figure 5

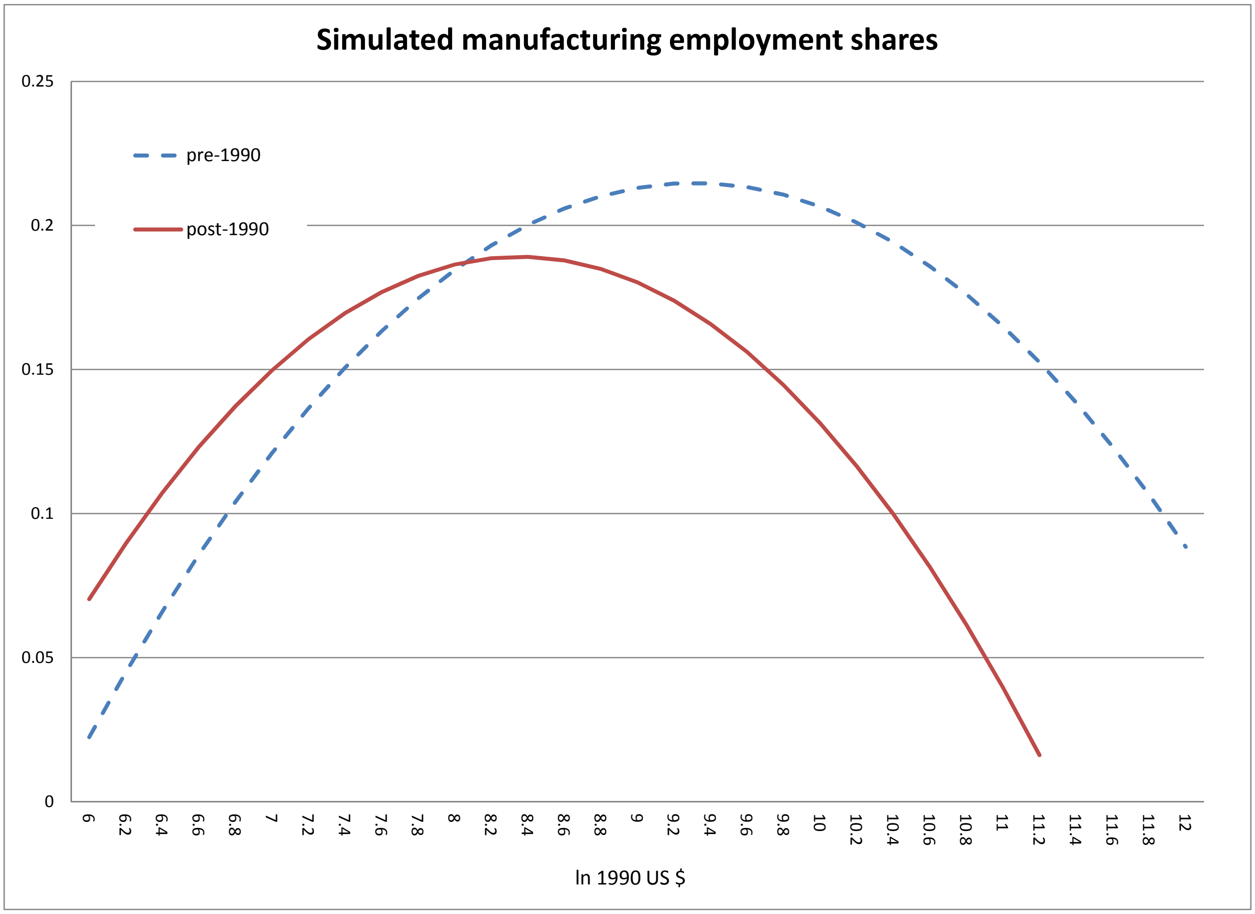

Simulated manufacturing employment shares
0.25
0.2
0.15
0.1
0.05
0
pre-1990
post-1990
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
8.4
8.6
8.8
9
9.2
9.4
9.6
9.8
10
10.2
10.4
10.6
10.8
11
11.2
11.4
11.6
11.8
12
ln 1990 US $

Figure 6

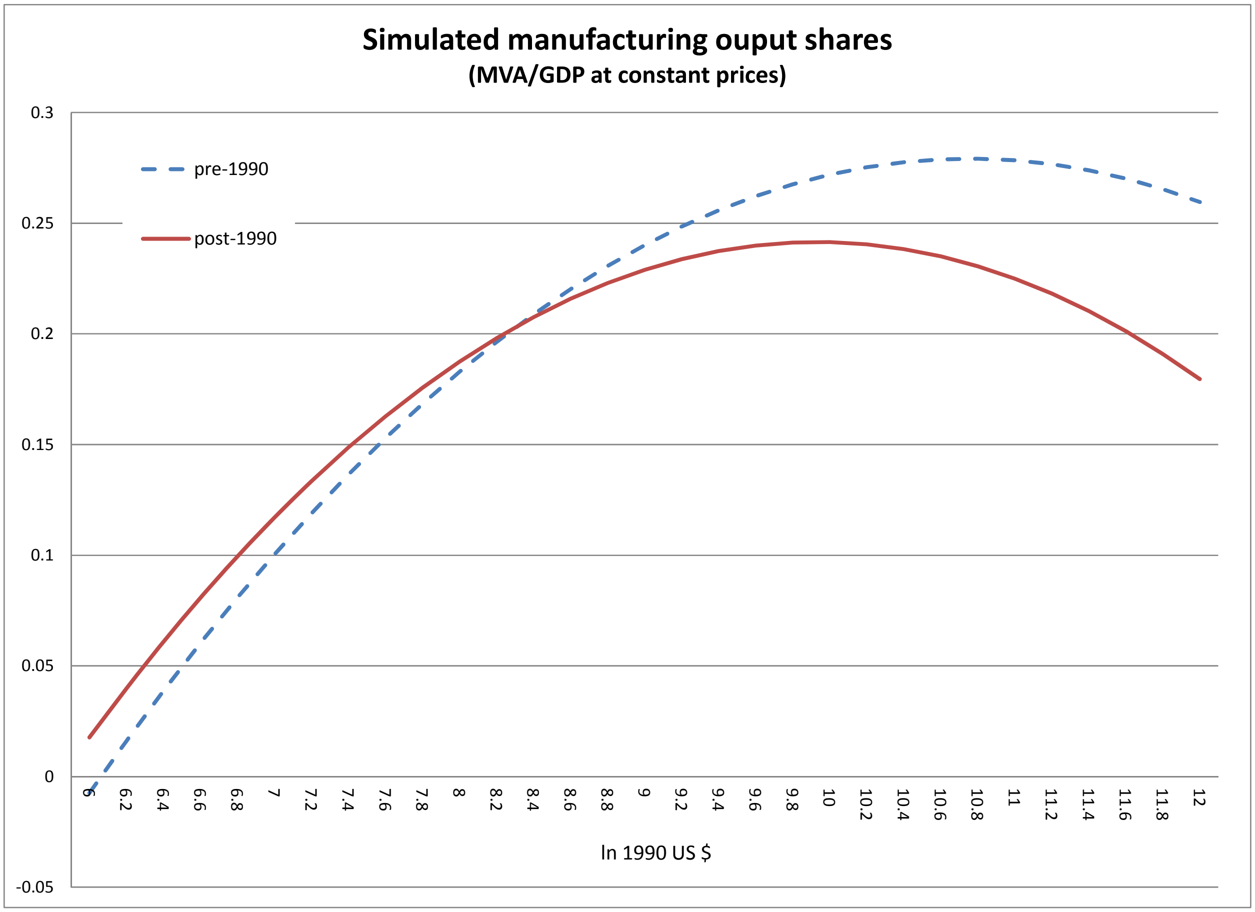

Simulated manufacturing ouput shares
(MVA/GDP at constant prices)
pre-1990
post-1990
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
6
6.2
6.4
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
8.4
8.6
8.8
9
9.2
9.4
9.6
9.8
10
10.2
10.4
10.6
10.8
11
11.2
11.4
11.6
11.8
12
ln 1990 US $

Figure 7

Table 1: Baseline regressions

	manemp	*nommva*	*realmava*	*manemp*	*nommva*	*realmava*
	common sample			largest sample		
ln population	**0.115***	**0.142***	**-0.113***	**0.122***	**0.192***	**-0.039**
	(0.021)	**(0.029)**	**(0.028)**	**(0.021)**	**(0.027)**	**(0.025)**
ln population squared	**-0.000**	**-0.002***	**0.005***	**-0.001**	**-0.004***	**0.003***
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
ln GDP per capita	**0.321***	**0.230***	**0.204***	**0.316***	**0.266***	**0.262***
	(0.027)	**(0.031)**	**(0.025)**	**(0.026)**	**(0.031)**	**(0.027)**
ln GDP per capita squared	**-0.018***	**-0.013***	**-0.009***	**-0.018***	**-0.014***	**-0.012***
	(0.002)	**(0.002)**	**(0.001)**	**(0.002)**	**(0.002)**	**(0.002)**
1960s	**-0.029***	**-0.011*****	**-0.008**	**-0.018***	**-0.010*****	**-0.028***
	(0.005)	**(0.006)**	**(0.005)**	**(0.004)**	**(0.006)**	**(0.007)**
1970s	**-0.044***	**-0.021***	**-0.004**	**-0.033***	**-0.014****	**-0.026***
	(0.006)	**(0.007)**	**(0.006)**	**(0.005)**	**(0.007)**	**(0.008)**
1980s	**-0.066***	**-0.033***	**-0.011*****	**-0.054***	**-0.028***	**-0.034***
	(0.007)	**(0.008)**	**(0.007)**	**(0.006)**	**(0.008)**	**(0.009)**
1990s	**-0.086***	**-0.052***	**-0.017****	**-0.074***	**-0.049***	**-0.040***
	(0.009)	**(0.009)**	**(0.008)**	**(0.008)**	**(0.009)**	**(0.010)**
2000s+	**-0.117***	**-0.085***	**-0.035***	**-0.105***	**-0.085***	**-0.059***
	(0.010)	**(0.010)**	**(0.009)**	**(0.009)**	**(0.010)**	**(0.011)**
country fixed effects	yes	yes	yes	yes	yes	yes
number of countries	42	42	42	42	42	42
number of observations	1,995	1,995	1,995	2,209	2,128	2,302

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 2: Alternative data sets

	manemp	*nommva*		*realmva*	
	ADB/ILO	ADB/UN	ADB/WB	ADB/UN	ADB/WB
ln population	**0.196***	**0.194***	**0.260***	**0.008**	**-0.044**
	(0.043)	**(0.026)**	**(0.031)**	**(0.019)**	**(0.029)**
ln population squared	**-0.004***	**-0.004***	**-0.007***	**0.001**	**0.002****
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
ln GDP per capita	**0.693***	**0.238***	**0.146***	**0.060***	**0.057***
	(0.052)	**(0.016)**	**(0.019)**	**(0.015)**	**(0.017)**
ln GDP per capita squared	**-0.039***	**-0.013***	**-0.008***	**-0.002****	**-0.002*****
	(0.003)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
1980s	**-0.023***	**-0.011***	**-0.002**	**-0.006***	**0.000**
	(0.002)	**(0.002)**	**(0.002)**	**(0.001)**	**(0.002)**
1990s	**-0.043***	**-0.029***	**-0.010***	**-0.016***	**-0.003**
	(0.004)	**(0.002)**	**(0.003)**	**(0.002)**	**(0.003)**
2000s+	**-0.065***	**-0.052***	**-0.030***	**-0.024***	**-0.009****
	(0.005)	**(0.003)**	**(0.004)**	**(0.003)**	**(0.003)**
country fixed effects	yes	yes	yes	yes	yes
number of countries	87	124	119	124	112
number of observations	1,947	4,378	3,691	5,070	3,312

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 3: Country groups, *manemp*

	all countries	*developed countries*	*Latin America*	*Asia*	*Sub-Saharan Africa*	*Sub-Saharan Africa (excl. Mauritius)*
ln population	**0.122***	**-0.652***	**0.191***	**0.789***	**0.199***	**0.178***
	(0.021)	**(0.122)**	**(0.032)**	**(0.102)**	**(0.019)**	**(0.014)**
ln population squared	**-0.001**	**0.017***	**-0.003***	**-0.025***	**-0.005***	**-0.004***
	(0.001)	**(0.003)**	**(0.001)**	**(0.003)**	**(0.001)**	**(0.000)**
ln GDP per capita	**0.316***	**1.070***	**0.902***	**0.912***	**0.190***	**0.148***
	(0.026)	**(0.088)**	**(0.071)**	**(0.071)**	**(0.024)**	**(0.018)**
ln GDP per capita squared	**-0.018***	**-0.057***	**-0.052***	**-0.051***	**-0.014***	**-0.011***
	(0.002)	**(0.005)**	**(0.004)**	**(0.004)**	**(0.002)**	**(0.001)**
1960s	**-0.018***	**-0.004**	**-0.027***	**-0.003**	**n.a.**	**n.a.**
	(0.004)	**(0.004)**	**(0.004)**	**(0.013)**		
1970s	**-0.033***	**-0.021***	**-0.050***	**0.016**	**0.002**	**-0.003**
	(0.005)	**(0.006)**	**(0.006)**	**(0.016)**	**(0.004)**	**(0.003)**
1980s	**-0.054***	**-0.052***	**-0.079***	**0.022**	**0.004**	**-0.021***
	(0.006)	**(0.007)**	**(0.008)**	**(0.019)**	**(0.007)**	**(0.005)**
1990s	**-0.074***	**-0.072***	**-0.096***	**0.013**	**0.007**	**-0.033***
	(0.008)	**(0.009)**	**(0.010)**	**(0.022)**	**(0.012)**	**(0.007)**
2000s+	**-0.105***	**-0.096***	**-0.131***	**0.004**	**0.007**	**-0.035***
	(0.009)	**(0.010)**	**(0.012)**	**(0.026)**	**(0.014)**	**(0.008)**
country fixed effects	yes	yes	yes	yes	yes	yes
number of countries	42	10	9	11	11	10
number of observations	2,209	575	545	519	524	481

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 4: Country groups, *nommva*

	all countries	*developed countries*	*Latin America*	*Asia*	*Sub-Saharan Africa*	*Sub-Saharan Africa (excl. Mauritius)*
ln population	**0.192***	**0.752****	**0.223***	**1.009***	**0.552***	**0.519***
	(0.027)	**(0.309)**	**(0.046)**	**(0.081)**	**(0.049)**	**(0.045)**
ln population squared	**-0.004***	**-0.016****	**-0.007***	**-0.029***	**-0.017***	**-0.014***
	(0.001)	**(0.008)**	**(0.001)**	**(0.002)**	**(0.001)**	**(0.001)**
ln GDP per capita	**0.266***	**1.024***	**0.308*****	**0.877***	**0.047**	**0.027**
	(0.031)	**(0.139)**	**(0.157)**	**(0.054)**	**(0.061)**	**(0.056)**
ln GDP per capita squared	**-0.014***	**-0.059***	**-0.016*****	**-0.050***	**-0.007**	**-0.006**
	(0.002)	**(0.008)**	**(0.009)**	**(0.003)**	**(0.005)**	**(0.004)**
1960s	**-0.010*****	**-0.003**	**-0.001**	**0.008**	**n.a.**	**n.a.**
	(0.006)	**(0.007)**	**(0.008)**	**(0.007)**		
1970s	**-0.014****	**-0.035***	**-0.006**	**0.032***	**0.030***	**0.017***
	(0.007)	**(0.010)**	**(0.010)**	**(0.010)**	**(0.005)**	**(0.005)**
1980s	**-0.028***	**-0.054***	**-0.002**	**0.036***	**0.029***	**-0.008**
	(0.008)	**(0.011)**	**(0.014)**	**(0.014)**	**(0.008)**	**(0.009)**
1990s	**-0.049***	**-0.062***	**-0.010**	**0.033*****	**0.010**	**-0.050***
	(0.009)	**(0.013)**	**(0.018)**	**(0.018)**	**(0.010)**	**(0.013)**
2000s+	**-0.085***	**-0.079***	**-0.039****	**0.032**	**-0.004**	**-0.079***
	(0.010)	**(0.015)**	**(0.020)**	**(0.022)**	**(0.012)**	**(0.016)**
country fixed effects	yes	yes	yes	yes	yes	yes
number of countries	42	10	9	11	11	10
number of observations	2,128	451	498	576	565	512

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 5: Country groups, *realmva*

	all countries	*developed countries*	*Latin America*	*Asia*	*Sub-Saharan Afirca*	*Sub-Saharan Afirca (excl. Mauritius)*
ln population	**-0.039**	**-4.564***	**0.263***	**0.251***	**0.062****	**0.053*****
	(0.025)	**(0.776)**	**(0.027)**	**(0.084)**	**(0.029)**	**(0.031)**
ln population squared	**0.003***	**0.113***	**-0.004***	**-0.011***	**-0.001**	**-0.000**
	(0.001)	**(0.019)**	**(0.001)**	**(0.003)**	**(0.001)**	**(0.001)**
ln GDP per capita	**0.262***	**0.778***	**-0.135****	**0.737***	**0.123***	**0.106***
	(0.027)	**(0.129)**	**(0.059)**	**(0.040)**	**(0.025)**	**(0.024)**
ln GDP per capita squared	**-0.012***	**-0.036***	**0.006*****	**-0.038***	**-0.009***	**-0.008***
	(0.002)	**(0.008)**	**(0.003)**	**(0.003)**	**(0.002)**	**(0.002)**
1960s	**-0.028***	**-0.021*****	**-0.011***	**0.011*****	**n.a.**	**n.a.**
	(0.007)	**(0.011)**	**(0.004)**	**(0.006)**		
1970s	**-0.026***	**0.007**	**-0.017***	**0.027***	**0.017***	**0.012***
	(0.008)	**(0.015)**	**(0.006)**	**(0.010)**	**(0.005)**	**(0.004)**
1980s	**-0.034***	**0.006**	**-0.052***	**0.034****	**0.015****	**-0.004**
	(0.009)	**(0.018)**	**(0.007)**	**(0.013)**	**(0.006)**	**(0.006)**
1990s	**-0.040***	**0.013**	**-0.078***	**0.041****	**0.011**	**-0.022***
	(0.010)	**(0.023)**	**(0.008)**	**(0.017)**	**(0.009)**	**(0.008)**
2000s+	**-0.059***	**0.021**	**-0.101***	**0.044****	**-0.003**	**-0.042***
	(0.011)	**(0.027)**	**(0.010)**	**(0.020)**	**(0.011)**	**(0.010)**
country fixed effects	yes	yes	yes	yes	yes	yes
number of countries	42	10	9	11	11	10
number of observations	2,302	592	556	577	530	487

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 6: Results by manufacturing specialization

	non-manufactures exporters				manufactures exporters			
	manufactured exports < 75%		share of manufactured exports < share of manufactured imports		manufactured exports > 75%		share of manufactured exports > share of manufactured imports	
	manemp	*realmva*	*manemp*	*realmva*	*manemp*	*realmva*	*manemp*	*realmva*
ln population	**0.202***	**0.146***	**0.174***	**0.130***	**0.326***	**0.034**	**0.444***	**0.184***
	(0.025)	**(0.031)**	**(0.028)**	**(0.035)**	**(0.031)**	**(0.034)**	**(0.025)**	**(0.033)**
ln population squared	**-0.003***	**-0.001*****	**-0.002****	**-0.001**	**-0.009***	**-0.002****	**-0.014***	**-0.007***
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
ln GDP per capita	**0.172***	**0.314***	**0.161***	**0.314***	**0.704***	**0.645***	**0.772***	**0.627***
	(0.021)	**(0.051)**	**(0.022)**	**(0.051)**	**(0.043)**	**(0.021)**	**(0.042)**	**(0.025)**
ln GDP per capita squared	**-0.010***	**-0.018***	**-0.009***	**-0.017***	**-0.039***	**-0.033***	**-0.042***	**-0.032***
	(0.001)	**(0.003)**	**(0.001)**	**(0.003)**	**(0.003)**	**(0.001)**	**(0.003)**	**(0.002)**
1960s	**-0.032***	**-0.055***	**-0.028***	**-0.057***	**-0.004**	**0.004**	**-0.002**	**0.007*****
	(0.004)	**(0.011)**	**(0.004)**	**(0.011)**	**(0.006)**	**(0.003)**	**(0.005)**	**(0.004)**
1970s	**-0.057***	**-0.070***	**-0.054***	**-0.073***	**-0.004**	**0.024***	**-0.002**	**0.030***
	(0.005)	**(0.013)**	**(0.005)**	**(0.013)**	**(0.008)**	**(0.005)**	**(0.008)**	**(0.005)**
1980s	**-0.080***	**-0.087***	**-0.078***	**-0.091***	**-0.025***	**0.014****	**-0.020****	**0.022***
	(0.006)	**(0.015)**	**(0.006)**	**(0.015)**	**(0.009)**	**(0.007)**	**(0.009)**	**(0.007)**
1990s	**-0.093***	**-0.097***	**-0.093***	**-0.101***	**-0.057***	**0.013**	**-0.050***	**0.019****
	(0.007)	**(0.016)**	**(0.008)**	**(0.017)**	**(0.011)**	**(0.008)**	**(0.011)**	**(0.009)**
2000s+	**-0.120***	**-0.123***	**-0.123***	**-0.128***	**-0.089***	**0.012**	**-0.079***	**0.014**
	(0.009)	**(0.018)**	**(0.009)**	**(0.019)**	**(0.013)**	**(0.010)**	**(0.013)**	**(0.011)**
country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
number of countries	26	26	26	26	16	16	16	16
number of observations	1,315	1,374	1,327	1,373	801	834	789	835

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 7: Results by manufacturing specialization (ADB/ILO/WB data)

	non-manufactures exporters				manufactures exporters			
	manufactured exports < 75%		share of manufactured exports < share of manufactured imports		manufactured exports > 75%		share of manufactured exports > share of manufactured imports	
	manemp	*realmva*	*manemp*	*realmva*	*manemp*	*realmva*	*manemp*	*realmva*
ln population	**0.139***	**-0.094****	**0.130***	**-0.131***	**-0.336**	**0.136****	**0.022**	**0.116***
	(0.049)	**(0.040)**	**(0.046)**	**(0.050)**	**(0.130)**	**(0.053)**	**(0.1135)**	**(0.043)**
ln population squared	**-0.002**	**0.004***	**-0.002**	**0.006***	**0.001**	**-0.005***	**-0.001**	**-0.004***
	(0.002)	**(0.001)**	**(0.002)**	**(0.002)**	**(0.004)**	**(0.002)**	**(0.003)**	**(0.001)**
ln GDP per capita	**0.525***	**0.065***	**0.528***	**0.078***	**0.825***	**0.173***	**0.817***	**0.102***
	(0.056)	**(0.017)**	**(0.061)**	**(0.018)**	**(0.008)**	**(0.032)**	**(0.069)**	**(0.031)**
ln GDP per capita squared	**-0.030***	**-0.003***	**-0.030***	**-0.004***	**-0.045***	**-0.008***	**-0.045***	**-0.003**
	(0.003)	**(0.001)**	**(0.003)**	**(0.001)**	**(0.005)**	**(0.002)**	**(0.004)**	**(0.002)**
1980s	**-0.028***	**-0.008***	**-0.028***	**-0.007***	**-0.018***	**0.018***	**-0.019***	**0.010***
	(0.003)	**(0.002)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**
1990s	**-0.042***	**-0.016***	**-0.042***	**-0.013***	**-0.049***	**0.023***	**-0.049***	**0.009****
	(0.004)	**(0.003)**	**(0.004)**	**(0.003)**	**(0.005)**	**(0.005)**	**(0.004)**	**(0.004)**
2000s+	**-0.066***	**-0.028***	**-0.166***	**-0.026***	**-0.069***	**0.034***	**-0.071***	**0.015***
	(0.006)	**(0.004)**	**(0.006)**	**(0.0049)**	**(0.007)**	**(0.006)**	**(0.006)**	**(0.006)**
country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
number of countries	55	80	52	73	32	32	35	39
number of observations	1,058	2,411	1,028	2,238	889	901	919	1,074

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 8: Regressions with interaction terms for post-1990

	manemp	*realmava*
ln population	**0.166***	**-0.016**
	(0.019)	**(0.025)**
ln population squared	**-0.005***	**0.001**
	(0.001)	**(0.001)**
ln GDP per capita	**0.326***	**0.273***
	(0.018)	**(0.029)**
ln GDP per capita squared	**-0.018***	**-0.013***
	(0.001)	**(0.002)**
ln GDP per capita X post-1990	**0.031***	**0.015***
	(0.002)	**(0.002)**
ln GDP per capita squared X post-1990	**-0.004***	**-0.002***
	(0.000)	**(0.000)**
country fixed effects	yes	yes
Number of countries	42	42
number of observations	2,209	2,302

Robust standard errors are reported in parentheses.
Levels of statistitical signficance: *: 99%; **: 95%; ***: 90%.

Table 9: Maximum industrialization levels, pre- and post-1990

	manemp		*realmva*	
	pre-1990	post-1990	pre-1990	post-1990
maximum share	21.5%	18.9%	27.9%	24.1%
reached at income level (GDP per capita, in 1990 international $)	$ 12,088	$ 4,447	$ 49,021	$ 22,026

Source: Author's calculations; see text.