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Is Manufacturing Destiny?

ON THE DYNAMICS OF FUTURE SECTORAL SHARES AND DEVELOPMENT

Brian Webster, Charles Kenny, and Ranil Dissanayake

Abstract

We develop a simple empirical model of sector employment and output shares which, coupled with long-term projections of GDP per capita, provide indicative projections of the evolution and peak of manufacturing in lower income countries to 2050. These indicative projections suggest that cross-country income convergence will continue despite manufacturing peaking as a share of output. This forecast might seem implausible: countries have historically developed and become rich by shifting the composition of their production into manufacturing (and eventually out of manufacturing and into services). But we argue there is reason to think that this is a realistic possibility. First, we argue that there is the potential for a significant relocation of the global manufacturing base in the next two decades that are not fully captured in forecast estimates. Second, notwithstanding this potential relocation, we argue that the role of manufacturing as the unique path to prosperity has likely been overstated. We make the case for cautious, conditional optimism.

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1. Introduction

From the very first models of economic development, structural transformation has been considered a central aspect of the growth process. Both Lewis (1954) and Rostow (1959) present models of economic development in which the motor for growth is provided by an expanding 'modern' (by which each meant manufacturing or industrial) sector.[1] Labor and capital are reallocated from the 'traditional' (agricultural) sector and into the modern sector. This process of reallocation *is* economic development in these models (most explicitly in Rostow's stages of growth model, which essentially describes a historical process).

The general historical process Rostow described is now empirically well-established: agriculture declines as a share of both employment (hours worked) and production (value-added, nominal or real) with GDP per capita, services increase consistently, and manufacturing follows an inverted-U. This relationship is observed across countries using a number of data sources and regardless of whether we look at employment or value added.[2] Recent work, however, has questioned whether this pattern of structural transformation is indeed universal. Bah (2009) found that Africa appears to be following a different shape of structural transformation to the 'norm' described above, while Latin America is shifting between sectors at different levels of per capita GDP than developed countries; East Asia follows the general pattern described above, but with higher levels of GDP per capita than found in the West.[3]

Rodrik goes further than Bah in his 'Premature Deindustrialization' argument: that countries developing after the East Asian growth miracle followed the same pattern of evolution in the labour share of manufacturing, but were doing so at lower levels of GDP per capita, and lower shares of labour, than those that came before them.[4] In other words, these countries started to see manufacturing peak when they were poorer than Asian and Western countries, and never had as large a share of their working-age population employed in manufacturing as those countries did. In this regard, Felipe et al (2019) noted that nearly all high income economies today saw a peak manufacturing employment share above 18 percent at some point since 1970, but that maximum expected employment share for a typical developing economy has fallen to below 15%, with earlier deindustrialization.[5]

1 Lewis, W.A. (1954). Economic Development with Unlimited Supplies of Labour. The Manchester School, 22: 139–191. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x; Rostow, W. W. (1959). The stages of economic growth and the problems of peaceful co-existence. Cambridge, Mass.: Center for International Studies, Massachusetts Institute of Technology, 1959.

2 Defining structural transformation by consumption complicates the picture somewhat: consumption of manufactures does not demonstrate the same clear-cut inverted U shape, appearing more flat or very slightly upward sloping. Herrendorf, B., Rogerson, R., & Valentinyi, A. (2014). Chapter 6-Growth and Structural Transformation, volume 2 of NBER Handbook of Economic Growth.

3 Bah, El-hadj (2009) : Structural Transformation in Developed and Developing Countries, Proceedings of the German Development Economics Conference, Frankfurt A.M. 2009, No. 42, Verein für Socialpolitik, Ausschuss für Entwicklungsländer, Göttingen.

4 Rodrik, D. (2015, February). Premature Deindustrialization. Working Paper 20935, National Bureau of Economic Research.

5 Felipe, J., Mehta, A., & Rhee, C. (2019). Manufacturing matters... but it's the jobs that count. Cambridge Journal of Economics, 43(1), 139–168.

Rodrik provides reasons to believe a large manufacturing sector was an important *causal* factor in rapid growth—including that the sector saw unconditional productivity convergence, produced exportable products that do not rely exclusively on domestic demand, and provided a source of unskilled employment for workers taking part in a structural shift out of agriculture.[6] He also suggested powerful reasons for concern that the export-led manufacturing model was becoming harder to follow. He argued that the skills requirement of manufacturing jobs were climbing and manufacturing location decisions were increasingly driven by factors beyond labor cost (that is, giving greater weight to factors that are less-well provided by poorer countries).[7]

Looking forward, robotics and AI may increase productivity in rich country manufacturing, making manufacturing in poorer countries less competitive than it would otherwise be, while demand for manufactures may rise more slowly because as consumers' incomes rise, they shift demand to services.[8] The scope for multiple countries to dramatically grow their manufacturing sectors through export-led growth correspondingly declines. Rodrik amongst others has noted that other paths to rapid growth face challenges: services are still not nearly as exportable as manufactures and the higher-productivity components of the services sector tend to be high-skilled and employ relatively few people.

This paper forecasts the structural transformation worldwide based on independent GDP growth forecasts and a simple empirical model linking sector shares to income, time and fixed country characteristics, suggesting manufacturing employment may decline at the global level but arguing that there are still grounds for optimism regarding growth overall. We use historical data from 1975–2018[9] and projections of GDP per capita from Gehan and Kenny (2023) to generate projections of the expected evolution and peak of manufacturing for 59 countries, which account for roughly 76 per cent of current world population and 74 per cent of expected world population ins 2050. The economic growth forecasts suggest continued global convergence while the sector share forecasts suggests manufacturing employment will decline everywhere but in (current) low income countries, where it will stagnate. Using these projections as a starting point, we make two arguments in the rest of the paper related to the plausibility of this forecast. First, the demise of the manufacturing route to prosperity may be exaggerated by our projections. Looking forward, we see some reasons for optimism in the manufacturing prospects of poor countries, including opportunities to expand into any low-skilled manufacturing space vacated by China. Secondly, we argue that the uniqueness of manufacturing as a route to prosperity has been overstated; there are important routes in agriculture and services. Both of these routes are tractable to policy and provide opportunities

6 Rodrik, D. (2013, February). Unconditional Convergence in Manufacturing*. The Quarterly Journal of Economics 128(1), 165–204.

7 Rodrik, D. (2015, February). Premature Deindustrialization. Working Paper 20935, National Bureau of Economic Research.

8 And may decline, depending on the rate at which demand for manufacturing declines with respect to income and the distribution of incomes.

9 The data is drawn from Dieppe, A., & Matsuoka, H. (2021). Sectoral Decomposition of Convergence in Labor Productivity: A Re-Examination from a New Dataset World Bank Policy Research Working Paper 9767.

for poorer countries. This makes us optimistic that global convergence can continue even with premature deindustrialization.

The paper proceeds as follows. The next section develops and presents our projections of sectoral shares in developing countries to 2050. Section 3 uses these projections as a starting point to empirically assess the likely extent of premature deindustrialization as a concern for international development, drawing on the extensive literature on the topic from the last 15 years and our own analysis. Section 4 proceeds with a discussion of the role of non-manufacturing paths to prosperity. Section 5 concludes by discussing the policy implications of this work.

2. The future of structural transformation

To investigate what the future of structural transformation might be, we construct a forecast using a simple model and data from three sources. We use the eight-sector database compiled by Dieppe and Matsuoka for historical data on labor shares in each sector, GDP per capita and sectoral productivity. This dataset is both broader (covers more countries) more detailed (covers more sectors) and longer (covers more years) than alternatives.[10] For estimates of future GDP per capita, we use the central scenario for future growth generated by Gehan and Kenny, which uses a simple model based on past performance and independent demographic, climatic and educational forecasts to generate forecasts for GDP by country.[11] For estimates of future population we use the UN's World Population Prospects database. An additional, (even) more speculative analysis reported in Annex 4 uses World Integrated Trade Solution data drawn from the World Bank on exports by sector.[12] Throughout this paper, unless otherwise stated, we use GDP per capita in 2017 PPP terms as our core metric of economic development; and employment shares in each sector as our core measure of structural transformation.[13]

Our simple model uses this data to generate sectoral forecasts for each country in our dataset, and speculative estimates of the implications for future exports by country. The sectoral forecasts take economic and labor force growth as given. It takes per capita income figures for 2019 and 2050 and uses them to predict total output and sectoral output distribution for countries in 2050 based on the historical relationship between sectoral share of output and country, time, GDP per Capita and

10 It uses information from a number of sources to extend coverage geographically, and uses some backward extrapolation to increase time coverage. Details are reported in the Appendix of Dieppe and Matsuoka (2021). Note, we use a corrected version of the dataset kindly provided by the authors.

11 Charles Kenny and Zack Gehan. 2023. "Scenarios for Future Global Growth to 2050." CGD Working Paper 634. Washington, DC: Center for Global Development.

12 https://wits.worldbank.org/.

13 These are common choices in the literature on economic development and structural transformation. An alternative measures of economic development would be GDP per hour worked, which might sometimes be appropriate if we wanted to compare, say, Europe with the US (since GDP per hour worked is similar, but GDP per capital much higher in the US, since workers work longer hours in the latter). However, data on hours worked is not available for many developing countries. Alternative measures of structural transformation might value-added shares in each sector, or consumption shares for each sector.

GDP per capita squared. The underlying GDP per capita figures are themselves based on forecasts of demographic variables, education, temperature and conditional convergence that build on a historical regression of those factors against income growth (See Table 1). It takes the labor force (based on World Population Prospects central forecasts) and uses them to predict total employment and sectoral employment distribution for countries in 2050 based on the historical relationship between sectoral share of employment and country, time, GDP per Capita and GDP per capita squared. In other words, the sectoral forecasts answer 'what would we expect sectoral employment and output to look like in 2050 if the relationship between sectoral share, income, country and time remained the same while income grew according to the current relationship between income and demographics, temperature, education and convergence using independent forecasts of demographics, education and temperature?'

TABLE 1. Underlying economic forecasts: GDP per capita in 2019 and 2050

	GDP per Capita (PPP)		Growth (annualized)
	2019	2050	
LIC	1,940	4,800	2.97
LMIC	7,012	14,743	2.43
UMIC	16,036	32,760	2.33
HIC	48,913	62,269	0.78
World	16,176	24,499	1.35

Note: Country groupings are current (2022) income group members.

Given the *considerable* uncertainty of the growth forecasts added to the fact that we assume the current relationship between sectoral income and employment shares on the one hand and country, time and income on the other, these forecasts should be seen as illustrative and subject to very large margins of error. We use them here as the basis of a discussion about the future shape of structural transformation and its possibilities.

We have data on the number of individuals employed and their labor productivity (measured in 2017 purchasing power parity dollars) within 8 sectors of 91 national economies in a given year. Countries with only partial data available between the years 1975 and 2018 are then ignored, as well as Bhutan which exhibits extreme outliers in its productivity data, thereby limiting the analysis to 59 countries over that time span. We refer to this sample of 59 countries as our '1975–2018 fixed sample' throughout this paper. This data is then paired with national GDP and GDP per capita data (also measured in international PPP dollars) for those countries for the years 1975 to 2018 and projections for the year 2050, as well as working age population statistics[14] from the UN for both 1975 through 2018 and 2050, all drawn from Gehan and Kenny.

14 Working age being defined here as between the ages of 15 and 65.

TABLE 2. Fixed sample: mean (standard deviation)

Year	Employees (Millions)	Working Age Population (Millions)	Labor Productivity (Thousands 2017 PPPs)	GDP (Billions 20177 PPP)	GDP per Capita (Thousands 2017 PPPs)
1975	21.9 (63.4)	30.8 (81.4)	$26.6 ($50.7)	$335 ($850)	$11.8 ($30.4)
1995	33.7 (101.1)	47.4 (129.5)	$30.2 ($32.5)	$681 ($1,680)	$14.1 ($17.1)
2018	44.7 (119.8)	66.6 (174.3)	$45.8 ($38.7)	$1,620 ($3,770)	$23.6 ($23.5)
2050 (Projections)	NA	78.2 (181.0)	NA	$3,210 ($7,500)	NA

Note: The 'fixed sample' is our list of 59 countries with compete data. The full list of countries covered can be seen in the country coefficients listed in Annex 1.

The full sample covers 62% of the 2000 global population ages 15–64. While the 1975–2018 fixed sample covers 56%. Average daily income/consumption in the world in 2000 was $12.36, and the median was $3.15 (population weighted). Of the 90 countries in our full sample for which we have income/consumption data, the average was $12.81 and median $3.05. For the 1975–2018 sample with data the 2000 average was $12.72 and the median $2.52.[15] Table 2 presents raw data on employment at the national level in our fixed sample of countries, and Table 3 shows global employment at the sectoral level. Tables 1 and 2 of Annex 3 provide additional information on employment rates and levels.

We should note a clarification and further caveat regarding what is counted as output and implications for interpretation. This data is based on annual local currency unit output measured (for the private sector) by what people pay for it and (for public goods provided by the public sector, largely) by what it costs to provide. That is then deflated by price indices at the national level. In agriculture, mining and manufacturing, price changes are constructed by dividing total prices paid by total output in a year and measuring price per unit over time: dollars per bushel of wheat, ton of iron and so on. Sporadically, it is also adjusted for quality, with 'hedonic adjustments' (for example, not dollars per computer, but dollars per computer with a given RAM capacity). With private services, more recently, there has been some effort to measure output (number of banking transactions, for example) but it is partial. And in many government services not paid for by consumers, output is simply measured by the cost to provide it, with no attempt to adjust for quantity let alone quality. Measures of total real output are constructed from this data using weights that are periodically 'rebased' so that they better reflect the current distribution of economic activity. Finally, these national output numbers are adjusted for differences across countries in the price of goods and services (services are cheaper in countries where people are paid less, and so overall average prices are lower). This is done using one overall 'purchasing power parity' adjustment made on 2017 prices across countries.

15 Consumption/income data from World Bank PIP. Note: China is in our sample but not in PIP for 2000.

This process is far from perfect. For example, imagine in one country over time the same number of factory workers make better widgets for the same price (Ford Escapes rather than Ford Model T's as it might be). Meanwhile, the same number of policemen get significant pay rises even though they are capturing the same number or even fewer criminals. Our data would suggest no change in relative productivity. Our forecasts, built on this data, may compound this issue.

TABLE 3. Global jobs (absolute number, million)

	1975 Fixed	1995 Fixed	2018 Fixed	1995 Full	2018 Full
Total	1291.6	1987.7	2636.2	2234.7	2964.7
Agriculture	723.6	876.6	754.9	925.0	794.4
Mining	10.8	17.1	15.0	19.9	17.7
Manufacturing	172.4	281.3	377.3	323.4	417.8
Utilities	6.8	11.4	13.8	15.9	18.8
Construction	45.0	101.6	202.4	118.7	229.1
Whole sale, Accommodation and food service activities	110.6	236.2	439.8	273.6	506.4
Transportation, information and communication, Finance, insurance, real estate and business services	72.1	145.7	277.8	178.0	330.8
Government services, Community, social and personal services	150.3	317.8	555.3	380.2	649.6

From this data, the share of employment represented by each economic sector is forecast in the year 2050. Employment within each sector is calculated as a percentage of total employment for each country for the years 1975 to 2018:

$$Y_{sit} = e_{sit}/E_{it}$$

Where e represents the number of people employed in sector (s) in country (i) at time (t) and E represents the total number of people employed in country (i) at time (t). The relationship between national economic performance and sectoral employment shares is then established for the 1975 through 2018 period by estimating the following regression:

$$Y_{sit} = \beta_0 + \beta_1 P_{it} + \beta_2 P_{it}^2 + \beta_3 C + \beta_4 T \qquad \text{(Model 1)}$$

Where P represents the natural log of GDP per capita measured in 2017 PPP dollars in country (i) at time (t), C is a dummy variable for each country, and T represents the year (as a time trend). Regression results for national sector data between 1975 and 2018 are reported in Annex 1. GDP per capita estimates for the year 2050 are then applied to Model 1 to estimate the share of national employment represented by each sector in 2050 in each of the 59 countries with data for 1975 to 2018. To ensure that total employment shares do not exceed 100%, 2050 employment shares are recalculated as percentages of the sum total of estimated employment shares at the national level.

The same framework of Model 1 is then reapplied in Model 2 to estimate the labor force participation rate (See Table 1 in Annex 3) in the 1975 through 2018 period:

$$L_{it} = \beta_0 + \beta_1 P_{it} + \beta_2 P_{it}^2 + \beta_3 C + \beta_4 T \qquad \text{(Model 2)}$$

Where

$$L_{it} = E_{it}/N_{it}$$

Where N is the total working age population in country (i) at time (t). (Results are presented in Annex 1). GDP per capita estimates for the year 2050 are again utilized in Model 2 to estimate national labor force participation rates in each of our sample countries in the year 2050.

The 2050 estimates from Models 1 and 2 are used to estimate global sectoral employment shares. UN national working age population estimates for 2050 are multiplied by estimated national labor force participation rates to obtain estimates for total employment levels in each country in the year 2050. These totals are then multiplied by national sectoral employment share estimates from Model 1 to obtain projected employment totals at the national sector level. These are then totaled by sector (across countries) to obtain global estimates of total employment and employment shares. The process is repeated to obtain estimates for low, lower-middle, upper-middle, and high income countries.

A similar approach is employed to estimate the percentage of global output represented by each sector in 2050. For each country with data from 1975 through 2018, total sectoral output measured in 2017 PPP dollars is calculated as

$$O_{sit} = e_{sit} * o_{sit}$$

Where O is the output per worker in sector (s) in country (i) at time (t)

Output at the national sector level is then calculated as a percentage of total national output in a given year:

$$S_{sit} = O_{sit}/O_{it}$$

The relationship between national output shares and economic performance in the 1975 through 2018 period is established using Model 3 (results are presented in Annex 1), and 2050 GDP per capita estimates are then applied to obtain output share estimates in 2050.

$$S_{sit} = \beta_0 + \beta_1 P_{it} + \beta_2 P_{it}^2 + \beta_3 C + \beta_4 T \qquad \text{(Model 3)}$$

Total national output in 2050 (O_{i2050}) is then estimated. GDP per capita data from 2018 and GDP per capita estimates for 2050 are used to calculate average GDP per capita growth rates between those years using the following method:

$$R = 1 - (GDP_{2050}/GDP_{2018})^{(1/(2050-2018))}$$

Using R, national output totals (O_{i2050}) from 2018 are inflated to 2050.

Using these estimates, global sectoral output totals expressed in 2017 PPPs are estimated for 2050 by multiplying O_{i2050} by S_{si2050} and sum totaling the country level results by sector. Using this methodology, estimates are obtained for (current) low, lower-middle, upper-middle, and high income countries as well. Finally, sectoral productivity estimates at the global and income category level are produced for 2050 by dividing the estimated output totals by the estimated employment totals. Table 4 presents the overall global results (results by income group are in Annex 1).

TABLE 4. Employment, Output and Labour Productivity 2018 and 2050 (Fixed Sample)

Sector	Employed Workers (Millions, Rounded)		Output (Billions of 2017 PPPs, Rounded)		Implied Productivity (Output per Worker, Rounded)			
	2018	2050	2018	2050	2018	2050	% Change	Avg % Change
Total	2,636 (100%)	3,251 (100%)	$92,200 (100%)	$179,000 (100%)	$35,000	$55,100	57.7%	1.4%
Agriculture	755 (28.6%)	805 (24.8%)	$5,600 (6.1%)	$7,300 (4.0%)	$7,400	$9,000	21.4%	0.6%
Mining	15 (0.6%)	18 (0.6%)	$2,800 (3.0%)	$11,500 (6.4%)	$183,100	$645,400	252.5%	4.0%
Manufacturing	377 (14.3%)	311 (9.6%)	$16,900 (18.4%)	$27,000 (15.0%)	$44,800	$86,800	93.5%	2.1%
Utilities	14 (0.5%)	14 (0.4%)	$2,000 (2.2%)	$4,600 (2.6%)	$146,400	$327,500	123.7%	2.6%
Construction	202 (7.7%)	235 (7.2%)	$5,500 (6.0%)	$9,000 (5.0%)	$27,300	$38,400	40.7%	1.1%
Wholesale, Accommodation and food service activities	440 (16.7%)	694 (21.4%)	$13,000 (14.2%)	$23,400 (13.1%)	$29,700	$33,700	13.6%	0.4%
Transportation, information and communication, Finance, insurance, real estate and business services	278 (10.5%)	501 (15.4%)	$27,600 (30.0%)	$61,900 (34.6%)	$99,500	$123,500	24.1%	0.7%
Government services, Community, social and personal services	555 (21.1%)	672 (20.7%)	$18,700 (20.3%)	$34,500 (19.2%)	$33,700	$51,300	52.5%	1.3%

The forecasts suggest the next three decades will see a continuation of the century-long process of shifting employment and output shares from agriculture to services, but accompanied by the relatively new phenomenon of global deindustrialization. These trends will affect every income level to a greater or lesser extent. Note again, the sectoral results are driven by growth projections that suggest slower overall growth but continued overall convergence—growth is given and sectoral change in this exercise is treated as the dependent variable.

Global totals suggest that the workforce will expand by about 23 percent between 2018 and 2050 while output will climb 94 percent—equal to an annual average global increase in labor productivity of about 1.4 percent over the period. Productivity will rise more rapidly in low and middle income countries than high income countries, but a rising share of workers in the poorest countries (as the absolute number declines in high income countries and stagnates in upper middle income countries) reduces the rate of global productivity growth.

At the sectoral level, agriculture and industry (including mining, manufacturing, utilities and construction) accounted for 74 percent of the global workforce in 1975. By 2018 that was 51.7 percent and by 2050 it is predicted to be 42.5 percent. Peak (absolute) global agricultural employment has passed—it was higher in 1995 than since then or forecast to 2050. As a share of total employment, agriculture will fall from 28.6 in 2018 to 24.8 percent in 2050, bringing it to considerably less than half of its employment share in 1975 (which was 56 percent). The absolute number of manufacturing jobs will fall worldwide between now and 2050. In 1975, manufacturing employed 13.3 percent of the global workforce, this had climbed to 14.3 percent in 2018, but will decline to 9.6 percent in 2050. Picking up the slack will be private services (wholesale, accommodation, food, transport, ICT, finance, insurance real estate and business services). From accounting for 14 percent of global employment in 1975, these sectors' shares have risen to 27.2 percent today and will climb to 36.8 percent by 2050. The employment shift is toward sectors which are forecast to see fairly low productivity *growth*, but transport, communication, finance and business services see very high productivity *levels*, while agriculture is very low productivity, so sectoral shifts overall are forecast to be a considerable positive force for growth.

Most of these results broadly hold across (current) income groupings (See Annex 1). Our forecasts suggest that even in low income countries, manufacturing employment will only maintain its employment share (at 7.7 percent). It is also predicted to see comparatively sluggish productivity growth, and overall productivity growth is driven in large part by the shift into services. In upper middle-income countries, manufacturing employment is forecast to fall from 17.8 to 9.9 percent while transport, communications finance and business services climb from 7.5 percent to 15.6 percent. High income countries, where the transition to services is already far advanced, will see comparatively limited sectoral reallocation of employment although the model does suggest high-income agricultural employment will reach zero (!). More than in developing countries, overall productivity is driven by productivity growth within sectors.

This forecast world sees both farms and factories empty out worldwide while ever more people work in offices, shops and restaurants. The results are driven by three forces: the general evolution of labor shares in each sector with GDP (the historical pattern of structural transformation that is a feature of the literature); a secular change over time in the share of employment in each sector (that is, over time, some sectors increase or decrease in their employment share for any given level of GDP per capita); and a country effect (cross-country differences in each country's share of employment in each sector that are constant over time).

Our forecast illustrates some characteristics of the ways in which economic transformation might happen in the future. Note, though, that the projections are essentially deterministic: they observe what has happened in the past and use them to engineer estimates of what will happen in the future, assuming that past trends extend forward.

Again, we have assumed a certain amount of growth is going to happen and asked what this implies for sectoral shares. For those that argue manufacturing is a unique force for economic growth, this process is the wrong way around: the growth will not be achieved if manufacturing declines as we predict. That is, if there is a secular shift away from manufacturing over time (as our results suggest), GDP per capita growth will be slower, and the sectoral reallocation will be slower than we predict here.

We do not provide confidence intervals on our projections. Suffice it to say that they would be very large indeed: the underlying growth forecasts are subject to *considerable* uncertainty even if the underlying relationship between correlates and income remains unchanged and then there are further and once again considerable uncertainties regarding the relationship between income, time and country factors and sectoral shares again even if those underlying relationships remain unchanged.[16]

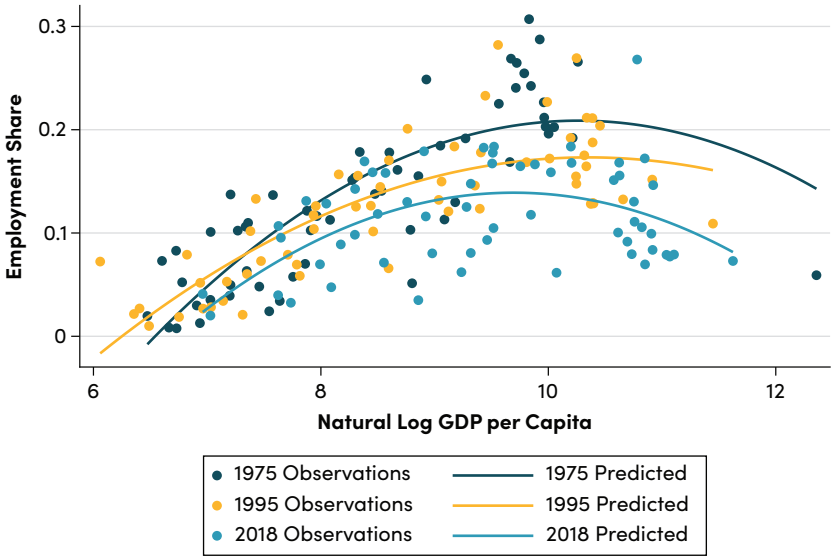
Instead, in the next section, we discuss the main results from the literature on observed processes of structural transformation to ask if the forecast of continued convergence is plausible. First, we note there are reasons to think the manufacturing picture might be brighter than Rodrik's concerns and our forecasts both suggest and second, we examine if it is plausible to imagine the world closer to what we have forecast: of declining opportunities for manufacturing led growth while convergence of the last decades continues? Is a shift into services sufficient to sustain opportunities for growth in developing countries?

16 Nor do we undertake scenarios analysis, in which we speculate alternative patterns of sectoral reallocation. As will become clear in the next section, we use our models to provide an idea of what change might look like if the patterns of the future are the patterns of the past; and we discuss why the future might reasonably deviate from this. This discussion, driven by the academic literature on structural transformation, is effectively a substitute to scenarios analysis.

3. Assessing the prospects for premature deindustrialization

The data we use certainly supports the historical narrative of a declining manufacturing share and rising services share over time and across countries, as illustrated in Figure 1. The figure reports predicted sectoral employment share using our model at a given income level at three different periods in time (1975, 1995 and 2018. It shows that at any given income, the proportion of people working in manufacturing is declining over time.

FIGURE 1. Manufacturing employment as a function of GDP



But the model is driven to some extent by the fact that a very large country (China) has taken an outsized share of global manufacturing employment; as of 2022, China accounted for roughly 27% of global manufacturing.[17] Over the covered period, China's share of manufacturing output within our sample countries has increased from 10.4% in 1975, to roughly 30% in 2018. It may have further to go; our forecast predicts that China's share of manufacturing output in the study countries might rise to 43.7% in 2050 (this even as the sector accounts for a lower percentage of Chinese output and employment). The comparative good news is that this still suggests an absolute growth in manufacturing output outside of China, likely to be concentrated at the low-skilled end. And because our model predicts that in 2018, China should have a 14 percent manufacturing employment share where it is in fact it is 18 percent, our global forecast for manufacturing employment may be depressed: it does not account for any 'pick-up' effect of China's divestment of low-productivity global manufacturing might have for other countries (although of course, China's share may remain elevated, further consolidating its relative lead in a shrinking global manufacturing sector).

17 See China Share of manufacturing—data, chart | TheGlobalEconomy.com.

This finding is reflected in the literature. Szirmai notes China experienced a peak in manufacturing employment share that was higher than the peak in the average advanced economy and Haraguchi et al. (2017) find that while the manufacturing sector's global value added and employment share have not changed significantly since 1970, developing countries as a group are seeing a rising share driven by China, which may be on the cusp of shedding some of that share as it gets richer.[18] There is linked evidence that regions including Sub-Saharan Africa have seen rising manufacturing employment over the last few years, which has increased employment particularly in unregistered firms.[19]

China satisfies a large portion of manufacturing demand in other countries. Chinese manufactures accounted for more than 40% of global exports in some categories at their peak. To the extent that this demand persists (and while higher incomes are accompanied by a *relative* decline in the demand for manufactured goods, there is little evidence yet that *absolute* demand falls), it will need to be satisfied. There are three possibilities for how this may happen. The first is that other countries will assign more of their labor to manufacturing for export; the second is that manufacturing will become more technologically sophisticated and less labor will be used to meet global demand; and the third is that China will simply retain its outsized share of global manufacturing employment, perhaps through relocating production to currently less-industrialized areas.[20]

Our forecast effectively assumes some of the third channel, captures some element of the second, and is unable to account for the first. (Note on the second channel, the evidence of a rapid uptick in the speed of manufacturing automation is limited: we have not (yet) seen a step change in robot productivity or robotization, nor a dramatic change in employment in response to automation[21]). But to the extent that China's sectoral shift opens up the possibility of some global manufacturing moving to new locations, our model is too pessimistic on the manufacturing prospects of poor countries as a whole.

18 Szirmai, A. (2012, December). Industrialisation as an engine of growth in developing countries, 1950–2005. Structural Change and Economic Dynamics 23(4), 406–420. Haraguchi, N., Cheng, C. F. C., & Smeets, E. (2017). The importance of manufacturing in economic development: has this changed? World Development, 93, 293–315.

19 Kruse, H., Mensah, E., Sen, K., & de Vries, G. (2022). A manufacturing (re) naissance? Industrialization in the developing world. IMF Economic Review, 1–35. See also Xinshen Diao & Kenneth Harttgen & Margaret McMillan, 2017. "The Changing Structure of Africa's Economies," The World Bank Economic Review, vol 31(2), pages 412–433, who report a shift out of agriculture into a (slowly) growing manufacturing sector as well as services, both of which are higher-productivity. See also eboah, F. K., & Jayne, T. S. (2016). Africa's Evolving Employment Structure (No. 259511). Retrieved from Michigan State University, Department of Agricultural, Food, and Resource Economics, Feed the Future Innovation Lab for Food Security (FSP).

20 Hanson, G. H. (2021). *Who will fill China's shoes? The global evolution of labor-intensive manufacturing* (No. w28313). National Bureau of Economic Research.

21 Scholl, K., & Hanson, R. (2020). Testing the automation revolution hypothesis. *Economics Letters*, *193*, 109287. Hötte, K., Somers, M., & Theodorakopoulos, A. (2022). Technology and jobs: A systematic literature review. *arXiv preprint arXiv:2204.01296*. Lian, Weicheng, et al. "The price of capital goods: a driver of investment under threat." *IMF Economic Review* 68.3 (2020): 509–549. Fujiwara, I., Kimoto, R., Shiratsuka, S., & Shirota, T. (2021). Measuring Robot Quality: Has Quality Improvement Slowed Down?

This is not, of course, the only way in which a deterministic model may lead us astray; other factors may also lead to an increase in the pace and extent of the shift into manufacturing in currently poor countries. But beyond this, there are other reasons why, even if our projections are accurate for the fate of manufacturing jobs, they may not be cause for considerable alarm. We turn to these next.

4. How unique is manufacturing?

Even if our model is accurate in predicting the future of manufacturing in developing countries, pessimism inspired by Rodrik's work may be unfounded on two grounds: first, it may be based on a faulty understanding of the process of past structural transformation even if the empirical facts the thesis is based on (that the share of manufacturing achieved was higher for longer in countries that developed in the past) are correct. And secondly, it may fail to adequately account for future changes that counteract the impact of a smaller role for manufacturing in economies as they develop in the future. We consider both in this section, and both amount to questioning how uniquely valuable manufacturing is to the process of economic development.

Two characteristics are typically cited in accounts of what makes manufacturing special in the process of economic development. The first is that some of the tasks that make up the manufacturing process are easy to copy and tend to be improved regularly over time. Once a kettle is designed, it is easy for the people building its parts or assembling it to copy the exact same design or something similar; once the design is improved, it does not take long for the improvements to be learnt by all producers. Secondly, once a kettle is made, anywhere in the world, it enters into competition with kettles made everywhere else (in the absence of any artificial restraints to trade). A kettle made in Ghana has to compete with a kettle made in Kenya—and even one made in Japan, China or the UK. It's this force of competition that pushes producers everywhere to adopt the latest techniques to make their kettles as well and as cheaply as those made elsewhere. These are the forces that drive Rodrik's claim that manufacturing is unique in demonstrating unconditional convergence to the global productivity frontier, and thus providing a uniquely powerful pathway to growth.

How accurate is this account? There are two reasons it may be a bad guide to future prospects of developing countries. It may overstate the historical uniqueness of manufacturing in embodying these characteristics and it may understate the role of other, simultaneous changes in economic structure that drove historical growth episodes. There is evidence that both are true.

Agriculture can provide a powerful force for growth for poorer countries: Dieppe and Matsuoka find both within-sector productivity growth and sectoral reallocation have become important drivers of labor productivity β-convergence (more rapid growth in poorer countries), and that agricultural productivity growth has been the most significant contributor to *overall* β-convergence across countries (even though there has not been recent convergence within the agriculture sector globally). This points to the first weakness in the manufacturing-driven account of economic development:

that it underplays the importance of active changes in the agricultural sector especially in countries with a high agriculture share, which can be understood as more than simply a reservoir of labor and resources waiting for reallocation to the real business of manufacturing. It appears agricultural productivity is not significantly constrained by land quality or other geographic features, suggesting considerable remaining upside potential for regions of the world where productivity is low.[22] In the case of sub-Saharan Africa, low productivity is not a particular mystery; there has been long-standing and substantial underinvestment in agricultural research and development over many years (Suri and Udry 2022), and recent work has identified large productivity and growth effects from the innovations that underlay the Green Revolution in India.[23] Further, a growing body of research suggests substantial misallocation of labor and land in the agricultural sector.

More generally, accounts of structural transformation which provide a uniform role for the agricultural sector are inappropriate given the heterogeneity of the sector and its role as economies develop; in some cases it may simply respond to changes in productivity in other sectors, but in others may take a more active role in the process of structural transformation (Gollin 2021). In terms of our analysis for the future prospects of today's poorer countries this suggests that agriculture may potentially be a source of convergence in African countries which are currently characterized by extremely low levels of agricultural productivity and low historical investment in locally-valuable innovation. Increasing relative productivity in this sector may partially offset lower and shorter peak manufacturing shares.

The manufacturing-focused accounts of Rodrik and similar authors may also understate the historical role for services in convergence and economic development. Three factors should be distinguished: first that the division between manufacturing and services is as much statistical artifact as practical difference, second that structural transformation into *services* has also been an important part of economic development, and third that the productivity and tradability of services is now higher than conventional accounts suggest.

Economic sectors are artificial constructs, developed for accounting and analytical convenience, and only imperfectly mapping to a conceptual understanding of the different kinds of activity that constitute an economy. We typically think of the production of say, an electric kettle to be 'manufacturing'; but on a closer inspection of its constituent tasks, things become more complex. There is design of the kettle, the building of its core mechanical and electrical parts, its assembly

22 https://voxdev.org/topic/agriculture/can-geography-explain-agricultural-productivity-differences-across-countries.

23 Suri, Tavneet, and Christopher Udry. 2022. "Agricultural Technology in Africa." *Journal of Economic Perspectives*, 36(1), 33–56. Gollin, D., Hansen, C. W., & Wingender, A. M. (2021). Two blades of grass: The impact of the green revolution. *Journal of Political Economy*, 129(8), 2344–2384. Note, though, that Gollin et al are relatively pessimistic about the prospects of a similar Green Revolution in Africa, for a number of reasons. First, the consumption patterns of African consumers is different to that observed in Asia, and no single product is as important in their basket of goods as rice was in South Asia. Second, famers in Africa do not necessarily seek to increase yields above all else: in many cases they prefer labour-saving innovation to engage in non-farm work. And thirdly, the relationship between African cities and their rural hinterlands is very different to that observed in Asia in the 1960s.

into a unit, its painting, cleaning and packaging into a box and its labelling and marketing and so on. The boxes are packed into a crate, and it gets transported somewhere at home or abroad, and then unpacked in a shop or warehouse before being handed over to customer, in either a retail shop or via home delivery. This process probably encompasses around four sectors,[24] with some arbitrary distinctions drawn for the convenience of counting. The kettles being put in a box in the factory is counted as a manufacturing activity; being taken out of the same box in a shop is a service.

What's more industrial reorganization also affects how labor shares in different sectors are calculated. All workers in a firm characterized as manufacturing are classed as manufacturing workers, so janitors, lawyers, accountants and security specialists employed directly by the firm are counted as manufacturing workers. If such functions are outsourced to specialist firms full of lawyers, janitors, accountants and security specialists, the same people doing the same jobs are now part of the service sector (Gollin 2018). This specialization has been documented in the context of inter-firm inequality, but has important implications for how we think about 'sectors' in the economy and their role in transformation.[25]

Relatedly, the role of services in structural transformation is clear even among countries undergoing structural transformation and income convergence in the 19th and early/middle 20th Centuries. Both the US and Germany, for example, did industrialize rapidly and substantially, but their income convergence was largely driven by a shift of labor from agriculture and into services.[26] And much of the sectoral change that has undergirded recent economic growth in developing countries has involved movement from low productivity agriculture to high productivity services, even if those services themselves see low productivity *growth*.[27] As we have seen, our forecasts suggest that trend will continue.

Furthermore, there is evidence of productivity convergence within countries across sectors and across countries within sectors: manufacturing does not appear unique. Using the Dieppe and Matsuoka dataset we produce a global average coefficient of variation of sectoral productivity at the country level.[28] The results suggest evidence of sigma convergence of productivity across sectors within countries, with the average weighted coefficient of variation declining over time (the decline is particularly dramatic if mining is excluded, although note there is a slight rise in the average

24 Depending on exactly how different processes are defined, 'Professional Scientific and Technical Activities', 'Production', 'Transportation and Storage' and 'Retail and Wholesale Services'.

25 Jae Song and others, Firming Up Inequality, *The Quarterly Journal of Economics*, Volume 134, Issue 1, February 2019, Pages 1–50

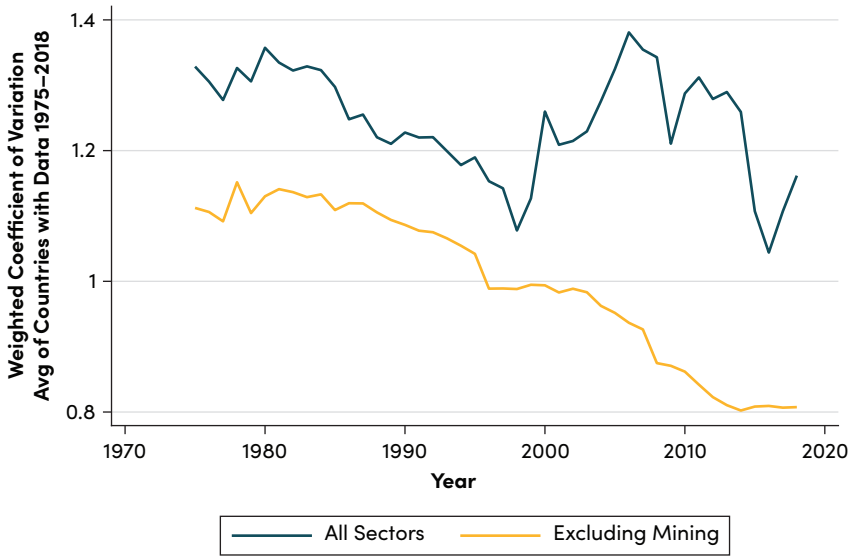
26 Broadberry, S. N. (1998). How Did the United States and Germany Overtake Britian? A Sectoral Analysis of Comparative Productivity Levels, 1870–1990. *The Journal of Economic History*, *58*(2), 375–407.

27 Dieppe, A., & Matsuoka, H. (2021). Sectoral Decomposition of Convergence in Labor Productivity.

28 Thew process: (i) calculate the weighted (by country-sector employment) average of sectoral productivity in the country, then (ii) calculate the weighted (by country-sector employment) standard deviation of sectoral productivity in the country, (iii) divide the weighted standard deviation by the weighted average to get weighted coefficient of variation and then (iiv) average those results across countries.

unweighted coefficient of variation with and without mining). This convergence suggests structural transformation is working to equalize the productivity of labor.

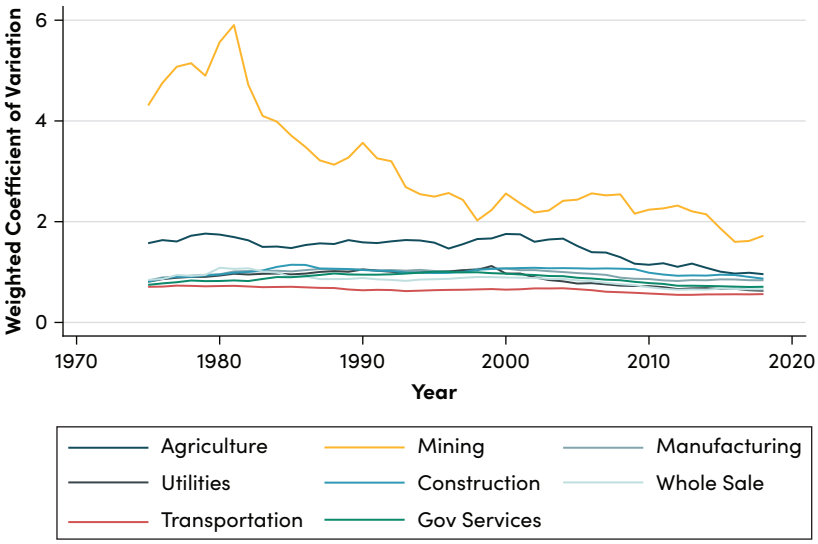
FIGURE 2. Average weighted coefficient of variation over time



We also calculate cross-country sectoral sigma convergence.[29] On average, the weighted coefficient of variation has fallen from around 1.4 in the 1970s and 1980s to below 0.9 today, and there is strong evidence of sigma convergence across a range of sectors using both weighted and unweighted approaches. The unweighted coefficient of variation of productivity for our fixed sample over 1975–2018 has declined from 1.24 to 1.08 for agriculture, 2.07 to 0.77 for wholesale, accommodation and food service activities and 1.08 to 0.68 for transport, information, finance and real estate. This compares to a *rise* in the coefficient of variation from 0.75 to 0.83 for manufacturing (!). Looking at Beta convergence (a negative relationship between initial level and growth), every sector shows evidence of convergence across countries between 1975 and 2018 (statistically significant at p=0.05 for all but mining and wholesale), with agriculture, utilities and government services outperforming manufacturing in the speed of that convergence. In the period 1995–2018, manufacturing convergence appears to have considerably slowed (to the point of statistical insignificance) while it has significantly increased in agriculture and utilities (Full details in Annex 3).

29 The process: (i) calculate the weighted (by country-sector employment) average of productivity in the sector across countries (Argentina agriculture productivity, Belize agriculture productivity… etc, weighted by Argentina agricultural employment, Belize agricultural employment…. etc), then (ii) calculate the weighted (by country-sector employment) standard deviation of productivity in the sector across countries, (iii) divide the weighted standard deviation by the weighted average to get weighted coefficient of variation.

FIGURE 3. Weighted coefficients of variation over time



This result is reflected in the literature. Ghani and O'Connell note services convergence across countries has been more rapid than manufacturing convergence 1990–2010, suggesting that manufacturing is not the only sector where learning across borders is possible, and fast.[30] Similarly, Szirmai suggests that manufacturing's significance as a source of growth was greatest 1950–73 and has declined since then.[31] Services have been characterized by substantial learning-by-doing and learning across countries.[32] Finance, communications and transport are among services sectors that see rapid productivity growth and can drive convergence.[33] Furthermore services are becoming a larger share of global demand. Consumption of manufactured goods as a percentage of total consumption has been trending downwards for decades across rich countries.[34] The same applies to agriculture.[35] And rising services exports means the impetus to increase productivity in employment-generating services sectors is growing (Kenny 2019).[36] Services trade has been rising as a percentage of output—in transportation, information and communication, finance, insurance, real estate and business services at rates far faster than manufacturing (See Annex 4). Services account for thirty percent of the value of manufactured exports, intangible assets (brand, design and

30 Ghani, E., & O'Connell, S. D. (2014). Can service be a growth escalator in low-income countries? (No. WPS6971; pp. 1–25). Retrieved from The World Bank.

31 Szirmai, A. (2009). Industrialisation as an engine of growth in developing countries (No. 010). Retrieved from United Nations University—Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT).

32 Gollin, D. 2018. Structural transformation without industrialization. Pathways for Prosperity Commission Background Paper Series; no. 2. Oxford. United Kingdom Gollin further argues that the historical account of structural transformation assumes a causal relationship between industrialization and development for which only weak evidence exists in the data.

33 Duarte, M., & Restuccia, D. (2020). Relative prices and sectoral productivity. *Journal of the European Economic Association*, *18*(3), 1400–1443.

34 Herrendorf, B., Rogerson, R., & Valentinyi, Á. (2013). Growth and Structural Transformation (Working Paper No. 18996).

35 Comin, D., Lashkari, D., & Mestieri, M. (2021). Structural change with long-run income and price effects. Econometrica, 89(1), 311–374. Herrendorf, B., Rogerson, R., & Valentinyi, A. (2014). Growth and structural transformation. Handbook of economic growth, 2, 855–941.

36 Kenny, C. (2019). Automation and AI: Implications for African Development Prospects? CGD Note, 2019.

other IP) contribute value on top of that and digital services are largely uncaptured in trade statistics. Add these three issues together and services trade may already be larger than goods trade.[37]

This points to another reason for optimism in the face of our manufacturing projections. The future role of services may be even more important in structural transformation than the above analysis suggests. Given trends in technology, education and how services are delivered, services may now demonstrate greater learning from the frontier characteristics, and greater tradability, and consequently be subject to stronger pressure to adopt best practices. Examples include the rapidly expanding online gig workforce, already above 4.4 percent of the global labor force, which is seeing particularly fast growth rates in developing countries.[38] This is the kind of change in services employment that allows for greater productivity In other words, with changing technologies, services are becoming more like the literature imagines that only manufacturing is like.

It is true that both global demand for goods is rising more slowly than for services and that productivity increases in goods output is rising faster than in services, so that the employment opportunities in tradeable goods production are falling and this fall is absolutely larger than any increase in employment opportunities in tradeable services. The net result is that 'classically tradeable employment' (involving production that can be performed at a distance from consumption) is falling.[39] Related to that, the services for which demand is growing in rich countries are hard to provide from a distance, including care services.[40] Even many 'offshoreable' service jobs have their challenges. Jobs that can be done remotely often rely on strong oral and written expression, language and soft skills at least partly specific to particular contexts. While medical transcription can be offshored along with software engineering, sales and marketing is harder. Regulatory agencies and accreditation lag the ability of people not based in a country to deliver services of a sufficient quality (think of therapy delivered by video conferencing, which may require medical certification in the country of the consumer; or accounting or legal advice offered electronically, also regulated in the country whose legal system the accounts or contract are engaged for). These will be reasons that distance has a negative effect on service trade flows that is larger than the effect in gravity estimates of goods trade, one that holds across different subsectors of services trade. Based on this Baldwin and Dingel conclude "the number of offshored jobs is unlikely to be transformative when it comes to the development paths of most emerging economies."[41] It also suggests that limits on the movement of people may be a binding constraint on seeking service exports opportunities.

At the same time, there are signs that those constraints are weakening. And a greater role for services in global demand, increasing ability for service providers to learn from the frontier,

37 https://www.mckinsey.com/featured-insights/innovation-and-growth/globalization-in-transition-the-future-of-trade-and-value-chains.

38 Datta, N., Rong, C., Singh, S., Stinshoff, C., Iacob, N., Nigatu, N. S & Klimaviciute, L. (2023). Working Without Borders: The Promise and Peril of Online Gig Work. Washington DC: World Bank.

39 Chen, L., Felipe, J., Kam, A. J., & Mehta, A. (2021). Is employment globalizing? *Structural Change and Economic Dynamics*, *56*, 74–92.

40 Arntz, Melanie, Terry Gregory, and Ulrich Zierahn. 2017. "Revisiting the Risk of Automation." Economics Letters 159 (October): 157–60.

41 Baldwin, R., & Dingel, J. I. (2021). Telemigration and development: On the offshorability of teleworkable jobs. In *Robots and AI* (pp. 150–179). Routledge.

and increased tradability all suggest that to whatever extent manufacturing has been unique it is becoming less so. For what they are worth, our trade projections in Annex 4 suggest while manufacturing exports as a percentage of global GDP may remain close to their current level, exports in transportation, information and communication, finance, insurance, real estate and business services might rise from 4.6 to 9.8 percent of global GDP between 2018 and 2050, with the shift toward services exports particularly pronounced in low and lower middle income countries.

5. Conclusion and policy implications

Historically, a high manufacturing share has been a consistent part of the growth stories of countries that are rich today. But there is strong evidence that manufacturing shares are peaking lower and earlier and our forecasts illustrate how that process may continue. Does this spell doom for the growth prospects of low and middle income countries and imply forecasting continued income convergence is contradictory? We suggest not.

First, the manufacturing route may be narrower, but it is still there: assuming China deindustrializes there will be considerable opportunities for other countries and little evidence that automation is about to take all of those opportunities away. Second, the uniqueness of manufacturing is overstated, and there are important routes to convergence through productivity gains in agriculture and services. Previously, very fast growth may be something that has largely been achieved using non-universally-replicable strategies. From the UK industrial revolution onward, manufacturing led growth has taken the form of exporting a lot of manufactured goods –not every country can do that at once. To the extent that growth becomes more reliant on improving productivity in less exported sectors, it may become more replicable. At the same time, service exports are likely to increase.

Furthermore, at a 'root causes' level, supporters of the centrality of institutions have always argued it is about 'getting services right'—in particular government services. It is the provision of public infrastructure and regulation that determines where will attract, retain and expand globally competitive industry. Something similar holds for those who believe in the centrality of human capital, with a greater focus on education as the 'root' service that needs focus. In the future, these viewpoints probably have even more to offer—as global demand for manufactures and agriculture continues to lag, getting services right will be increasingly important for economic growth as well as quality of life. Convergence and growth will be more rapid if countries try to expand employment opportunities in the services that are seeing more rapid productivity growth including finance, ICT and ICT-enabled service production.

That said, any 'export-led' model through services in particular is likely to demand greater freedom of movement. If the traditional path to rapid development was to move manufacturing jobs to poor places, the new model may be to move poor people to services employment in rich places. As global forecasts suggest a slowdown in richer country growth rates considerably driven by a declining workforce, this would be a beneficial path for poor countries and rich ones alike.

Annexes

Annex 1

	Model 1							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transport**	**Gov. Serv.**
Log GDP per Capita	−0.287***	0.0198***	0.295***	0.00969***	0.0308***	0.113***	−0.118***	−0.0634***
	(0.0151)	(0.00198)	(0.00862)	(0.00129)	(0.00504)	(0.00706)	(0.00578)	(0.00933)
Log GDP per Capita Squared	0.0138***	−0.00106***	−0.0169***	−0.000516***	−0.000393	−0.00641***	0.00754***	0.00391***
	(0.000875)	(0.000115)	(0.000499)	(7.46e-05)	(0.000292)	(0.000408)	(0.000334)	(0.000540)
Year	−0.00343***	−7.30e-05***	−0.000399***	−2.52e-05***	−0.000293***	0.00187***	0.00121***	0.00114***
	(0.000103)	(1.35e-05)	(5.87e-05)	(8.78e-06)	(3.43e-05)	(4.81e-05)	(3.94e-05)	(6.35e-05)
Australia	−0.595***	0.00647***	0.0674***	0.00932***	−0.0196***	0.152***	0.0801***	0.299***
	(0.0146)	(0.00192)	(0.00832)	(0.00125)	(0.00487)	(0.00682)	(0.00558)	(0.00901)
Austria	−0.569***	−0.00549***	0.127***	0.00821***	−0.0249***	0.148***	0.146***	0.171***
	(0.0145)	(0.00190)	(0.00823)	(0.00123)	(0.00482)	(0.00675)	(0.00552)	(0.00892)
Bahrain	−0.623***	0.00358*	0.0538***	0.00472***	0.0816***	0.0824***	0.0931***	0.304***
	(0.0140)	(0.00183)	(0.00796)	(0.00119)	(0.00466)	(0.00652)	(0.00534)	(0.00862)
Bangladesh	−0.239***	−0.00404***	0.0250***	−0.000802	0.00215	0.0775***	0.0701***	0.0691***
	(0.00967)	(0.00127)	(0.00551)	(0.000824)	(0.00322)	(0.00451)	(0.00370)	(0.00597)
Belgium	−0.620***	−0.00561***	0.110***	0.00563***	−0.0338***	0.113***	0.190***	0.242***
	(0.0144)	(0.00189)	(0.00822)	(0.00123)	(0.00481)	(0.00673)	(0.00551)	(0.00890)
Burkina Faso	0.0290***	0.00535***	−0.0311***	−0.00212***	−0.0114***	0.0143***	0.00789**	−0.0120**
	(0.00941)	(0.00123)	(0.00536)	(0.000802)	(0.00314)	(0.00439)	(0.00359)	(0.00580)
Cambodia	−0.0853***	−0.00332***	−0.0142***	−0.00183**	−0.00469	0.0668***	0.0249***	0.0177***
	(0.00952)	(0.00125)	(0.00542)	(0.000812)	(0.00317)	(0.00444)	(0.00364)	(0.00587)
Cameroon	−0.0390***	−0.00570***	−0.0367***	−0.00192**	−0.0212***	0.0340***	0.0360***	0.0345***
	(0.0102)	(0.00134)	(0.00583)	(0.000873)	(0.00341)	(0.00478)	(0.00391)	(0.00632)
Chile	−0.551***	0.00891***	0.00347	0.00108	0.00518	0.0690***	0.143***	0.319***
	(0.0124)	(0.00162)	(0.00705)	(0.00106)	(0.00413)	(0.00578)	(0.00473)	(0.00764)
China	−0.192***	0.00501***	0.0541***	0.000676	0.00891**	−0.00235	0.0353***	0.0899***
	(0.0107)	(0.00140)	(0.00609)	(0.000912)	(0.00357)	(0.00499)	(0.00409)	(0.00660)
Colombia	−0.387***	−0.00290*	0.00629	−0.00203**	−0.0162***	0.128***	0.149***	0.126***
	(0.0120)	(0.00157)	(0.00681)	(0.00102)	(0.00398)	(0.00557)	(0.00457)	(0.00737)
Costa Rica	−0.433***	−0.00794***	0.0478***	0.0111***	−0.00402	0.107***	0.105***	0.174***
	(0.0122)	(0.00160)	(0.00696)	(0.00104)	(0.00408)	(0.00571)	(0.00467)	(0.00754)

Model 1								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transport**	**Gov. Serv.**
Denmark	−0.596***	−0.00678***	0.0853***	0.00326***	−0.0316***	0.129***	0.146***	0.271***
	(0.0146)	(0.00191)	(0.00831)	(0.00124)	(0.00486)	(0.00680)	(0.00557)	(0.00899)
Egypt	−0.381***	−0.00497***	0.0260***	0.00743***	0.0395***	0.0461***	0.0868***	0.180***
	(0.0106)	(0.00139)	(0.00605)	(0.000906)	(0.00354)	(0.00496)	(0.00406)	(0.00656)
Ethiopia = o,	–	–	–	–	–	–	–	–
Fiji	−0.527***	0.00557***	0.0630***	0.0406***	−0.00179	0.0954***	0.152***	0.173***
	(0.0115)	(0.00151)	(0.00657)	(0.000983)	(0.00384)	(0.00538)	(0.00441)	(0.00711)
Finland	−0.563***	−0.00555***	0.118***	0.00631***	−0.0213***	0.0901***	0.148***	0.228***
	(0.0143)	(0.00188)	(0.00815)	(0.00122)	(0.00477)	(0.00667)	(0.00547)	(0.00882)
France	−0.592***	−0.00683***	0.0804***	0.00682***	−0.0269***	0.106***	0.181***	0.251***
	(0.0144)	(0.00188)	(0.00818)	(0.00122)	(0.00479)	(0.00670)	(0.00549)	(0.00885)
Germany	−0.615***	−0.00267	0.159***	0.00943***	−0.0246***	0.112***	0.153***	0.209***
	(0.0144)	(0.00189)	(0.00822)	(0.00123)	(0.00481)	(0.00674)	(0.00552)	(0.00891)
Ghana	−0.189***	0.00108	0.0192***	−0.000463	−0.0204***	0.107***	0.0373***	0.0451***
	(0.0106)	(0.00138)	(0.00601)	(0.000900)	(0.00352)	(0.00493)	(0.00403)	(0.00651)
India	−0.172***	−0.000352	0.0353***	−1.62e-05	0.0198***	0.0272***	0.0554***	0.0346***
	(0.00990)	(0.00130)	(0.00563)	(0.000843)	(0.00330)	(0.00462)	(0.00378)	(0.00610)
Indonesia	−0.229***	0.000736	0.00813	−0.00298***	−0.00857**	0.103***	0.0495***	0.0790***
	(0.0108)	(0.00142)	(0.00616)	(0.000922)	(0.00360)	(0.00504)	(0.00413)	(0.00667)
Iran	−0.431***	−0.000990	0.0619***	0.00472***	0.0604***	0.0453***	0.0909***	0.169***
	(0.0117)	(0.00153)	(0.00665)	(0.000995)	(0.00389)	(0.00545)	(0.00446)	(0.00720)
Italy	−0.572***	−0.00713***	0.139***	0.00633***	−0.0244***	0.130***	0.130***	0.198***
	(0.0143)	(0.00187)	(0.00812)	(0.00122)	(0.00476)	(0.00666)	(0.00545)	(0.00880)
Japan	−0.564***	−0.00719***	0.127***	0.00362***	−0.00443	0.111***	0.0766***	0.257***
	(0.0143)	(0.00187)	(0.00814)	(0.00122)	(0.00477)	(0.00667)	(0.00546)	(0.00882)
Kenya	−0.115***	−0.00334**	−0.0118**	−0.00163*	−0.0155***	0.0398***	0.0404***	0.0675***
	(0.0100)	(0.00132)	(0.00571)	(0.000855)	(0.00334)	(0.00468)	(0.00383)	(0.00619)
Lao People's Dem Rep.	0.0400***	−0.00295**	−0.0588***	0.000829	−0.0171***	−0.0175***	0.0119***	0.0435***
	(0.00973)	(0.00128)	(0.00554)	(0.000829)	(0.00324)	(0.00454)	(0.00372)	(0.00600)
Lesotho	−0.366***	0.0198***	−0.0101*	0.00228***	0.0353***	0.00762*	0.0534***	0.258***
	(0.00970)	(0.00127)	(0.00553)	(0.000827)	(0.00323)	(0.00453)	(0.00371)	(0.00598)
Luxembourg	−0.631***	−0.00523**	0.134***	0.00908***	−0.00361	0.144***	0.219***	0.133***
	(0.0161)	(0.00211)	(0.00917)	(0.00137)	(0.00537)	(0.00751)	(0.00615)	(0.00993)

Model 1								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transport**	**Gov. Serv.**
Malawi	0.000584	−0.00271**	−0.0305***	−0.000289	0.00519*	0.0119***	0.0164***	−0.000601
	(0.00931)	(0.00122)	(0.00530)	(0.000794)	(0.00310)	(0.00434)	(0.00356)	(0.00574)
Malaysia	−0.442***	−0.00296*	0.0847***	0.000660	0.00438	0.128***	0.0868***	0.140***
	(0.0125)	(0.00164)	(0.00712)	(0.00107)	(0.00417)	(0.00584)	(0.00478)	(0.00771)
Mauritius	−0.511***	−0.00750***	0.134***	0.0178***	0.0275***	0.0810***	0.126***	0.133***
	(0.0125)	(0.00164)	(0.00711)	(0.00106)	(0.00416)	(0.00582)	(0.00477)	(0.00769)
Mexico	−0.449***	−0.00432***	0.0811***	−0.000223	−0.0138***	0.141***	0.0616***	0.183***
	(0.0128)	(0.00168)	(0.00728)	(0.00109)	(0.00426)	(0.00596)	(0.00488)	(0.00788)
Mongolia	−0.347***	0.0143***	0.00231	0.0103***	0.00704**	0.0683***	0.0857***	0.159***
	(0.0106)	(0.00139)	(0.00602)	(0.000901)	(0.00352)	(0.00493)	(0.00404)	(0.00652)
Morocco	−0.258***	−0.000105	0.0221***	−0.000338	0.0265***	0.0736***	0.0490***	0.0872***
	(0.0110)	(0.00144)	(0.00625)	(0.000936)	(0.00366)	(0.00512)	(0.00420)	(0.00677)
Mozambique	−0.00899	0.00212*	−0.0160***	−0.000872	0.00567*	0.0110**	0.00890**	−0.00177
	(0.00920)	(0.00121)	(0.00524)	(0.000784)	(0.00307)	(0.00429)	(0.00351)	(0.00567)
Myanmar	−0.169***	0.00793***	0.0205***	−0.00144*	0.00311	0.0456***	0.0756***	0.0178***
	(0.00942)	(0.00123)	(0.00536)	(0.000803)	(0.00314)	(0.00439)	(0.00360)	(0.00581)
Namibia	−0.289***	0.0170***	−0.0554***	0.00429***	−0.00776**	0.0474***	0.0792***	0.204***
	(0.0116)	(0.00152)	(0.00661)	(0.000989)	(0.00387)	(0.00542)	(0.00443)	(0.00716)
Nepal	−0.0133	−0.00327***	−0.0219***	0.00371***	−0.00250	0.00325	0.0153***	0.0187***
	(0.00939)	(0.00123)	(0.00534)	(0.000800)	(0.00313)	(0.00438)	(0.00359)	(0.00579)
Netherlands	−0.610***	−0.00673***	0.0693***	0.00260**	−0.0300***	0.134***	0.224***	0.216***
	(0.0147)	(0.00193)	(0.00837)	(0.00125)	(0.00490)	(0.00685)	(0.00561)	(0.00906)
Nigeria	−0.102***	−0.00268**	0.00931*	−0.00155*	−0.0191***	0.0585***	0.0305***	0.0267***
	(0.00975)	(0.00128)	(0.00555)	(0.000831)	(0.00325)	(0.00455)	(0.00373)	(0.00601)
Norway	−0.592***	0.00748***	0.0741***	0.00681***	−0.0358***	0.117***	0.146***	0.277***
	(0.0149)	(0.00196)	(0.00850)	(0.00127)	(0.00498)	(0.00696)	(0.00570)	(0.00920)
Pakistan	−0.246***	−0.00631***	0.0294***	0.00294***	0.0206***	0.0640***	0.0633***	0.0726***
	(0.0103)	(0.00135)	(0.00589)	(0.000881)	(0.00345)	(0.00482)	(0.00395)	(0.00637)
Philippines	−0.291***	−0.00426***	−0.0121*	−0.000399	-0.00196	0.113***	0.0932***	0.104***
	(0.0109)	(0.00143)	(0.00620)	(0.000928)	(0.00363)	(0.00508)	(0.00416)	(0.00671)
Rep. of Korea	−0.487***	−0.00497***	0.116***	−0.00212*	−0.0104**	0.160***	0.125***	0.104***
	(0.0130)	(0.00171)	(0.00742)	(0.00111)	(0.00434)	(0.00608)	(0.00498)	(0.00804)

Model 1								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transport**	**Gov. Serv.**
Rwanda	0.0712***	−0.00121	−0.0499***	−0.00164**	−0.00259	−0.0283***	0.0113***	0.00119
	(0.00935)	(0.00123)	(0.00532)	(0.000797)	(0.00312)	(0.00436)	(0.00357)	(0.00576)
Senegal	−0.154***	−0.00511***	−0.0180***	6.71e-05	−0.0119***	0.0950***	0.0334***	0.0604***
	(0.0102)	(0.00134)	(0.00582)	(0.000870)	(0.00340)	(0.00476)	(0.00390)	(0.00630)
South Africa	−0.442***	0.0447***	0.0194***	0.00810***	−0.00818**	0.103***	0.116***	0.159***
	(0.0123)	(0.00161)	(0.00698)	(0.00104)	(0.00409)	(0.00572)	(0.00468)	(0.00756)
Spain	−0.558***	−0.00524***	0.0851***	0.00473***	0.00257	0.154***	0.130***	0.187***
	(0.0138)	(0.00180)	(0.00783)	(0.00117)	(0.00458)	(0.00642)	(0.00525)	(0.00848)
Sri Lanka	−0.292***	0.00336**	0.0478***	−0.000969	0.000975	0.0542***	0.0724***	0.114***
	(0.0110)	(0.00144)	(0.00624)	(0.000934)	(0.00365)	(0.00511)	(0.00419)	(0.00676)
Taiwan	−0.528***	−0.00566***	0.216***	0.00458***	−0.0104**	0.147***	0.0701***	0.107***
	(0.0139)	(0.00182)	(0.00792)	(0.00119)	(0.00464)	(0.00649)	(0.00531)	(0.00858)
Thailand	−0.175***	−0.00710***	0.0228***	0.00123	−0.0156***	0.0949***	0.0347***	0.0438***
	(0.0116)	(0.00152)	(0.00662)	(0.000991)	(0.00388)	(0.00543)	(0.00444)	(0.00717)
Turkey	−0.275***	−0.00121	0.0581***	−0.00137	−0.0184***	0.0736***	0.0685***	0.0955***
	(0.0126)	(0.00165)	(0.00718)	(0.00108)	(0.00420)	(0.00589)	(0.00482)	(0.00778)
United Arab Emirates	−0.607***	0.0160***	0.114***	0.0122***	0.0695***	0.143***	0.0247***	0.226***
	(0.0185)	(0.00243)	(0.0106)	(0.00158)	(0.00618)	(0.00865)	(0.00708)	(0.0114)
United Kingdom	−0.625***	−0.00304	0.0819***	0.00673***	−0.0202***	0.150***	0.201***	0.208***
	(0.0143)	(0.00187)	(0.00813)	(0.00122)	(0.00476)	(0.00666)	(0.00545)	(0.00880)
United Rep. of Tanzania	0.0321***	0.00296**	−0.0532***	−0.00185**	−0.0131***	0.0191***	0.0178***	−0.00385
	(0.00950)	(0.00125)	(0.00541)	(0.000810)	(0.00317)	(0.00443)	(0.00363)	(0.00586)
United States	−0.625***	−0.00204	0.0806***	0.00280**	−0.0488***	0.172***	0.163***	0.258***
	(0.0152)	(0.00200)	(0.00868)	(0.00130)	(0.00508)	(0.00711)	(0.00582)	(0.00939)
Viet Nam	−0.125***	−0.00189	0.0151***	−0.000620	0.00762**	0.0410***	0.0374***	0.0269***
	(0.00985)	(0.00129)	(0.00561)	(0.000840)	(0.00328)	(0.00460)	(0.00376)	(0.00608)
Zambia	−0.105***	0.0166***	−0.0347***	0.000989	−0.0108***	0.0402***	0.0517***	0.0412***
	(0.00977)	(0.00128)	(0.00556)	(0.000832)	(0.00326)	(0.00456)	(0.00373)	(0.00602)
Constant	8.983***	0.0632**	−0.377***	0.0103	0.404***	−4.158***	−1.957***	−1.968***
	(0.211)	(0.0277)	(0.120)	(0.0180)	(0.0704)	(0.0986)	(0.0807)	(0.130)
Observations	2,596	2,596	2,596	2,596	2,596	2,596	2,596	2,596
R-squared	0.978	0.723	0.863	0.786	0.871	0.892	0.958	0.937

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model 2					
Variables (All Sectors)					
Log GDP per Capita	−0.360*** (0.0176)	France	−0.422*** (0.0167)	Nepal	−0.148*** (0.0109)
Log GDP per Capita Squared	0.0247*** (0.00102)	Germany	−0.373*** (0.0168)	Netherlands	−0.392*** (0.0171)
Year	−0.00190*** (0.000120)	Ghana	−0.110*** (0.0123)	Nigeria	−0.257*** (0.0113)
Constant	5.952*** (0.246)	India	−0.181*** (0.0115)	Norway	−0.344*** (0.0174)
Australia	−0.398*** (0.0170)	Indonesia	−0.212*** (0.0126)	Pakistan	−0.325*** (0.0120)
Austria	−0.393*** (0.0168)	Iran	−0.489*** (0.0136)	Philippines	−0.236*** (0.0127)
Bahrain	−0.414*** (0.0163)	Italy	−0.471*** (0.0166)	Rep. of Korea	−0.356*** (0.0152)
Bangladsh	−0.215*** (0.0113)	Japan	−0.335*** (0.0166)	Rwanda	0.0517*** (0.0109)
Belgium	−0.485*** (0.0168)	Kenya	−0.0553*** (0.0117)	Senegal	−0.219*** (0.0119)
Burkina Faso	−0.0280** (0.0109)	Lao People's Dem Rep.	−0.0236** (0.0113)	South Africa	−0.390*** (0.0143)
Cambodia	0.0202* (0.0111)	Lesotho	−0.488*** (0.0113)	Spain	−0.473*** (0.0160)
Cameroon	−0.150*** (0.0119)	Luxembourg	−0.363*** (0.0187)	Sri Lanka	−0.337*** (0.0127)
Chile	−0.421*** (0.0144)	Malawi	−0.0941*** (0.0108)	Taiwan	−0.419*** (0.0162)
China	−0.0821*** (0.0124)	Malaysia	−0.318*** (0.0146)	Thailand	−0.122*** (0.0135)
Colombia	−0.350*** (0.0139)	Mauritius	−0.407*** (0.0145)	Turkey	−0.439*** (0.0147)
Costa Rica	−0.358*** (0.0142)	Mexico	−0.369*** (0.0149)	United Arab Emirates	−0.658*** (0.0216)
Denmark	−0.324*** (0.0170)	Mongolia	−0.282*** (0.0123)	United Kingdom	−0.364*** (0.0166)
Egypt	−0.453*** (0.0124)	Morocco	−0.340*** (0.0128)	United Rep. of Tanzania	−0.0655*** (0.0111)
Ethiopia = o,	–	Mozambique	−0.144*** (0.0107)	United States	−0.396*** (0.0177)
Fiji	−0.353*** (0.0134)	Myanmar	−0.257*** (0.0110)	Viet Nam	−0.0591*** (0.0115)
Finland	−0.375*** (0.0166)	Namibia	−0.436*** (0.0135)	Zambia	−0.276*** (0.0114)
Observations: 2,596					
R-squared: 0.851					

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Model 3								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transportation**	**Gov. Serv.**
Log GDP per Capita	−0.296***	0.0922***	0.171***	0.0387***	0.0881***	−0.0242**	−0.113***	0.0431***
	(0.0133)	(0.0128)	(0.0107)	(0.00258)	(0.00648)	(0.0100)	(0.0114)	(0.00817)
Log GDP per Capita Squared	0.0136***	−0.00254***	−0.00966***	−0.00222***	−0.00449***	0.000778	0.00697***	−0.00240***
	(0.000772)	(0.000738)	(0.000620)	(0.000149)	(0.000375)	(0.000579)	(0.000657)	(0.000473)
Year	−0.000962***	−0.000799***	−0.000920***	0.000146***	−0.000239***	0.000230***	0.00175***	0.000789***
	(9.09e−05)	(8.69e−05)	(7.30e−05)	(1.76e−05)	(4.41e−05)	(6.81e−05)	(7.74e−05)	(5.57e−05)
Australia	−0.274***	−0.123***	0.0620***	0.0138***	−0.0218***	0.0216**	0.194***	0.127***
	(0.0129)	(0.0123)	(0.0104)	(0.00249)	(0.00626)	(0.00966)	(0.0110)	(0.00790)
Austria	−0.286***	−0.178***	0.141***	0.0165***	−0.0227***	0.0748***	0.159***	0.0955***
	(0.0128)	(0.0122)	(0.0102)	(0.00247)	(0.00620)	(0.00956)	(0.0109)	(0.00781)
Bahrain	−0.312***	0.0151	0.0498***	−0.00581**	0.0151**	−0.0263***	0.191***	0.0731***
	(0.0123)	(0.0118)	(0.00990)	(0.00239)	(0.00599)	(0.00925)	(0.0105)	(0.00755)
Bangladsh	−0.225***	−0.0330***	0.0744***	−0.00956***	−0.0102**	0.00389	0.133***	0.0669***
	(0.00853)	(0.00816)	(0.00685)	(0.00165)	(0.00414)	(0.00640)	(0.00726)	(0.00523)
Belgium	−0.296***	−0.179***	0.126***	0.0134***	−0.0398***	0.0378***	0.213***	0.125***
	(0.0127)	(0.0122)	(0.0102)	(0.00246)	(0.00618)	(0.00954)	(0.0108)	(0.00780)
Burkina Faso	−0.242***	0.0267***	0.0866***	−0.0127***	−0.0275***	0.0131**	0.0703***	0.0853***
	(0.00830)	(0.00793)	(0.00666)	(0.00160)	(0.00403)	(0.00622)	(0.00706)	(0.00508)
Cambodia	−0.0866***	−0.0360***	0.0639***	−0.0109***	−0.0151***	0.0300***	0.0647***	−0.0100*
	(0.00840)	(0.00803)	(0.00674)	(0.00162)	(0.00408)	(0.00630)	(0.00715)	(0.00515)
Cameroon	−0.284***	−0.0289***	0.0675***	−0.00441**	−0.0260***	0.0338***	0.195***	0.0466***
	(0.00904)	(0.00864)	(0.00726)	(0.00175)	(0.00439)	(0.00677)	(0.00769)	(0.00553)
Chile	−0.285***	−0.0234**	0.0688***	0.00482**	−0.0284***	0.0135*	0.194***	0.0561***
	(0.0109)	(0.0104)	(0.00877)	(0.00211)	(0.00531)	(0.00819)	(0.00930)	(0.00669)
China	−0.212***	−0.0489***	0.245***	0.000177	−0.0311***	−0.0276***	0.0735***	0.000991
	(0.00944)	(0.00902)	(0.00758)	(0.00182)	(0.00458)	(0.00707)	(0.00803)	(0.00578)
Colombia	−0.244***	−0.0769***	0.0941***	0.00207	−0.0449***	0.0233***	0.204***	0.0426***
	(0.0105)	(0.0101)	(0.00846)	(0.00204)	(0.00512)	(0.00790)	(0.00897)	(0.00646)

Model 3								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transportation**	**Gov. Serv.**
Costa Rica	−0.232***	−0.133***	0.105***	0.00434**	−0.0445***	0.0583***	0.166***	0.0755***
	(0.0108)	(0.0103)	(0.00866)	(0.00209)	(0.00524)	(0.00809)	(0.00918)	(0.00661)
Denmark	−0.281***	−0.171***	0.0943***	0.00646***	−0.0432***	0.0475***	0.187***	0.160***
	(0.0129)	(0.0123)	(0.0103)	(0.00249)	(0.00625)	(0.00964)	(0.0110)	(0.00788)
Egypt	−0.234***	−0.00650	0.0806***	−0.00656***	−0.0353***	0.0406***	0.107***	0.0537***
	(0.00938)	(0.00896)	(0.00753)	(0.00181)	(0.00455)	(0.00703)	(0.00798)	(0.00574)
Ethiopia = o,	–	–	–	–	–	–	–	–
Fiji	−0.196***	−0.106***	0.0327***	−0.00311	−0.0462***	0.0509***	0.196***	0.0724***
	(0.0102)	(0.00973)	(0.00817)	(0.00197)	(0.00494)	(0.00763)	(0.00866)	(0.00623)
Finland	−0.262***	−0.178***	0.161***	0.0107***	−0.0284***	0.0157*	0.165***	0.117***
	(0.0126)	(0.0121)	(0.0101)	(0.00244)	(0.00613)	(0.00946)	(0.0107)	(0.00773)
France	−0.284***	−0.181***	0.0912***	0.00913***	−0.0372***	0.0349***	0.235***	0.132***
	(0.0127)	(0.0121)	(0.0102)	(0.00245)	(0.00615)	(0.00950)	(0.0108)	(0.00776)
Germany	−0.299***	−0.178***	0.182***	0.0114***	−0.0402***	0.0145	0.201***	0.108***
	(0.0127)	(0.0122)	(0.0102)	(0.00246)	(0.00619)	(0.00955)	(0.0108)	(0.00780)
Ghana	−0.171***	−0.0429***	0.101***	−0.00526***	−0.0458***	0.0523***	0.0614***	0.0505***
	(0.00932)	(0.00890)	(0.00748)	(0.00180)	(0.00452)	(0.00698)	(0.00793)	(0.00571)
India	−0.196***	−0.0365***	0.0841***	−0.000537	−0.0162***	0.0152**	0.118***	0.0315***
	(0.00873)	(0.00834)	(0.00701)	(0.00169)	(0.00424)	(0.00654)	(0.00743)	(0.00535)
Indonesia	−0.249***	0.00718	0.0909***	−0.0161***	−0.0304***	0.0487***	0.173***	−0.0240***
	(0.00954)	(0.00912)	(0.00766)	(0.00184)	(0.00463)	(0.00715)	(0.00812)	(0.00584)
Iran	−0.251***	0.0568***	0.0546***	−0.00131	−0.0238***	0.0181**	0.107***	0.0398***
	(0.0103)	(0.00985)	(0.00827)	(0.00199)	(0.00500)	(0.00772)	(0.00877)	(0.00631)
Italy	−0.277***	−0.176***	0.136***	0.00258	−0.0383***	0.0604***	0.199***	0.0934***
	(0.0126)	(0.0120)	(0.0101)	(0.00243)	(0.00611)	(0.00943)	(0.0107)	(0.00771)
Japan	−0.292***	−0.180***	0.168***	0.000769	−0.0257***	0.0349***	0.0998***	0.195***
	(0.0126)	(0.0121)	(0.0101)	(0.00244)	(0.00613)	(0.00945)	(0.0107)	(0.00773)

Model 3								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	Agriculture	Mining	Manufacturing	Utilities	Construction	Whole Sale	Transportation	Gov. Serv.
Kenya	−0.144***	−0.0569***	0.0696***	0.00849***	−0.0428***	−0.0514***	0.187***	0.0299***
	(0.00885)	(0.00846)	(0.00711)	(0.00171)	(0.00430)	(0.00663)	(0.00753)	(0.00542)
Lao People's Dem Rep.	0.0154*	−0.0144*	−0.000590	0.0123***	−0.00597	0.0154**	0.0121*	−0.0342***
	(0.00858)	(0.00820)	(0.00689)	(0.00166)	(0.00417)	(0.00643)	(0.00731)	(0.00526)
Lesotho	−0.319***	−0.0237***	0.0825***	0.0183***	0.0436***	0.00459	0.0836***	0.110***
	(0.00856)	(0.00818)	(0.00687)	(0.00166)	(0.00416)	(0.00642)	(0.00729)	(0.00524)
Luxembourg	−0.299***	−0.205***	0.0909***	0.00694**	−0.0311***	0.0411***	0.327***	0.0692***
	(0.0142)	(0.0136)	(0.0114)	(0.00275)	(0.00690)	(0.0106)	(0.0121)	(0.00870)
Malawi	−0.184***	−0.0169**	0.0895***	−0.00713***	−0.0301***	0.00743	0.104***	0.0376***
	(0.00821)	(0.00785)	(0.00659)	(0.00159)	(0.00399)	(0.00616)	(0.00699)	(0.00503)
Malaysia	−0.192***	−0.0501***	0.140***	0.00132	−0.0524***	0.0435***	0.0672***	0.0417***
	(0.0110)	(0.0105)	(0.00886)	(0.00213)	(0.00536)	(0.00827)	(0.00939)	(0.00676)
Mauritius	−0.237***	−0.134***	0.0969***	−0.00239	−0.0395***	0.0499***	0.210***	0.0571***
	(0.0110)	(0.0105)	(0.00884)	(0.00213)	(0.00535)	(0.00825)	(0.00937)	(0.00674)
Mexico	−0.280***	−0.0639***	0.101***	−0.00871***	−0.0216***	0.0966***	0.169***	0.00778
	(0.0113)	(0.0108)	(0.00905)	(0.00218)	(0.00548)	(0.00845)	(0.00960)	(0.00690)
Mongolia	−0.256***	0.0405***	0.0378***	−0.00169	−0.0285***	0.150***	0.0842***	−0.0254***
	(0.00933)	(0.00892)	(0.00749)	(0.00180)	(0.00453)	(0.00699)	(0.00794)	(0.00571)
Morocco	−0.230***	−0.0683***	0.105***	−0.00422**	−0.0352***	0.0177**	0.125***	0.0901***
	(0.00969)	(0.00926)	(0.00778)	(0.00187)	(0.00471)	(0.00726)	(0.00825)	(0.00593)
Mozambique	−0.234***	0.00668	0.0741***	−0.000644	−0.0391***	0.0682***	0.116***	0.00911*
	(0.00811)	(0.00775)	(0.00651)	(0.00157)	(0.00394)	(0.00608)	(0.00690)	(0.00497)
Myanmar	−0.0551***	0.0940***	0.0138**	−0.0127***	−0.0338***	0.0627***	−0.0299***	−0.0391***
	(0.00831)	(0.00794)	(0.00667)	(0.00161)	(0.00404)	(0.00623)	(0.00707)	(0.00509)
Namibia	−0.272***	0.0530***	0.0170**	−0.00277	−0.0606***	−0.00480	0.0953***	0.175***
	(0.0102)	(0.00979)	(0.00822)	(0.00198)	(0.00497)	(0.00768)	(0.00872)	(0.00627)

Model 3								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	Agriculture	Mining	Manufacturing	Utilities	Construction	Whole Sale	Transportation	Gov. Serv.
Nepal	−0.0886***	−0.0270***	0.00495	−0.00804***	−0.00549	0.0312***	0.0927***	0.000299
	(0.00828)	(0.00791)	(0.00665)	(0.00160)	(0.00402)	(0.00621)	(0.00705)	(0.00507)
Netherlands	−0.280***	−0.155***	0.0900***	0.00262	−0.0417***	0.0426***	0.214***	0.127***
	(0.0130)	(0.0124)	(0.0104)	(0.00251)	(0.00630)	(0.00972)	(0.0110)	(0.00794)
Nigeria	−0.244***	0.0558***	0.0816***	−0.0102***	−0.0356***	0.0190***	0.134***	−0.00103
	(0.00860)	(0.00822)	(0.00691)	(0.00166)	(0.00418)	(0.00645)	(0.00732)	(0.00527)
Norway	−0.284***	−0.0235*	0.0525***	0.0147***	−0.0442***	0.0164*	0.148***	0.120***
	(0.0132)	(0.0126)	(0.0106)	(0.00255)	(0.00640)	(0.00987)	(0.0112)	(0.00806)
Pakistan	−0.135***	−0.0509***	0.0341***	−0.00546***	−0.0567***	0.0768***	0.108***	0.0286***
	(0.00912)	(0.00872)	(0.00732)	(0.00176)	(0.00443)	(0.00683)	(0.00776)	(0.00558)
Philippines	−0.226***	−0.0821***	0.155***	0.00679***	−0.0212***	0.0329***	0.122***	0.0120**
	(0.00961)	(0.00918)	(0.00771)	(0.00186)	(0.00467)	(0.00720)	(0.00818)	(0.00588)
Rep. of Korea	−0.251***	−0.151***	0.196***	0.00264	−0.0280***	0.0234***	0.153***	0.0545***
	(0.0115)	(0.0110)	(0.00923)	(0.00222)	(0.00558)	(0.00862)	(0.00979)	(0.00704)
Rwanda	−0.131***	−0.0177**	0.0489***	0.00789***	−0.0175***	−0.0437***	0.117***	0.0360***
	(0.00825)	(0.00788)	(0.00662)	(0.00159)	(0.00400)	(0.00618)	(0.00702)	(0.00505)
Senegal	−0.249***	−0.0581***	0.131***	−0.00686***	−0.0630***	0.0317***	0.154***	0.0603***
	(0.00901)	(0.00861)	(0.00723)	(0.00174)	(0.00438)	(0.00675)	(0.00767)	(0.00552)
South Africa	−0.303***	−0.0407***	0.0996***	0.00416**	−0.0604***	0.0292***	0.176***	0.0949***
	(0.0108)	(0.0103)	(0.00868)	(0.00209)	(0.00525)	(0.00811)	(0.00921)	(0.00662)
Spain	−0.272***	−0.167***	0.107***	0.0103***	−0.00528	0.0781***	0.156***	0.0937***
	(0.0121)	(0.0116)	(0.00974)	(0.00235)	(0.00589)	(0.00909)	(0.0103)	(0.00743)
Sri Lanka	−0.252***	−0.0785***	0.116***	−0.0120***	−0.0294***	0.0332***	0.131***	0.0911***
	(0.00967)	(0.00924)	(0.00776)	(0.00187)	(0.00469)	(0.00724)	(0.00823)	(0.00592)
Taiwan	−0.276***	−0.171***	0.238***	0.0114***	−0.0578***	0.0645***	0.110***	0.0821***
	(0.0123)	(0.0117)	(0.00985)	(0.00237)	(0.00596)	(0.00920)	(0.0104)	(0.00752)

Model 3								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	**Agriculture**	**Mining**	**Manufacturing**	**Utilities**	**Construction**	**Whole Sale**	**Transportation**	**Gov. Serv.**
Thailand	−0.242***	−0.0967***	0.175***	−5.80e−05	−0.0514***	0.0760***	0.0944***	0.0455***
	(0.0103)	(0.00981)	(0.00824)	(0.00198)	(0.00498)	(0.00769)	(0.00873)	(0.00628)
Turkey	−0.202***	−0.135***	0.141***	−0.00444**	−0.0257***	0.0522***	0.146***	0.0276***
	(0.0111)	(0.0106)	(0.00893)	(0.00215)	(0.00540)	(0.00834)	(0.00947)	(0.00682)
United Arab Emirates	−0.305***	0.0956***	0.0641***	0.0137***	0.0296***	0.0919***	0.0239*	−0.0134
	(0.0164)	(0.0156)	(0.0131)	(0.00316)	(0.00794)	(0.0123)	(0.0139)	(0.0100)
United Kingdom	−0.300***	−0.154***	0.0901***	0.0118***	−0.0329***	0.0358***	0.253***	0.0966***
	(0.0126)	(0.0120)	(0.0101)	(0.00244)	(0.00612)	(0.00944)	(0.0107)	(0.00771)
United Rep. of Tanzania	−0.229***	−0.0176**	0.0781***	−0.00432***	−0.00423	0.0176***	0.158***	0.00141
	(0.00838)	(0.00801)	(0.00673)	(0.00162)	(0.00407)	(0.00628)	(0.00713)	(0.00513)
United States	−0.296***	−0.178***	0.102***	0.00488*	−0.0468***	0.0423***	0.234***	0.138***
	(0.0134)	(0.0128)	(0.0108)	(0.00260)	(0.00653)	(0.0101)	(0.0114)	(0.00823)
Viet Nam	−0.143***	0.00318	0.0662***	0.00415**	−0.0258***	−0.0195***	0.0975***	0.0170***
	(0.00869)	(0.00831)	(0.00698)	(0.00168)	(0.00422)	(0.00652)	(0.00740)	(0.00532)
Zambia	−0.358***	0.112***	0.000635	0.0140***	−0.0160***	0.0658***	0.114***	0.0669***
	(0.00862)	(0.00824)	(0.00692)	(0.00167)	(0.00418)	(0.00646)	(0.00733)	(0.00528)
Constant	3.839***	1.096***	1.175***	−0.435***	0.144	−0.192	−2.963***	−1.663***
	(0.186)	(0.178)	(0.150)	(0.0360)	(0.0905)	(0.140)	(0.159)	(0.114)
Observations	2,596	2,596	2,596	2,596	2,596	2,596	2,596	2,596
R-squared	0.931	0.768	0.794	0.567	0.547	0.580	0.854	0.849

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Low Income Countries								
Sector	**Employed Workers (Millions, Rounded)**		**Output (2017 PPP $s, Billions)**		**Implied Productivity**			
	2018	**2050**	**2018**	**2050**	**2018**	**2050**	**% Change**	**Avg % Change**
Total	85.6 (100%)	192.2 (100%)	$400,000 (100%)	$2,204 (100%)	$4,700	$11,500	145.5%	2.9%
Agriculture	55 (64.3%)	96.9 (50.4%)	$110,000 (27.5%)	$512 (23.3%)	$2,000	$5,300	164.4%	3.1%
Mining	0.8 (0.9%)	1.3 (0.7%)	$17,000 (4.3%)	$170 (7.7%)	$22,400	$133,400	494.8%	5.7%
Manufacturing	6.6 (7.7%)	14.7 (7.7%)	$28,000 (7.1%)	$140 (6.4%)	$4,300	$9,500	122.2%	2.5%
Utilities	0.4 (0.5%)	0.7 (0.3%)	$6,000 (1.4%)	$73 (3.3%)	$14,200	$111,700	687.2%	6.7%
Construction	2.4 (2.8%)	7.4 (3.8%)	$60,000 (15.1%)	$150 (6.8%)	$25,000	$20,400	–18.4%	–0.6%
Whole sale, Accommodation and food service activities	8.1 (9.5%)	35 (18.2%)	$64,000 (16%)	$311 (14.1%)	$7,900	$8,900	12.8%	0.4%
Transportation, information and communication, Finance, insurance, real estate and business services	2.3 (2.7%)	14.2 (7.4%)	$61,000 (15.3%)	$481 (21.8%)	$26,400	$33,800	28.0%	0.8%
Government services, Community, social and personal services	10 (11.6%)	22.1 (11.5%)	$53,000 (13.3%)	$367 (16.7%)	$5,400	$16,600	210.4%	3.6%
Lower Middle Income Countries								
Sector	**Employed Workers (Millions, Rounded)**		**Output (2017 PPP $s, Billions)**		**Implied Productivity**			
	2018	**2050**	**2018**	**2050**	**2018**	**2050**	**% Change**	**Avg % Change**
Total	1,121.5 (100%)	1,706.2 (100%)	$19,600 (100%)	$58,000 (100%)	$17,500	$34,000	94.1%	2.1%
Agriculture	457 (40.7%)	489.3 (28.7%)	$3,000 (15.4%)	$4,200 (7.2%)	$6,600	$8,600	29.4%	0.8%
Mining	6.1 (0.5%)	7.4 (0.4%)	$1,100 (5.7%)	$5,500 (9.4%)	$183,100	$737,000	302.5%	4.5%
Manufacturing	146.6 (13.1%)	169.1 (9.9%)	$3,000 (15.3%)	$6,700 (11.5%)	$20,500	$39,500	93.0%	2.1%
Utilities	4.5 (0.4%)	6.8 (0.4%)	$400 (2.2%)	$1,500 (2.7%)	$97,000	$225,300	132.2%	2.7%
Construction	88.4 (7.9%)	122.1 (7.2%)	$1,400 (7.0%)	$3,500 (6.0%)	$15,600	$28,600	83.3%	1.9%
Whole sale, Accommodation and food service activities	189.1 (16.9%)	380.5 (22.3%)	$3,400 (17.2%)	$8,300 (14.4%)	$17,900	$21,900	22.6%	0.6%
Transportation, information and communication, Finance, insurance, real estate and business services	94.8 (8.5%)	236.7 (13.9%)	$4,500 (22.7%)	$18,200 (31.5%)	$47,000	$77,100	63.8%	1.6%
Government services, Community, social and personal services	135.2 (12.1%)	294.4 (17.3%)	$2,800 (14.4%)	$10,000 (17.3%)	$21,000	$34,100	62.6%	1.5%

Upper Middle Income Countries								
Sector	Employed Workers (Millions, Rounded)		Output (2017 PPP $s, Billions)		Implied Productivity			
	2018	2050	2018	2050	2018	2050	% Change	Avg % Change
Total	955.9 (100%)	957.8 (100%)	$26,900 (100%)	$60,700 (100%)	$28,100	$63,300	125.1%	2.6%
Agriculture	231.2 (24.2%)	218.7 (22.8%)	$1,900 (7.0%)	$2,500 (4.2%)	$8,100	$11,500	42.1%	1.1%
Mining	6.6 (0.7%)	8.9 (0.9%)	$800 (3.0%)	$5,200 (8.5%)	$123,600	$581,800	370.8%	5.0%
Manufacturing	170 (17.8%)	94.3 (9.9%)	$7,200 (26.6%)	$14,000 (23.1%)	$42,000	$148,600	253.4%	4.0%
Utilities	4.9 (0.5%)	4.2 (0.4%)	$600 (2.2%)	$1,600 (2.6%)	$123,300	$364,600	195.8%	3.5%
Construction	81.5 (8.5%)	82.5 (8.6%)	$1,800 (6.7%)	$3,100 (5.1%)	$22,200	$37,700	69.9%	1.7%
Whole sale, Accommodation and food service activities	144.4 (15.1%)	177.5 (18.5%)	$3,600 (13.4%)	$6,500 (10.8%)	$25,000	$36,900	47.6%	1.2%
Transportation, information and communication, Finance, insurance, real estate and business services	71.6 (7.5%)	149.5 (15.6%)	$6,300 (23.2%)	$18,400 (30.4%)	$87,300	$123,200	41.2%	1.1%
Government services, Community, social and personal services	245.8 (25.7%)	222.2 (23.2%)	$4,800 (17.8%)	$9,300 (15.4%)	$19,500	$42,100	115.5%	2.4%
High Income Countries								
Sector	Employed Workers (Millions, Rounded)		Output (2017 PPP $s, Billions)		Implied Productivity			
	2018	2050	2018	2050	2018	2050	% Change	Avg % Change
Total	473.1 (100%)	394.3 (100%)	$45,200 (100%)	$58,400 (100%)	$95,600	$148,000	54.8%	1.4%
Agriculture	11.7 (2.5%)	0 (0.0%)	$600 (1.3%)	$10 (0.02%)	$49,400	–	–	–
Mining	1.6 (0.3%)	0.3 (0.1%)	$800 (1.8%)	$700 (1.3%)	$514,900	$2,511,700	387.9%	5.1%
Manufacturing	54.1 (11.4%)	32.5 (8.3%)	$6,700 (14.9%)	$6,100 (10.5%)	$124,500	$188,200	51.1%	1.3%
Utilities	4 (0.8%)	2.5 (0.6%)	$1,000 (2.1%)	$1,500 (2.5%)	$244,500	$603,800	147.0%	2.9%
Construction	30.2 (6.4%)	23.5 (6.0%)	$2,300 (5.0%)	$2,300 (3.9%)	$75,500	$97,200	28.9%	0.8%
Whole sale, Accommodation and food service activities	98.2 (20.8%)	101.4 (25.7%)	$6,000 (13.3%)	$8,200 (14.1%)	$61,100	$81,000	32.5%	0.9%
Transportation, information and communication, Finance, insurance, real estate and business services	109.1 (23.1%)	100.9 (25.6%)	$16,900 (37.3%)	$24,800 (42.5%)	$154,700	$245,700	58.9%	1.5%
Government services, Community, social and personal services	164.3 (34.7%)	133.3 (33.8%)	$11,000 (24.3%)	$14,700 (25.3%)	$67,000	$110,600	65.1%	1.6%

Annex 2

Coefficient (Standard Error)

Year	1975	1995	2018
Agriculture			
Constant	3.653805*** (0.6190003)	3.208716*** (0.5597604)	2.969882*** (0.7435988)
Log GDP Per Cap	−0.5498088*** (0.143601)	−0.4604763*** (0.131374)	−0.4106842** (0.1608884)
Log GDP Per Cap Squared	0.0197072** (0.0082105)	0.0151308** (0.0075521)	0.0128463 (0.0085934)
Mining			
Constant	−0.0439109 (0.0600267)	−0.0724962 (0.0546922)	0.009045 (0.0803329)
Log GDP Per Cap	0.0104558 (0.0139255)	0.0186121 (0.0128361)	0.0013643 (0.0173812)
Log GDP Per Cap Squared	−0.0004881 (0.0007962)	−0.0010589 (0.0007379)	−0.0001577 (0.0009284)
Manufacturing			
Constant	−1.378669*** (0.2314955)	−0.930546*** (0.2172442)	−1.313694*** (0.3609951)
Log GDP Per Cap	0.3092838*** (0.0537043)	0.2132586*** (0.0509865)	0.2996835*** (0.0781065)
Log GDP Per Cap Squared	−0.0150644*** (0.0030706)	−0.0103008*** (0.002931)	−0.0154554*** (0.0041718)
Utilities			
Constant	−0.0350751 (0.0344374)	−0.0641131** (0.0254849)	−0.1511508 (0.1256687)
Log GDP Per Cap	0.0067035 (0.0079891)	0.0145326** (0.0059812)	0.0329254 (0.0271903)
Log GDP Per Cap Squared	−0.0001873 (0.0004568)	−0.000703** (0.0003438)	−0.0016654 (0.0014523)
Construction			
Constant	0.3879134*** (0.1292272)	−0.1370454 (0.1268212)	−0.5460332** (0.2221469)
Log GDP Per Cap	−0.1097522*** (0.0299792)	0.0235214 (0.0297645)	0.1198213** (0.0480647)
Log GDP Per Cap Squared	0.0081659*** (0.0017141)	−0.0001594 (0.001711)	−0.0057246** (0.0025672)
Whole sale, Accommodation and food service activities			
Constant	−0.5943269*** (0.1614603)	−0.48946*** (.1825474)	−0.7331824* (0.3911931)
Log GDP Per Cap	0.1321587*** (0.0374569)	0.112707** (0.0428433)	0.1868292** (0.0846403)
Log GDP Per Cap Squared	−0.005636** (0.0021416)	−0.0044911* (0.0024629)	−0.0093085** (0.0045208)

Coefficient (Standard Error)			
Year	**1975**	**1995**	**2018**
Transportation, information and communication, Finance, insurance, real estate and business services			
Constant	−0.5270616*** (0.1647872)	0.0261916 (0.2169644)	0.5960386 (0.400951)
Log GDP Per Cap	0.1058668*** (0.0382287)	−0.0315213 (0.0509209)	−0.1637901* (0.0867516)
Log GDP Per Cap Squared	−0.0040062* (0.0021858)	0.004431 (0.0029272)	0.0120254** (0.0046336)
Government services, Community, social and personal services			
Constant	−0.4626747 (0.3110584)	−0.5412471 (0.3675291)	0.1690954 (0.4724613)
Log GDP Per Cap	0.0950925 (0.072162)	0.1093661 (0.0862579)	−0.0661493 (0.1022239)
Log GDP Per Cap Squared	−0.0024911 (0.0041259)	−0.0028485 (0.0049586)	0.0074399 (0.00546)

Note: X* denotes statistically significant at P value<=0.1, X** at P value<=0.05, X*** at P value<=0.01.

Annex 3

TABLE 1. Fixed sample: employed/working age population

Year	1975	1995	2018	2050*
Fixed Sample	71.0%	71.0%	67.1%	70.5%
LIC	78.1%	80.7%	76.2%	72.7%
LMIC	69.6%	64.9%	59.5%	65.3%
UMIC	76.9%	78.5%	73.3%	82.6%
HIC	64.7%	69.2%	75.7%	68.7%

*Estimates.

TABLE 2. Employed persons, nationally (thousands): average and (standard deviation)

	1975 Fixed: 59 Countries	1995 Fixed: 59 Countries	2018 Fixed: 59 Countries	1995 Full: 90 Countries	2018 Full: 90 Countries
Total	21,890.9 (63,406.6)	33,690.3 (101,137.9)	44,680.6 (119,826.1)	24,830.0 (83,062.4)	32,940.9 (98,769.4)
Agriculture	12,263.7 (47,025.1)	14858.0 (54,549.8)	12,794.3 (39,297.1)	10,277.7 (44,524.8)	8,827.2 (32,229.1)
Mining	183.2 (701.3)	290.6 (1,350.5)	254.3 (792.7)	221.5 (1,101.8)	196.9 (656.3)
Manufacturing	2,921.3 (7,052.0)	4,768.6 (15,339.5)	6,395.5 (20,215.2)	3,593.2 (12,591.6)	4,642.5 (16,557.5)
Utilities	114.7 (264.3)	192.7 (518.9)	233.3 (544.7)	176.3 (476.7)	209.4 (506.3)
Construction	763.3 (1,478.6)	1,721.8 (5,055.6)	3,430.9 (10,793.9)	1,319.3 (4,184.0)	2,545.5 (8,845.2)
Whole sale, Accommodation and food service activities	1,875.1 (3,684.4)	4,002.9 (8,510.8)	7,453.5 (16,691.0)	3,039.7 (7,130.1)	5,626.3 (13,945.9)
Transportation, information and communication, Finance, insurance, real estate and business services	1,222.7 (2,630.3)	2,469.1 (5,609.3)	4,707.8 (9,595.2)	1,978.1 (4,776.0)	3,675.9 (8,101.0)
Government services, Community, social and personal services	2,547.0 (5,469.0)	5,386.6 (14,073.2)	9,411.1 (28,386.2)	4,224.1 (11,724.9)	7,217.3 (23,397.6)

TABLE 3. Global labor productivity (2017 PPP): average and (standard deviation)

	1975 Fixed: 59 Countries	1995 Fixed: 59 Countries	2018 Fixed: 59 Countries	1995 Full: 90 Countries	2018 Full: 90 Countries
Total	26.6 (50.6)	30.2 (32.5)	45.8 (38.7)	31.5 (28.7)	51.5 (39.9)
Agriculture	12.29 (15.3)	15.3 (16.8)	24.7 (26.7)	16.3 (15.9)	27.6 (25.9)
Mining	300.6 (1173.4)	171.7 (308.5)	451.6 (1037.6)	169.7 (311.9)	424.7 (929.9)
Manufacturing	27.2 (20.5)	36.7 (30.4)	57.6 (47.8)	37.0 (28.9)	69.6 (82.1)
Utilities	53.9 (42.9)	89.2 (78.6)	167.8 (155.9)	91.8 (79.2)	161.8 (136.5)
Construction	28.8 (28.8)	27.5 (22.3)	39.9 (32.6)	27.9 (20.3)	40.4 (28.9)
Whole sale, Accommodation and food service activities	35.1 (72.5)	27.4 (31.2)	33.5 (25.8)	27.3 (26.5)	38.3 (27.9)
Transportation, information and communication, Finance, insurance, real estate and business services	68.1 (73.3)	70.7 (54.2)	83.6 (57.0)	70.0 (48.6)	95.5 (82.7)
Government services, Community, social and personal services	19.2 (13.7)	22.5 (18.7)	34.2 (23.7)	23.5 (17.1)	37.8 (23.6)

TABLE 4. Global labor productivity, weighted by employment (2017 PPP): average and (standard deviation)

	1975 Fixed	1995 Fixed	2018 Fixed	1995 Full	2018 Full
Total	15.1 (20.3)	19.7 (25.8)	35.0 (31.1)	20.4 (24.9)	36.5 (31.5)
Agriculture	2.7 (4.2)	3.1 (4.8)	7.4 (7.0)	3.4 (5.2)	7.9 (8.4)
Mining	59.2 (252.9)	48.6 (120.4)	183.1 (312.8)	55.4 (144.2)	235.6 (436.9)
Manufacturing	26.5 (21.8)	29.1 (29.5)	44.8 (37.2)	29.2 (28.7)	46.8 (41.6)
Utilities	57.8 (46.4)	80.0 (79.1)	146.4 (91.3)	71.0 (71.43)	131.5 (86.4)
Construction	28.5 (22.8)	21.9 (21.3)	27.3 (23.5)	22.5 (20.4)	28.0 (23.0)
Whole sale, Accommodation and food service activities	24.5 (20.5)	23.8 (20.2)	29.7 (19.3)	24.1 (19.6)	30.4 (19.8)
Transportation, information and communication, Finance, insurance, real estate and business services	60.0 (42.1)	76.6 (48.7)	99.5 (55.5)	71.3 (46.8)	97.1 (55.8)
Government services, Community, social and personal services	24.3 (18.0)	23.7 (23.6)	33.7 (23.6)	23.0 (22.0)	33.8 (22.7)

TABLE 5. Beta coefficients for each sector in a regression [α(labor productivity growth) = β(initial productivity) + π] P values in parentheses where labor productivity growth = the absolute change in labor productivity since the initial year divided by labor productivity in the initial year

	1975–2018 Fixed	1975–1995 Fixed	1995–2018 Fixed	1995–2018 Full
Total	−0.0123609* (0.0063553)	−0.0034708 (.0021085)	−0.0150969*** (0.0043784)	−0.0142456*** (0.0034894)
Agriculture	−0.0474968** (0.0196109)	−0.0111037 (.0081805)	−0.0269599** (0.0113644)	−0.0288664*** (0.0092779)
Mining	−0.0033466 (0.0072259)	−0.0004012 (0.0003482)	−0.0135499 (0.0119833)	−0.0092327 (0.0078171)
Manufacturing	−0.0322452** (0.012472)	−0.012337** (0.0053696)	−0.0040477 (0.0034716)	−0.0001891 (0.003996)
Utilities	−0.0903786*** (0.0291521)	−0.0162742*** (0.0046604)	−0.0303571** (0.0131909)	−0.0229818*** (0.0087168)
Construction	−0.0212579** (0.0090847)	−0.017796** (0.0087388)	−0.0139102* (0.0070911)	−0.0159078*** (0.005699)
Whole sale, Accommodation and food service activities	−0.005169* (0.0029518)	−0.0026027* (0.0013689)	−0.0065996* (0.0035819)	−0.0078213** (0.0034329)
Transportation, information and communication, Finance, insurance, real estate and business services	−0.0113224*** (0.0038956)	−0.0052646*** (0.0016322)	−0.0054475*** (0.0018671)	−0.0039834** (0.0017252)
Government services, Community, social and personal services	−0.1520876*** (0.0448984)	−0.0347591** (0.0144863)	−0.0352511*** (0.0091636)	−0.0342234*** (0.0071167)

Note: X* denotes statistically significant at P value<=0.1, X** at P value<=0.05, X*** at P value<=0.01.

Annex 4

To estimate sector level trends in trade, we match and combine World Bank data measuring exports as a share of national merchandise and services exports with the sectors enumerated in Dieppe and Matsuoka, 2021 as described in Table 1.

This is an imprecise exercise that should be taken as illustrative. For example, electricity exports are subsumed in the mining and quarrying trade category. Again, the agriculture, forestry and fishing and the mining and quarrying trade categories both include products that have been significantly processed (and so have manufacturing value added).

It is also important to note that gross trade statistics ill-capture value added. While manufacturing accounts for nearly 70 percent of total gross exports compared for 20 percent for services, the two sectors have an equal 40 percent share of total value-added exports.[42]

The resulting country level sector export shares are multiplied by the value of merchandise and service exports (measured in current US dollars) to obtain absolute values of exports within a national sector for a given year. These values are then aggregated to obtain global and low or lower-middle income country export estimates, limiting the sample of countries to those with export data for every year for 2005 through 2018, as well as productivity data for every year from 1975 to 2018, for a total of 39 countries. Using this same criteria, World Bank national annual GNI data measured in current US dollars is incorporated into the dataset, aggregated, and applied to the previously calculated export values to obtain sector level exports as a share of GNI and total exports for the years 2005 and 2018.

42 Johnson, R. C. (2014). Five facts about value-added exports and implications for macroeconomics and trade research. *Journal of Economic Perspectives*, 28(2), 119–142.

TABLE 1. Mapping of sectors to export codes

Dieppe and Matsuoka Sector	Data from World Bank
1. Agriculture, forestry and fishing	TX.VAL.AGRI.ZS.UN, TX.VAL.FOOD.ZS.UN
2. Mining and quarrying	TX.VAL.FUEL.ZS.UN, TX.VAL.MMTL.ZS.UN
3. Manufacturing	TX.VAL.MANF.ZS.UN Residual of merchandise trade
4. Utilities: Electricity, gas, steam and air conditioning supply	
5. Construction	
6. Wholesale and retail trade; repair of motor vehicles and motorcycles; Accommodation and food service activities	TX.VAL.TRVL.ZS.WT
7. Transportation and storage; Information and communication; Financial services Financial and insurance activities; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities	TX.VAL.OTHR.ZS.WT TX.VAL.INSF.ZS.WT TX.VAL.TRAN.ZS.WT
8. Other services: Public administration and defense; compulsory social security; Education; Human health and social work activities; Arts, entertainment and recreation; Other service activities; Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; Activities of extraterritorial organizations and bodies	Residual of Services

Note: We have data for total services and total merchandise (industry plus agriculture) exports. When you subtract the sum of (TX.VAL.AGRI.ZS.UN, TX.VAL.FOOD.ZS.UN TX.VAL.FUEL.ZS.UN, TX.VAL.MMTL.ZS.UN TX.VAL.MANF.ZS.U) from total meerchandise exports you get the residual of merchandise exports. When you subtract (TX.VAL.TRVL.ZS.WT TX.VAL.OTHR.ZS.WT TX.VAL.INSF.ZS.WT TX.VAL.TRAN.ZS.WT) from total services exports you get the residual of services exports.

Sectoral exports as a share of GNI and total exports for 2050 are then derived using the estimated export shares from 2005 to 2018, output data from 2018, and estimated output levels in 2050. Assuming that the exported share of sector output remains unchanged between 2018 and 2050 (static model), sector level exports as a share of GNI in 2050 are estimated using

$$X_{stotal2050} = (S_{stotal2050}/S_{stotoal2018}) * X_{stotal2018}$$

Where X represents the value of exports within a sector as a percentage of GNI. The static share assumption is then relaxed to estimate $X_{stotal2050}$ using a dynamic formulation:

$$X_{stotal2050} = [(S_{stotal2050}/S_{stotoal2018}) * X_{stotal2018}] * \{[(X_{stotal2018}/S_{stotal2018})/(X_{stotal2005}/S_{stotal2005})]^{(32/13)}\}$$

We cap trade as a percentage of GNI at the sector level to output as a percentage of total (a restriction only binding on mining).

Global

TABLE 2A. 2005

	Employment % Total	Output % Total	Export Value as a % GNI	Export Value as % of Total Exports
Total	100%	100%	21.9%	100%
Agriculture	37.0%	5.4%	1.4%	6.6%
Mining	0.7%	3%	1.8%	8.0%
Manufacturing	13.8%	19.5%	14%	64.0%
Utilities	0.6%	2.4%	–	–
Construction	6.7%	5.5%	–	–
Whole sale, Accommodation and food service activities	13.6%	13.5%	1.2%	5.3%
Transportation, information and communication, Finance, insurance, real estate and business services	9.2%	30.4%	3.5%	16.2%
Government services, Community, social and personal services	18.4%	20.4%	0%	0%

Repeat table for (current) low and lower middle income countries.

TABLE 2B. 2018

	Employment % Total	Output % Total	Export Value as a % GNI	Export Value as % of Total Exports
Total	100%	100%	24.2%	100%
Agriculture	26.5%	5.6%	1.7%	7.1%
Mining	0.6%	2.4%	2.1%	8.8%
Manufacturing	14.6%	18.6%	14.5%	59.8%
Utilities	0.5%	2.1%	–	–
Construction	8.1%	6.0%	–	–
Whole sale, Accommodation and food service activities	16.9%	14%	1.3%	5.4%
Transportation, information and communication, Finance, insurance, real estate and business services	10.8%	30.6%	4.6%	18.9%
Government services, Community, social and personal services	22.2%	20.7%	0%	0%

TABLE 3A. 2005 LICs and LMICs

	Employment % Total	Output % Total	Export Value as a % GNI	Export Value as % of Total Exports
Total	100%	100%	24.4%	100%
Agriculture	50.4%	17.2%	2.5%	10.0%
Mining	0.6%	4.7%	4.2%	17.2%
Manufacturing	12.3%	17.3%	11.1%	45.6%
Utilities	0.4%	2.0%	–	–
Construction	6.1%	6.4%	–	–
Whole sale, Accommodation and food service activities	12.9%	16.8%	1.8%	7.5%
Transportation, information and communication, Finance, insurance, real estate and business services	6.8%	22.4%	4.8%	19.6%
Government services, Community, social and personal services	10.5%	13.1%	0.0%	0.0%

TABLE 3B. 2018 LICs and LMICs

	Employment % Total	Output % Total	Export Value as a % GNI	Export Value as % of Total Exports
Total	100%	100%	19.8%	100%
Agriculture	41.3%	15.4%	2.3%	11.6%
Mining	0.6%	4.0%	2.9%	14.7%
Manufacturing	12.7%	15.4%	8.1%	40.8%
Utilities	0.4%	1.9%	–	–
Construction	8.5%	7.4%	–	–
Whole sale, Accommodation and food service activities	16.9%	18.1%	1.5%	7.7%
Transportation, information and communication, Finance, insurance, real estate and business services	8.0%	23.0%	5.0%	25.3%
Government services, Community, social and personal services	11.6%	14.7%	0.0%	0.0%

TABLE 4A. 2050 projections

	Export Value as a Percentage of GNI 2050 (static)	Export Values as a Percentage of Total Exports (static)	Export Value as a Percentage of GNI 2050 (dynamic)	Export Values as a Percentage of Total Exports (dynamic)
Total	24.9%	100%	34.1%	100%
Agriculture	1.1%	4.4%	1.6%	4.7%
Mining	5.0%	20.2%	6.4%	18.8%
Manufacturing	12.3%	49.4%	14.8%	43.4%
Utilities	–	–	–	–
Construction	–	–	–	–
Whole sale, Accommodation and food service activities	1.2%	4.9%	1.5%	4.4%
Transportation, information and communication, Finance, insurance, real estate and business services	5.3%	21.1%	9.8%	28.7%
Government services, Community, social and personal services	0.0%	0.0%	0.0%	0.0%

TABLE 4B. 2050 projections LICs and LMICs

	Export Value as a Percentage of GNI 2050 (static)	Export Values as a Percentage of Total Exports (static)	Export Value as a Percentage of GNI 2050 (dynamic)	Export Values as a Percentage of Total Exports (dynamic)
Total	21.6%	100%	16.6%	100%
Agriculture	1.1%	5.0%	1.2%	7.3%
Mining	6.0%	27.6%	3.6%	21.4%
Manufacturing	6.4%	29.5%	3.9%	23.4%
Utilities	–	–	–	–
Construction	–	–	–	–
Whole sale, Accommodation and food service activities	1.3%	5.8%	0.7%	4.0%
Transportation, information and communication, Finance, insurance, real estate and business services	6.9%	32.1%	7.3%	43.9%
Government services, Community, social and personal services	0.0%	0.0%	0.0%	0.0%