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Was Kuznets Right? New Evidence on the Relationship between Structural Transformation and Inequality

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ABSTRACT

We examine the Kuznets postulate that structural transformation leads to higher inequality using comparable panel data for a large number of developing and developed countries for 1960-2012. Countries show different paths of structural transformation, being either structurally under-developed, structurally developing or structurally developed. In contrast to the Kuznets hypothesis, we find that the movement of workers to manufacturing unambiguously decreases income inequality, irrespective of the stage of structural transformation that a particular country is in. We also find that while the movement of workers into services has no discernible overall impact on inequality across our set of countries, structural transformation relating to services increases inequality in structural developing countries and decreases inequality in structurally developed countries. Overall, our findings confirm the positive development effects that structural transformation relating to manufacturing may have in developing countries, not merely through higher growth but by reducing inequality as well. However, for the vast majority of low income countries, where manufacturing driven structural transformation seems a remote possibility, our findings suggest that inequality will increase with the movement of workers from agriculture to services.

KEYWORDS

structural transformation, inequality, Kuznets, manufacturing, services

About the GPID research network:

The ESRC Global Poverty and Inequality Dynamics (GPID) research network is an international network of academics, civil society organisations, and policymakers. It was launched in 2017 and is funded by the ESRC's Global Challenges Research Fund.

The objective of the ESRC GPID Research Network is to build a new research programme that focuses on the relationship between structural change and inclusive growth.

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THE DEVELOPER'S DILEMMA

The ESRC Global Poverty and Inequality Dynamics (GPID) research network is concerned with what we have called 'the developer's dilemma'.

This dilemma is a trade-off between two objectives that developing countries are pursuing. Specifically:

1. Economic development via structural transformation and productivity growth based on the intra- and inter-sectoral reallocation of economic activity.
2. Inclusive growth which is typically defined as broad-based economic growth benefiting the poorer in society in particular.

Structural transformation, the former has been thought to push up inequality. Whereas the latter, inclusive growth implies a need for steady or even falling inequality to spread the benefits of growth widely. The 'developer's dilemma' is thus a distribution tension at the heart of economic development.

1. Introduction

Structural transformation – the movement of workers from low productivity to high productivity activities and sectors – is an essential feature of rapid and sustained growth. The speed at which structural transformation occurs differentiates successful countries from unsuccessful ones (Kuznets and Murphy 1966). At the same time, since Kuznets' seminal (1955) piece, it is widely believed that structural transformation can lead to higher inequality, at least initially. Therefore, rapid structural transformation may entail a trade-off between growth and inequality, which may be called the developer's dilemma (Sumner 2017). As Kuznets argued, while inequality may increase at the early stages of structural transformation, beyond a certain level of structural transformation, inequality will decrease, giving rise to the famous inverted U-shaped relationship between income and inequality – the so-called Kuznets curve.

Several recent papers have looked at the relationship between structural transformation and economic growth (Duarte and Restuccia 2010, Dabla-Norris et al. 2013, Herrendorf et al. 2014, McMillan et al. 2014, Diao et al. 2017, Haraguchi et al. 2017).[1] In this paper, we examine the inequality dimension of structural transformation. We re-examine the Kuznets postulate that at the early process of structural transformation, inequality increases as workers move from a sector with low average incomes and lower within-sector inequality – agriculture – to a sector with higher average income and higher within-sector inequality, such as manufacturing. We argue that both from conceptual and empirical standpoints, there are reasons to question the Kuznets view on the relationship between structural transformation and inequality. Firstly, from a conceptual point of view, a closer examination of the assumptions behind the Kuznets process makes clear that it is not obvious that a movement of workers from agriculture to manufacturing necessarily involves an increase in inequality. In contrast, the movement of workers from agriculture to services may have a different implication for inequality, as the assumptions that underlie the Kuznets argument on the positive effect of structural transformation on inequality is more likely to be true for the services driven structural transformation.

[1] A separate (and large) literature has looked at the validity of the so-called Kuznets curve- the inverted U shaped relationship between inequality and the level of per capita income – without finding an unambiguous support for the Kuznets curve hypothesis of inequality first increasing and then decreasing with economic development (Anand and Kanbur 1993a, 1993b, Milanović 2000, Lindert and Williamson 2003, Roine and Waldenström 2015). However, this literature has focused on the growth-inequality relationship, while our interest in this paper is in the structural transformation-inequality relationship. One paper that looks at the effect of structural transformation on inequality is Angeles (2009). However, this paper does not differentiate between manufacturing and services driven structural transformation (by using total non-agricultural employment share as the core explanatory variable), which as we will show in this paper, have very different effects on inequality.

Secondly, as we will document later in this paper, in contrast to what was envisaged by Kuznets, for many developing countries, the movement of workers from agriculture even in the early stage of structural transformation has been primarily to services and not to manufacturing. Given that few countries outside of East Asia have seen a typical path of structural transformation that was witnessed originally among the advanced market economies where workers first moved from agriculture to manufacturing and then on to services, it is not clear whether the implications of structural transformation for increasing inequality may be the same for the many different paths of structural transformation that we observe in the developing and developed world.

Our historical data from 1960 to 2012 shows three different paths or stages of structural transformation. Firstly, there are a set of countries where the proportion of workers in agriculture is higher than any other sector for the most recent period for which we have the data– we call this set of countries *structurally under-developed*. These are mostly low-income countries. Secondly, for a set of countries, mostly in the middle-income category, the proportion of workers in services is higher than that in agriculture, though the share of workers in agriculture still higher than that in manufacturing. We call this set of countries *structurally developing*. Finally, we have a set of countries, which are a mix of middle and high-income countries, where the share of workers in manufacturing is higher than that in agriculture. We call this set of countries *structurally developed*.

In this paper, we examine the inequality implications of structural transformation for a range of low, middle and high-income countries from 1960 to 2012, allowing for the heterogeneity of the paths of structural transformation that we observe in the data. We also allow for the possibility that manufacturing driven structural transformation may have very different implications for inequality than services driven inequality. To examine the structural transformation-inequality relationship, we use two high quality data-sets which have become recently available, one for structural transformation and the other for income inequality. The data for structural transformation – that is, the share of workers in agriculture, manufacturing and services – comes from the Groningen Growth and Development Centre (GGDC) data-base,[2] which provides consistent annual data on sectoral employment for several countries from the 1950s onwards and the data for inequality comes from the most recent revisions to the World Income Inequality Data-base (WIID) which provides comparable inequality data over time for a large number of countries.[3]

Using the GGDC and WIID data-bases and panel data methods, we find that the Kuznets postulate *does not hold true* for manufacturing driven structural transformation. No matter at what stage of structural transformation a county may be in, manufacturing *unambiguously* decreases inequality – the marginal effect of an increase in manufacturing employment share on income inequality (as measured by the

[2] See https://www.rug.nl/ggdc/productivity/10-sector/.
[3] See https://www.wider.unu.edu/project/wiid-world-income-inequality-database.

Gini) is always negative and statistically significant, at all levels of manufacturing employment share. In contrast, we find that the marginal effect of an increase in the share of workers in services is positive on inequality for structurally developing countries, and negative for structurally developed countries, a process which is more in line with the original Kuznets argument. Given that the bulk of the movement of workers from agriculture are going to services and not to manufacturing in many low-income countries, this suggests that the Kuznets argument holds with greater force in contemporary times, but not in the manner envisaged by Kuznets and other scholars.

The rest of the paper is in six sections. In the next section, we discuss the argument proposed by Kuznets on the relationship between structural transformation and inequality, known in the literature as the Kuznets process. In Section 3, we describe the patterns of structural transformation in our sample of countries. In Section 4, we provide descriptive evidence on the relationship between structural transformation and inequality. In Section 5, we discuss the econometric methodology. We present our results in Section 6. Section 7 concludes.

2. The Kuznets Process

In his classic 1955 paper, Kuznets suggested that in the early phase of economic development, inequality will increase. At a later phase of economic development, as governments follow redistributive policies combining progressive taxation with welfare spending, inequality may decrease. The core of Kuznet's argument on the relationship between inequality and development is captured in the following paragraph extracted from his 1955 paper:

> *"An invariable accompaniment of growth in developed countries is the shift away from agriculture, a process usually referred to as industrialization and urbanization. The income distribution of total population in the simplest model, may therefore be viewed as a combination of the total income distributions of the rural and urban populations. What little we know of the structure of the two component income distributions reveals that a) the average per capita income of the rural population is usually lower than that of the urban; b) inequality in the percentage shares within the distribution for the rural population is somewhat narrower than that in the urban population … Operating with this simple model, what conclusions do we reach? First, all other conditions being unequal, the increasing weight of the urban population means an increasing share for the more unequal of the two component distributions. Second, the relative difference in per capita income between the rural and urban populations does not necessarily shift downward in the process of economic growth; indeed, there is some evidence to suggest that it is stable at best, and tends to widen because per capita productivity in urban pursuits increases more rapidly than in agriculture. If this is so, inequality in total income distribution should increase" (pp. 7-8).*

The Kuznets process of widening inequality with structural transformation (that is, movement of workers away from agriculture) can be described as composed of two sub-processes: i) between sector inequality: a movement of the population from a sector characterised **by lower mean income** to a sector characterised by **higher mean income**, and ii) within sector inequality: the movement of the population from a sector with **low within-sector inequality** to a sector with **higher within-sector inequality**. If both sub-processes work in the same direction – that is, if the movement of workers is from a sector with both a low mean and low variance in incomes to a sector with a higher mean and high variance in incomes, then structural transformation will unambiguously increase inequality. However, if the movement of workers is from a sector with low mean income but higher variance of income to a sector with a higher mean income but lower variance in income, then it is less obvious that inequality will necessarily increase.

Following Anand and Kanbur (1993a), we provide a diagrammatic exposition of the Kuznets process to make clear the contribution of between sector (or group) inequality and within sector (or group) inequality to overall inequality.[4] Let I be the overall measure of inequality in a given country and let x be the share of workers in the non-agricultural sector. For the sake of exposition, let us assume that there is only one non-agricultural sector, so that we do not make a distinction between the manufacturing and services sectors. Let the working population of the country be normalised to one. Define between-sector (or group) inequality as the inequality in the income distribution when a fraction x of the working population receives income u_1 and the remaining fraction, 1-x, receives income u_2 (where between-group inequality is defined as the value of the inequality measure when everyone in the sector receives the mean income of the sector). Following Kuznets, we can assume that the mean income of the non-agricultural sector is higher than that of the agricultural sector – that is, $u_1 > u_2$.

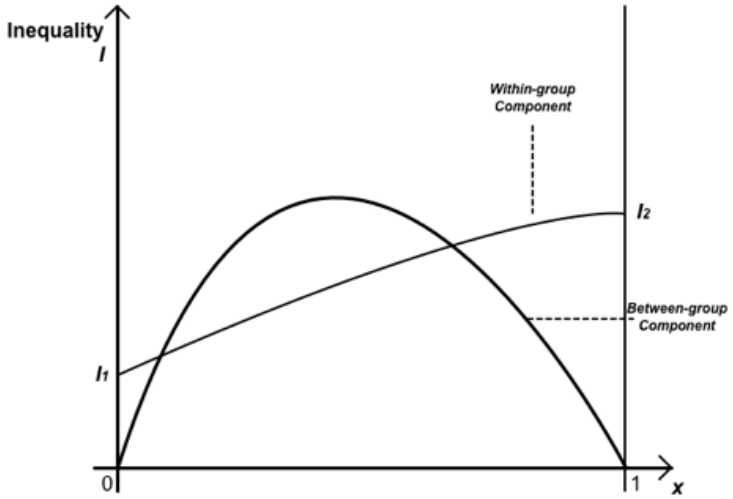
It is clear from between-group inequality must be zero at both x=1 and x=1, and must be positive elsewhere – that is, when all workers are either in the agricultural sector or in the non-agricultural sector, there can be no between-group inequality. However, in the range where x is higher than 0 but less than 1, inequality will first increase with increasing x, then fall (as captured in Figure 1). This is because with low x, there are more workers in the low-income sector (in our example, agriculture) than in the high-income sector, so that between sector income differences are considerable. However, once a larger proportion of workers are in the high-income sector, between-group inequality starts falling, till it reaches zero when all workers are in the high-income sector.

[4] This exposition depends on the assumption that the inequality measures we are considering is decomposable. Among the inequality measures available in the literature, the variance of log income and mean log deviation (which is Theil's second index) has such decomposition properties – see Robinson (1976) and Kanbur (2017).

Now consider the behaviour of within-group inequality. Defining within-group inequality as the difference between overall inequality and between-group inequality, its movement with the increase in x will depend on the assumptions that one makes on within-group inequality in the non-agricultural sector versus the agricultural sector. If one assumes that there is higher within-group inequality in the non-agricultural sector than in the agricultural sector (as seem to be implied by Kuznets), then the within-group inequality component of overall inequality will strictly increase as x increases – that is, within-group inequality will increase with structural transformation (as shown in Figure 1).

The combination of the behaviour of between-group inequality and within-group inequality may lead to the well-known inverted relationship between structural transformation and inequality – in Figure 1, as x increases, there is an unambiguous increase in inequality; however, once a certain x is reached, if the between-group component dominates the within-group component, inequality will start declining.

Figure 1. The Kuznets Process



Source: adapted from Anand and Kanbur (1993a)

The Kuznets process as described above does not differentiate between whether the movement of workers from agriculture is to manufacturing or services. Would the effects of manufacturing driven structural transformation be different than that for services driven structural transformation? Consider between group-inequality first. For this component to increase with structural transformation, mean income in the sector absorbing labour from agriculture has to be higher than the mean income prevailing in the agricultural sector. This assumption is likely to hold, no matter whether the labour absorbing sector is manufacturing or services as productivity in the manufacturing or services sector is expected to be higher than in agriculture, at least in the early part of industrialisation when agriculture is likely to be characterised by surplus labour (Lewis 1954).[5]

[5] Several studies document the much higher productivity of manufacturing and services than agriculture in low income countries (e.g., Gollin et al., 2014).

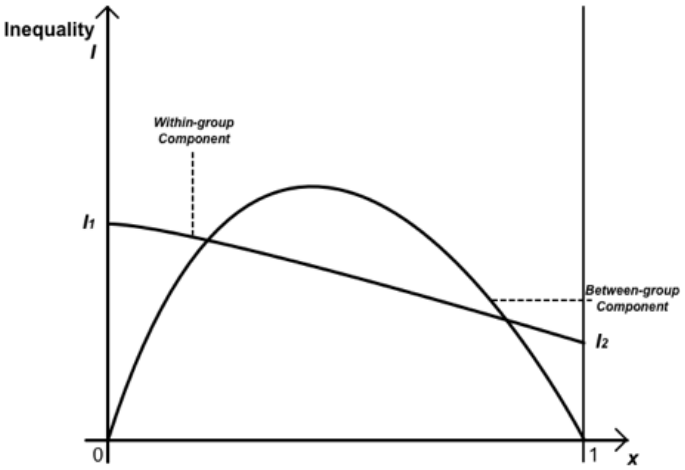
Now consider within-sector inequality. This component of overall inequality may not necessarily increase with manufacturing driven structural transformation for three reasons. Firstly, the historical experience of successful industrialisation among what are called the "late industrialisers" – for example, China, Mauritius, South Korea, Singapore, and Taiwan – indicates that much of the early success in industrialisation occurs in labour-intensive manufacturing, which is characterised by low within-sector inequality (Krueger 1980, World Bank 2017). Secondly, manufacturing activity tends to be factory based and in the formal sector (in contrast to the services sector, where a large part of economic activity is in the informal sector), where labour markets are characterised by minimum wages and other labour regulations. This is likely to lead to wage compression, and therefore, relatively low within-sector inequality. Finally, there may be a political channel through which within sector inequality may decrease with manufacturing driven structural transformation as the organised working class is likely to gain political strength over time in countries which witness rapid industrialisation. This may lead to democratisation that may encourage redistribution (Acemoglu and Robinson 2002).

However, a very different argument may apply to services driven structural transformation. A large of part of the employment created in the services may be self-employment in the poorly paid informal sector (such as household enterprises in the trade, hotels and restaurants sector), which may exist with well-paid jobs in the formal services sector (such as banking and finance). The lack of an organised working class in the informal services sector also does not allow workers to make demands of their employers for better wages or of the state for redistribution. This suggests that the Kuznets argument, which proposes that the move of workers from agriculture to non-agriculture will exacerbate the within sector component of inequality, is likely to hold more for the services sector than the manufacturing sector.

We illustrate the possibility of the within sector component of inequality falling with a movement of workers from agriculture to manufacturing in Figure 2. Here, the within group inequality component falls with an increase in x. As is clear from the figure, it is not obvious that inequality will necessarily increase at early stages of structural transformation – if the within-group component of inequality dominates the between-group component, inequality will *fall* with an increase in the number of workers in the non-agricultural sector. [6]

[6] It should also be noted that the assumption of low within sector inequality that is being implicitly made of the agricultural sector in the Kuznets process may not be correct in many country contexts in Latin America, South Asia and Sub-Sahara Africa, where the land distribution may be concentrated among a few land-owning elites.

Figure 2. An Alternate View of the Kuznets Process



Source: adapted from Anand and Kanbur (1993a)

3. Paths of Structural Transformation

In this section, we trace the different paths of structural transformation across the developing and developed world. Before we do so, we first describe the data we use in our analysis.

Data:

The data on structural transformation comes from the GGDC data-base of the University of Groningen (Timmer et al. 2015). There are 41 countries in the data-base, which includes annual disaggregated data on real value added and employment by sector from 1960 onwards to 2010 in most cases, with data available for a few countries till 2012. For our purpose, the GGDC data provides data on manufacturing industry and non-manufacturing industry (construction, mining and utilities) separately, as well as disaggregated data on services by type of sector (business services, government services, trade, hotels and restaurants, and so on). Table A1 in the Data Appendix provides details of the ten sectors in the GGDC data. Employment is defined as "all persons employed", including all paid employees, as well as self-employed and family workers.

The GGDC dataset has twelve African countries (including North Africa), nine Latin American countries, eleven Asian countries (including Japan) and the rest from Europe, and the United States. A key strength of the employment data is that the source of the data is the population census, which ensures full coverage of the working population as well as a precise sectoral breakdown. The population census which tends to be quinquennial or decennial in most countries is supplemented by the labour force surveys and the business surveys to derive annual trends. The use of the population census also ensures that informal employment, which is important in many low and middle-income countries, is captured in the GGDC data. A feature of the data is the careful attention paid to intertemporal, international and

internal consistency (Timmer and Vries 2009, Diao et al. 2017). This differentiates the quality of the data from other sources of employment data, such as the International Labour Organisation's ILOSTAT, which compiles data directly obtained from country sources without the consistency checks undertaken by GGDC.[7] We provide further discussion on the suitability of alternate sources of sectoral employment data for our analysis in Appendix A2.

The GGDC data has two limitations – firstly, it has limited coverage of low income countries, and secondly, ten countries do not report disaggregated employment data for community, social and personal services and government services. [8] According to the GGDC data, Government services employ 13 % of the working population in average with maximum rising up to 35 % (Sweden in 1993). The average employment rate in personal services is 6%, with the maximum being 17 % (Hong Kong in 1981). Employment rate in these subsectors also vary over time, as we will later demonstrate in Table 3. Since both sub-sectors employ a large portion of the population, we are unable to include countries with missing data in our own sample, as calculating averages would significantly inflate actual employment rates in other sectors. Hence, our sample size reduces to 31 countries. We address the limitation of a small sample size in the econometric analysis that we undertake by using the ILOSTAT data which includes several more low-income countries as a robustness check and including imputations of employment in community, social and personal services and government services where the data is missing for specific country-years as an additional robustness check.

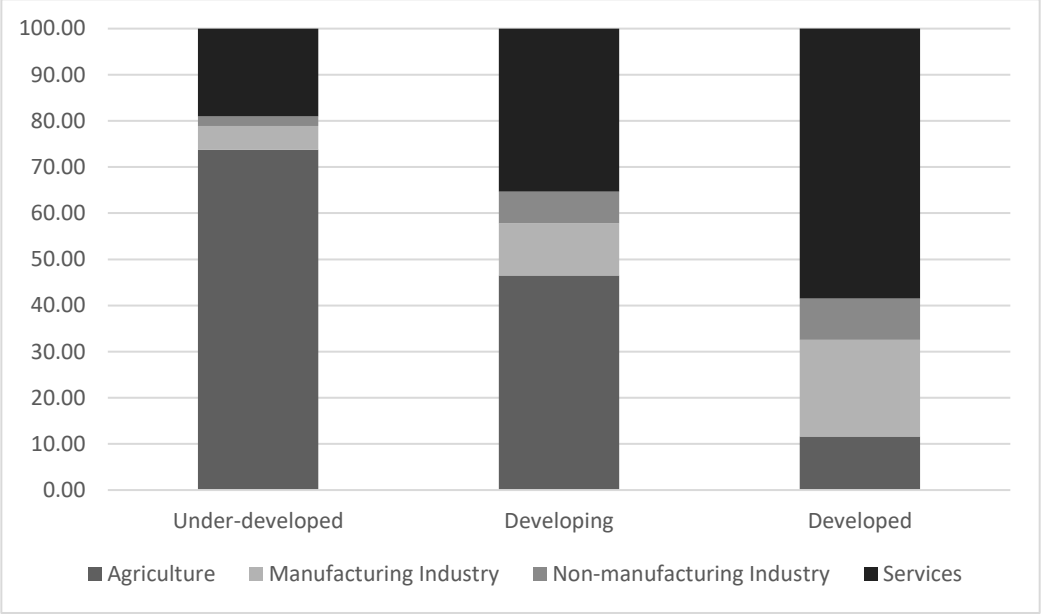
We categorise our countries by the different stage of structural transformation that they are in. A first set of countries are those where agriculture is still the largest sector in terms of the share of employment in the most recent time period available. In our sample, these countries are Ethiopia, India, Kenya, Malawi, Nigeria, Senegal, and Tanzania. These countries are all in Sub-Saharan Africa, with only India being the non-African country. We call these countries **structurally under-developed**. The next set of countries are where more people are employed in the services sector than agriculture, with agriculture being the second largest sector. These countries are Botswana, Brazil, People's Republic of China, Costa Rica, Ghana, Indonesia, Philippines, Thailand and South Africa. We call them **structurally developing countries**. These countries span all three continents – Africa, Asia and Latin America. The final set of countries has more people employed in manufacturing sector than agriculture. These countries in the sample are Argentina, Hong Kong (China), Malaysia, Mauritius, Mexico, and Taiwan, as well as Denmark, France, Italy, Japan, Netherlands, Spain, Sweden, United Kingdom and United States. These

[7] As discussed in Appendix A2, an alternate source of employment data is the labour force surveys (as in the International Labour Organisation's ILOSTAT). Though labour force surveys are more frequent than the population census, the data is often not representative in many developing countries and are sometimes restricted to particular regional areas, such as urban areas.

[8] Bolivia, Chile, Colombia, Peru, Singapore, South Korea, Venezuela and Zambia do not have data on government services. Egypt and Morocco do not have data on personal services. In addition, Indonesia lack both only in one year, 1961.

countries are either in East Asia or Latin America (with the exception of Mauritius, which is in Africa), and the advanced market economies. We call these countries **structurally developed**. We provide the list of countries by stage of structural transformation in Table 1.

Figure 3. Share of Employment by Stages of Structural Transformation



Note: In percentages of total employment, unweighted averages.

Source: GGDC data, our calculations.

Table 1. Stages of Structural Transformation

Structurally Underdeveloped (7 countries)	Structurally Developing (9 countries)	Structurally Developed (15 countries)
Ethiopia	Brazil	Argentina
India	Botswana	Denmark
Kenya	China	France
Malawi	Costa Rica	Hong Kong
Nigeria	Ghana	Italy
Senegal	Indonesia	Japan
Tanzania	Philippines	Malaysia
	Thailand	Mauritius
	South Africa	Mexico
		Netherlands
		Spain
		Sweden
		Taiwan
		United Kingdom
		United States

Note: Structurally underdeveloped: share of employment in agriculture higher than in manufacturing or services; structurally developing: share of employment in services higher than in agriculture; structurally developed: share of employment in manufacturing higher than in agriculture.

Table 2. Share of Employment by Stages of Structural Transformation Over Time

Country Group	Period	Agriculture	Manufacturing Industry	Non-manuf. Industry	Services
Under-developed	1960-1979	80.1	4.6	1.5	13.8
	1980-1999	73.4	4.7	1.9	20.0
	2000-2012	65.6	6.7	3.2	24.6
Developing	1960-1979	58.7	9.8	6.0	25.6
	1980-1999	44.1	12.0	7.5	36.4
	2000-2012	33.2	12.2	7.2	47.4
Developed	1960-1979	18.6	24.1	9.6	48.2
	1980-1999	9.8	21.1	8.7	60.5
	2000-2012	5.5	16.0	8.7	69.8

Note: In percentages of total employment, unweighted averages.

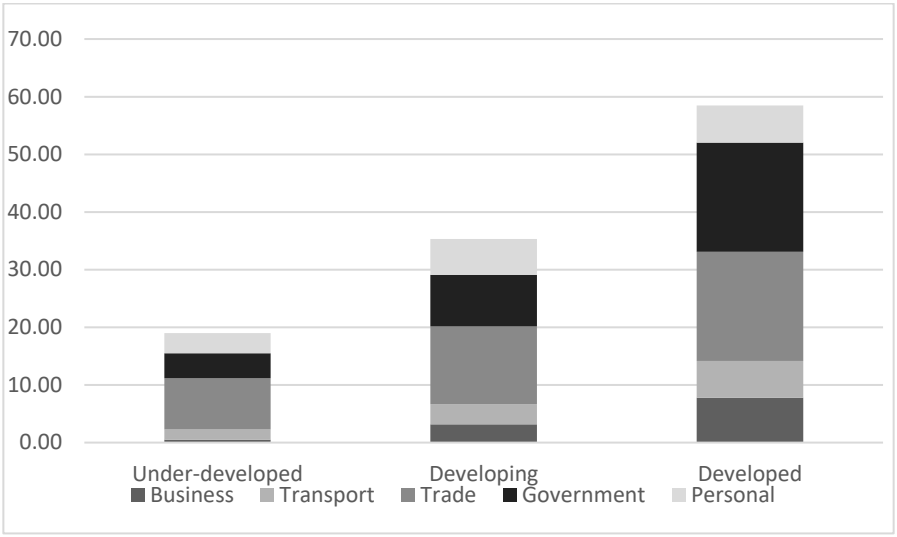
Source: GGDC data, our calculations.

In Figure 3, we provide the allocation of workers by stage of structural transformation, averaged over the entire period, 1960-2012. The broad sectors we look at are agriculture, manufacturing industry, non-manufacturing industry (mining, utilities, and construction) and services. Agriculture provides around 70 % of the employment for structurally underdeveloped countries, just over 45 % in structurally developing countries and around 11 % in structurally developed countries. For the period 1960-2012, Manufacturing provided an average of 5 % of employment in structurally underdeveloped countries, 11 % of employment in structurally developing countries and 21 % of employment in structurally developed countries. Finally, services provided an average of 19 % of employment in structurally underdeveloped countries, 35 % of employment in structurally developing countries and 58 % of employment in structurally developed countries.

In Table 2, we provide the same information as in Figure 3, except now we do it by sub-periods. We see the very slow movement of workers in agriculture in structurally underdeveloped countries, from 80 % in 1960-1979 to 66 % in 2000-2012. These countries have also seen a slow increase in the share of employment in manufacturing from 5 % in 1960-79 to 7 % in 2000-2012. In the case of structurally developing countries, average share of employment in services overtakes employment in agriculture only in the period between 2000 and 2012. Nevertheless, these countries have seen rapid decline in the share of employment in agriculture from 59 % in 1960-79 to 33 % in 2000-12, as well as an increase in

the share of employment in manufacturing from 10 % in 1970-79 to 12 % in 2000-12. For structurally developed, the share of employment in agriculture was low to start with at 19 % in 1970-79. By the time we reach the period 2000-12, more workers are employed in non-manufacturing industry in these countries than in agriculture, and services at 70 % provide the largest employment by far. Here, we observe a fall in the share of employment in manufacturing over time.

Figure 4. Share of Employment in Services Sub-Sectors by Country Group – Period Average



Note: In percentages of total employment, unweighted averages.

Source: GGDC data, our calculations.

Table 3. Share of Employment in Services Sub-Sectors by Country Group Over Time

Country Group	Period	Services	Business	Transport	Trade	Govt.	Personal
Under-developed	1960-1979	13.8	0.3	1.4	5.8	3.6	2.8
	1980-1999	20.0	0.5	1.7	9.4	4.5	3.8
	2000-2012	24.6	0.9	2.3	12.4	4.9	4.0
Developing	1960-1979	25.6	1.9	2.7	9.4	6.8	4.9
	1980-1999	36.4	3.1	3.4	13.4	9.8	6.6
	2000-2012	47.4	5.1	4.6	19.3	10.7	7.6
Developed	1960-1979	48.2	4.5	6.2	16.3	15.9	5.3
	1980-1999	60.5	7.9	6.5	19.5	19.8	6.7
	2000-2012	69.8	12.2	6.7	21.7	21.7	7.7

Note: In percentages of total employment, unweighted averages.

Source: GGDC data, our calculations.

The share of employment in the five sub-sectors that make up the total services sector, business, transport, trade, government and personal services, also differ between country groups as well over time. While the trade sub-sector which includes wholesale and retail trade, as well as restaurants and hotels, is the largest sub-sector within services in both under-developed and developing countries in our sample in almost all the periods, government services catch up to the trade sub-sector in structurally developed countries over the past three decades (Figure 4). Apart from the government services sub-sector, the most rapid increase for a particular sub-sector within the services sector is observed in the business services sub-sector for the structurally developing and developed countries – in the former group of countries, it goes up from 1.9 % of total employment in 1960-79 to 5.7 % in 2000-12, and for the latter group of countries, for the same periods, it goes up from 4.5 % to 12.2 % (Table 3). In contrast, the business services sub-sector remains a paltry 0.9 % of total employment in structurally underdeveloped countries in 2000-12.

Figures 5-8. Movement of Workers from Agriculture to Manufacturing and Services over Time

Figure 5. All Countries

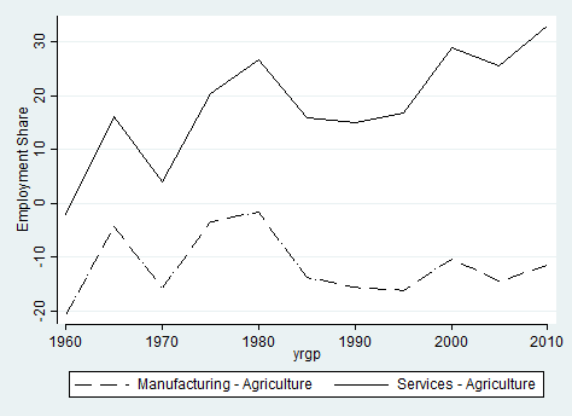


Figure 6. Structurally Underdeveloped Countries

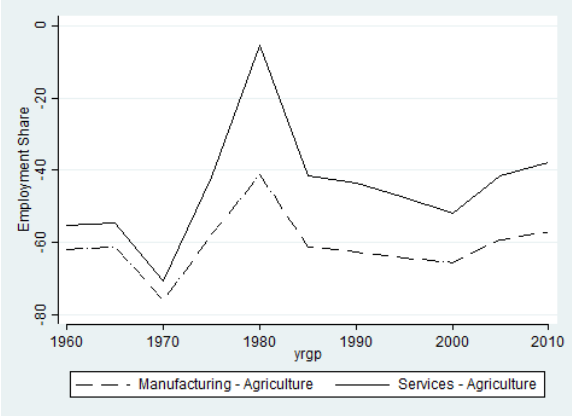


Figure 7. Structurally Developing Countries

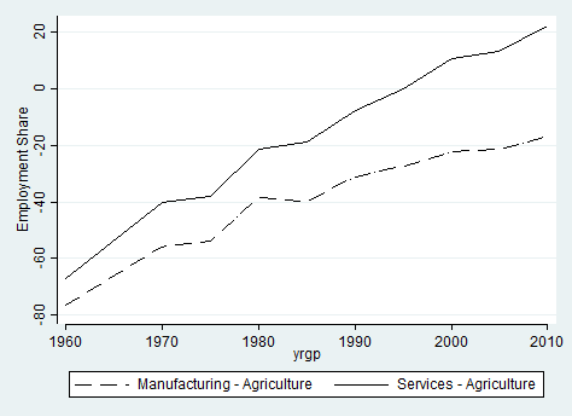
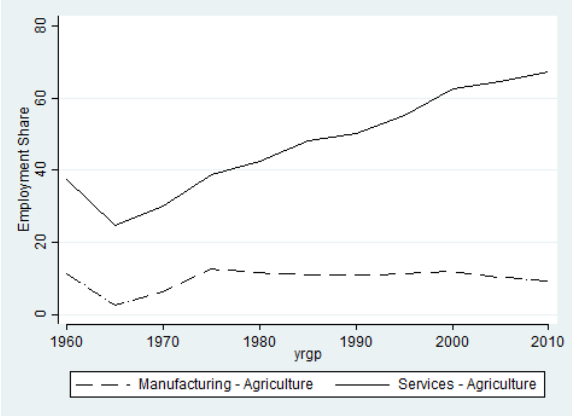


Figure 8 . Structurally Developed Countries



Note: Manufacturing-Agriculture: Employment Share in Manufacturing – Employment Share in Agriculture, Manufacturing-Services: Employment Share in Services – Employment Share in Agriculture; unweighted averages.

Source: GGDC data, our calculations.

A striking feature of structural transformation in our 31 countries is that the movement of employment from agriculture has been mostly to services (Figure 5). For structurally underdeveloped countries, there was a sharp incline in the movement of workers away from agriculture till the mid-1970s, then a reduction since then (Figure 6). We observe a rapid and sustained movement of workers from agriculture to manufacturing and services in structurally developing countries over the entire period 1960-2012, which is very different to what we observed in structurally underdeveloped countries (Figure 7). Finally, for structurally developed countries, the movement of workers from agriculture is mostly to services, with the movement of workers from agriculture to manufacturing falling over time (Figure 8).

Figures 9-12. Relative Productivity Differentials over Time

Figure 9. All Countries

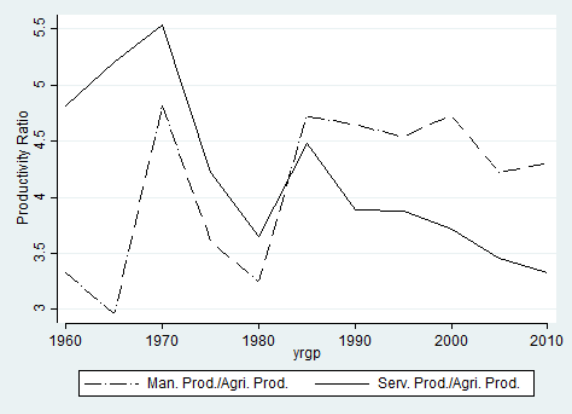


Figure 10. Structurally Underdeveloped Countries

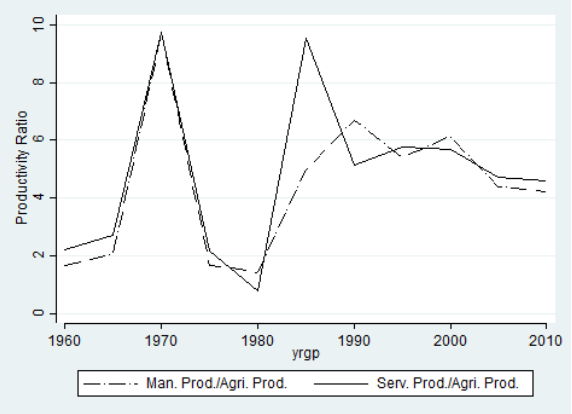


Figure 11. Structurally Developing Countries

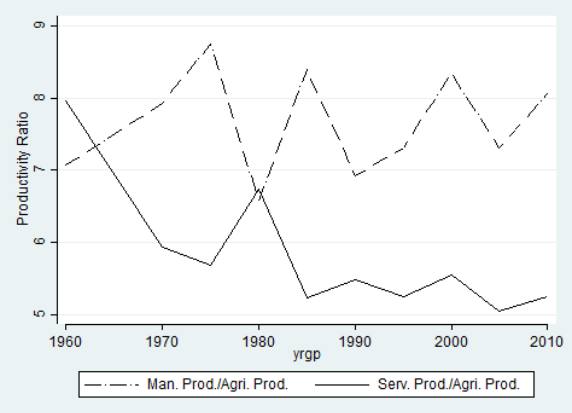
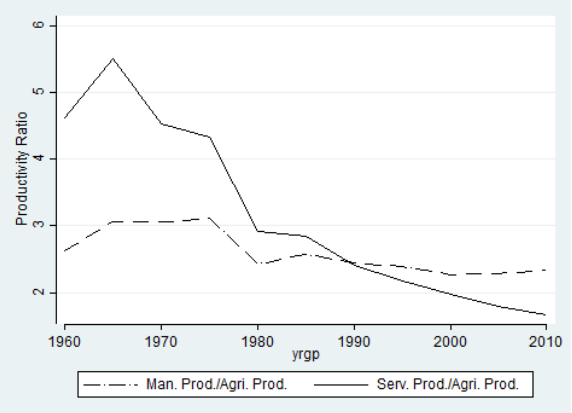


Figure 12. Structurally Developed Countries

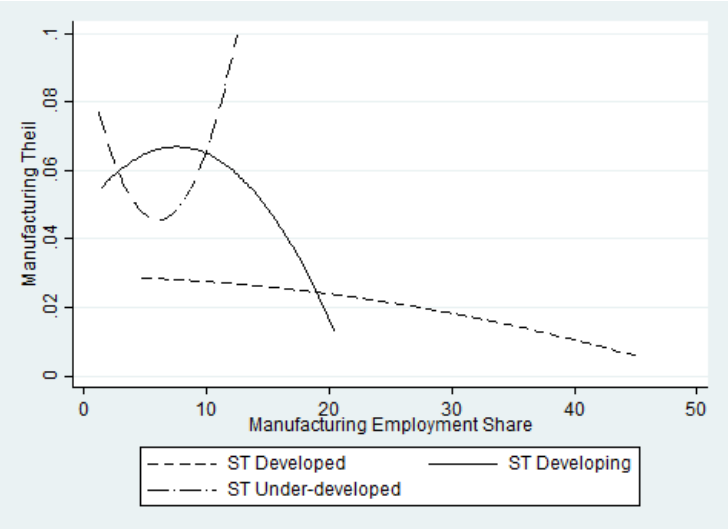


Note: Manufacturing Prod./Agri Prod.: Real Value Added per Worker in Manufacturing as Ratio of Real Value Added per Worker in Agriculture; Services Prod./Agri Prod.: Real Value Added per Worker in Services as Ratio of Real Value Added per Worker in Agriculture; unweighted averages.

Source: GGDC data, our calculations.

A second striking feature of structural transformation has been that the shift of employment from agriculture to services has been accompanied by falling relative productivity of services to agriculture (Figure 9).[9] In contrast, the relative productivity of manufacturing to agriculture has increased till the 1970s, then showed a sharp decline until 1980s, and is significantly higher than the relative productivity of the services sector since mid-1980s. This suggests that a services driven structural transformation has very different implications for overall productivity growth as compared to a manufacturing driven structural transformation (Herrendorf et al. 2014).[10] We also observe very different patterns of relative productivity movements over time across the three different country groups – consistent with the slow movement of workers from agriculture to manufacturing, manufacturing relative productivity levels are very similar to that of services in structurally underdeveloped countries (Figure 10). In contrast, for structurally developing countries, which have seen an increasing share of manufacturing employment in total employment, the relative productivity of manufacturing is significantly higher than that of services (Figure 11). For structurally developed countries, where agricultural productivity levels are high relative to what we observe in structurally underdeveloped and developing countries (see Gollin et al. 2014), relative productivity differences across sectors become insignificant over time as more workers move out of agriculture (Figure 12).

Figure 13. Structural Transformation and Within Sector Inequality in Manufacturing



Source: https://utip.lbj.utexas.edu/data.html, our calculations.

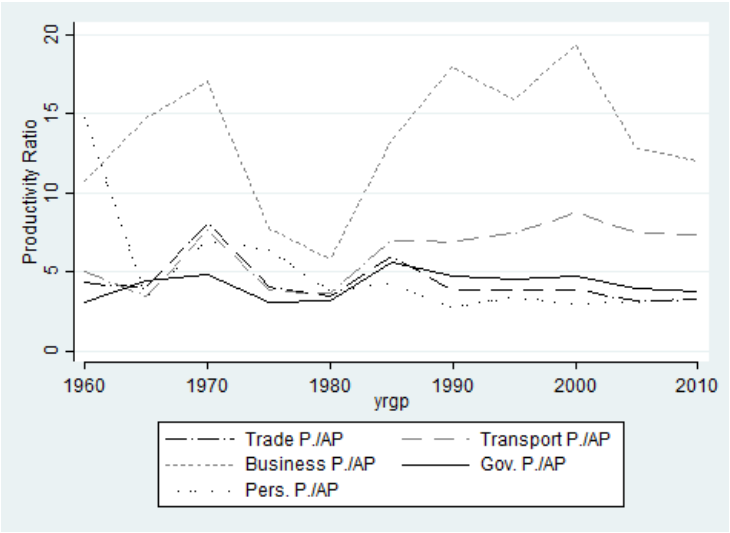
[9] We measure sectoral productivity as the ratio of real value added to total employment in the sector. The data is obtained from the GGDC data-base.

[10] This observation is also supported by the cross-country analysis undertaken by Duarte and Restuccia (2010) who show that productivity catch-up in industry explain about 50 per cent of the gains in aggregate productivity across countries, whereas low productivity in services and the lack of catch-up explain economic stagnation in low income countries.

In the previous section, we argued that one key assumption behind the Kuznets process – that the within-sector component of total inequality will increase at the early stages of structural transformation - may not necessarily hold if the movement of workers from agriculture is to manufacturing. We now provide some suggestive evidence to support our claim that manufacturing in the early stages of structural transformation may not be characterised by high within-sector inequality. To capture within-sector inequality manufacturing, we use the Theil measure of within industry pay inequality as calculated by the University of Texas Inequality Project (UTIP) using industry-specific wage data from the United Nations Industrial Development Organisation (UNIDO)'s industrial statistics data-base (see Galbraith et al. 2014). We present the relationship between manufacturing employment share and the Theil measure of within industry pay inequality by our country groups in Figure 13. We observe that for the set of countries which are at the relatively early stages of industrialisation – the structurally underdeveloped and developing countries – within sector inequality in manufacturing decreases with increases in the manufacturing employment share (this is not the case for the structurally developed countries). Particularly for countries where the share of employment in manufacturing has been very high (at over 20 %) in certain periods such as Hong Kong, Malaysia, Mauritius and Taiwan, the decreases in within sector inequality can be explained by the fact that much of the increase in employment occurred in the labour-intensive manufacturing sectors (Krueger 1978, Riedel 1988)

What about within sector inequality in services? We do not have data on mean incomes by sub-sector in services to allow us to compute within sector inequality in services. However, using productivity as a proxy for mean incomes at the sub-sectoral level, we find clear differences in relative productivity levels across sub-sectors – the Business Services sub-sector which comprise finance, banking and information technology, is far more productive than all other Services sub-sectors (Figure 14), and we see that this productivity gap has widened over time. This suggests that there is widening within-sector inequality in services as the business services sub-sector grew in importance, particularly in structurally developing and developed countries (as we noted earlier in this section).

Figure 14. Relative Productivity within Services sector over time, All Countries



Note: Trade P./AP: Real Value Added per Worker in Trade Services as Ratio of Real Value Added per Worker in Agriculture; Transport P./AP: Real Value Added per Worker in Transport Services as Ratio of Real Value Added per Worker in Agriculture; Business P./AP: Real Value Added per Worker in Business Services as Ratio of Real Value Added per Worker in Agriculture; Govt P./AP: Real Value Added per Worker in Government Services as Ratio of Real Value Added per Worker in Agriculture; Pers. P./AP: Real Value Added per Worker in Personal, Social and Community Services as Ratio of Real Value Added per Worker in Agriculture; unweighted averages.

Source: GGDC data, our calculations.

Overall, our analysis of the patterns of structural transformation suggests that different countries in Africa, Asia, Europe and North America and Latin America have shown very different paths of structural transformation over time, both in the across-sector movement of workers as well as the behaviour of relative productivities over time at the sectoral level. We next discuss the implications of these different paths of structural transformation for inequality.

4. Patterns of Structural Transformation and Inequality

Data for income inequality are taken from the standardized income inequality dataset, prepared by Baymul and Shorrocks (2018), which is a revision of the WIID data-base of the World Institute for Development Economics Research. The Gini coefficient is the most commonly used measure of inequality; however, conceptual and methodological differences between household surveys that are used to calculate Gini coefficients make their comparability between countries and over time problematic. The standardized dataset we use in this paper tries to overcome the issues of comparability by adjusting all available data that exceeds a quality threshold from various sources through a regression

adjustment method that includes an extensive list of independent variables. We use Net Ginis, which measure net per capita income inequality in a country in a given year (as a robustness test in our econometric analysis, we use Gross Ginis as well).

We first look at the overall relationship between manufacturing employment share and inequality, then by country group. In the overall sample as well as by country group, we see a clear negative relationship between manufacturing driven structural transformation and inequality (Figures 15 and 16). In the case of structurally developed countries, there is a suggestion that inequality increases, once manufacturing employment share crosses 30 %; however, as Figure 15 makes clear, there are very few countries-year observations that are over this threshold.

Figures 15-16. The Relationship between Manufacturing Employment Share and Inequality

Figure 15. All Countries

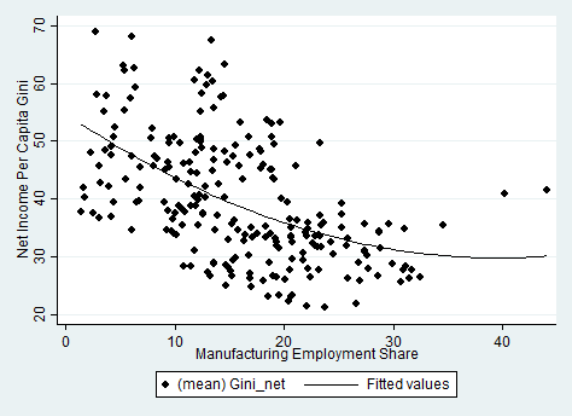
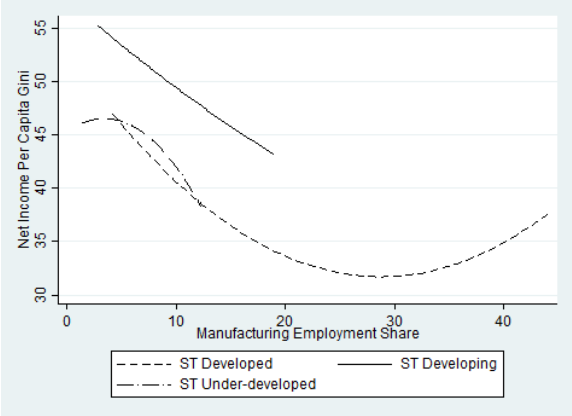


Figure 16. Different Paths of Structural Transformation



Source: GGDC data and Baymul-Shorrocks (2018), our calculations.

We next look at the relationship between services employment share and inequality, for the overall sample and then by country group (Figures 17 and 18). We do not see a clear relationship in the overall sample, with a lack of precision in the fitted line estimated in the scatter plot. By country group, we seem to see a U-shaped relationship for structurally developed countries, and a positive relationship for structurally under-developed and developing countries. Overall, the scatter plots suggest that there is a negative relationship between manufacturing driven structural transformation and inequality and a lack of a clear relationship between services driven structural transformation and inequality. We now proceed to an econometric analysis of the relationship between structural transformation and inequality. We next discuss the econometric methodology that we will use in the analysis.

Figures 17-18. The Relationship between Services Employment Share and Inequality

Figure 17. All Countries

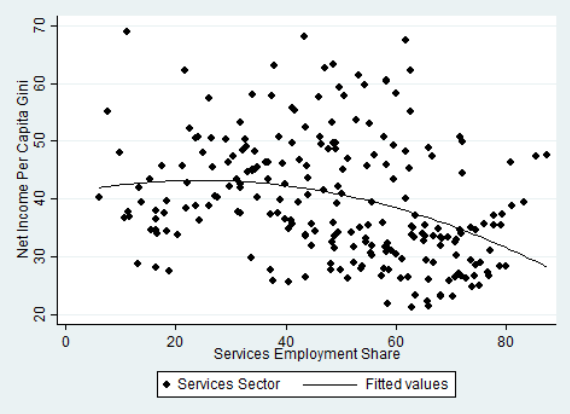
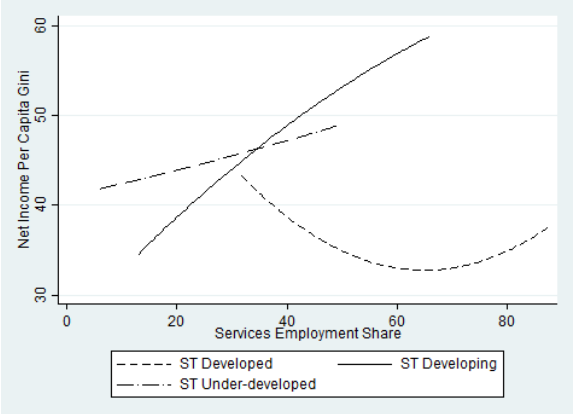


Figure 18. Different Paths of Structural Transformation



Source: GGDC data and Baymul-Shorrocks (2018), our calculations.

5. Methodology

Our paper has two core research questions: a) what are the effects of manufacturing driven structural transformation on income inequality, and do the effects differ by the path of structural transformation a country is in, and b) what are the effects of services driven structural transformation on income inequality, and how are they different from the effects of manufacturing driven structural transformation? To address the first research question, we estimate the marginal impact of an increase in the share of employment in manufacturing on inequality with the three following equations:

$$Gini_{it} = \beta_{man}Manufacturing_{it} + \beta_{min}Mining_{it} + \beta_{utl}Utilities_{it} + \beta_{cons}Construction_{it} + \beta_{Serv}Services_{it} + \beta X_{it} + \sigma_t + a_i + u_{it} \quad (1)$$

$$Gini_{it} = \beta_{man}Manufacturing_{it} + \beta_{mansq}Manufacturing_{it}^2 + \beta_{min}Mining_{it} + \beta_{utl}Utilities_{it} + \beta_{cons}Construction_{it} + \beta_{Serv}Services_{it} + \beta X_{it} + \sigma_t + a_i + u_{it} \quad (2)$$

$$Gini_{it} = \beta_{man}Manufacturing_{it} + \beta_{min}Mining_{it} + \beta_{utl}Utilities_{it} + \beta_{cons}Construction_{it} + \beta_{Serv}Services_{it} + \beta Developed_i + \beta Developing_i + \beta Developed * Manufacturing_{it} + \beta Developing * Manufacturing_{it} + \beta X_{it} + \sigma_t + a_i + u_{it} \quad (3)$$

Where i denotes country, and t denotes period. Manufacturing, Mining, Utilities, Construction and Services are the employment shares of country i in period t in these sectors. Since we are interested in the marginal impact of manufacturing employment share on inequality, we control for the employment shares of the other sectors. X is a vector of other controls, which we discuss below, and σ_t and a_i are period and country dummies.

We measure income inequality using the Net Per Capita Gini – that is, the level of income inequality in the country net of Taxes and Transfers. The net Gini allows us to capture the indirect effect that structural transformation may have on inequality through what we called the political channel – the demand for redistribution that may originate from the organised working class if there is an increase in the share of employment in manufacturing. However, it is not obvious if it should be the preferred measure of inequality over the Gross Gini – which captures the direct effect of structural transformation on market inequality. We also use the Gross Gini as an alternate dependent variable in our econometric analysis.[11]

The first equation (Equation 1) assumes a linear relationship between manufacturing employment share and inequality. In Equation (2), we allow a non-linear effect of manufacturing employment share on inequality – as suggested by the Kuznets postulate that inequality may first increase, then decrease with structural transformation. In Equation (3), we allow for the effect of manufacturing employment share on inequality to differ by the path of structural transformation a particular country is in, so we interact the manufacturing employment share with the dummies for whether the country is structurally developing or developed (the residual is if the country is structurally underdeveloped).

With respect to the control variables, we begin with a parsimonious sector of controls – these are the level of per capita income, human capital and government consumption (to capture the size of the government sector). Per capita income may have an independent effect on inequality (by providing more resources for redistribution) over and above through the effect of structural transformation on the level of economic development. Countries with higher levels of human capital are likely to see lower inequality as a higher supply of human capital would lead to lower wage inequality (Castello-Climent, A and R Doménech 2014). Finally, the larger the size of the government, the lower may be inequality (Dabla-Norris et al. 2015).[12]

[11] We also experimented with other measures of inequality such as the top 10 per cent and bottom 40 per cent shares of income, with no change in our results.

[12] We measure per capita income by the natural logarithmic values of Gross Domestic Product (GDP) per capita in 2011 US Dollars taken from the Penn World Table 9.0, human capital by percentage of people aged 15 and over who completed secondary school, taken from the Barro-Lee Educational Attainment Dataset and government consumption by the final government consumption expenditure as a share of the total GDP, taken from the World Bank's World Development Indicators. Additional information on data can be found in Appendix A3.

We estimate Equations 1 and 2 by panel fixed effects regressions to control for time-invariant country characteristics (such as the country's factor endowments) that may explain both the pattern of structural transformation and inequality.[13] We estimate the third equation by random effects as it contains time invariant dummy variables for structurally developing and developed countries that need to be estimated. We also include period dummies to control for common global shocks that may affect structural transformation and inequality.[14]

To address the second research question, we estimate the following two equations to examine whether a relationship exists between income inequality and services driven structural transformation using fixed effects regressions for Equation (4) and random effects regressions for Equation (5):

$$Gini_{it} = \beta_{serv}Services_{it} + \beta_{servsq}Services_{it}^2 + \beta_{min}Mining_{it} + \beta_{utl}Utilities_{it} + \beta_{cons}Construction_{it} + \beta_{man}Manufacturing_{it} + \beta X_{it} + a_i + u_{it} \quad (4)$$

$$Gini_{it} = \beta_{Serv}Services_{it} + \beta_{min}Mining_{it} + \beta_{utl}Utilities_{it} + \beta_{cons}Construction_{it} + \beta_{man}Manufacturing_{it} + \beta Developed_i + \beta Developing_i + \beta Developed * Services_{it} + \beta Developing * Services_{it} + \beta X_{it} + a_i + u_{it} \quad (5)$$

As we noted earlier, we have missing data for several years at the sub-sectoral level for the community, social and personal services and government services for 10 countries (see Footnote 8). This implies that for these countries, the share of employment in manufacturing and services is measured with error as we do not know what the true level of employment in these countries for the years when the data on sub-sectoral services is missing. Further, data on the Gini coefficient is not available on an annual basis, with usually one observation for a five-year period for many countries. In addition, data on one of our control variables - human capital – is unavailable for Ethiopia and Nigeria. We begin our econometric analysis with the 29 countries for which we have complete data on the core explanatory variables – the manufacturing and services employment shares – as well as all our basic set of control variables. We use five-year averaged data to take into account the infrequent nature of the data on income inequality. We have 219 observations for the 29 countries for the period 1960-2012. This is our basic empirical specification.

[13] For example, countries with more favourable endowments of unskilled labour may have both larger manufacturing sectors as well as lower inequality (see Wood 2017).

[14] For example, a boom in global commodity prices may lead to a rise in employment in primary commodity sectors coinciding with an increase in inequality as incomes increase in high rent natural resource intensive activities.

We then proceed to do several robustness checks. Firstly, we include a further set of controls – foreign direct investment, trade as a ratio of GDP and financial open-ness to capture the effect of globalisation on inequality (Goldberg and Pavcnik 2007, Jaumotte et al. 2013).[15] Including these set of controls implies that we lose 30 observations – we now only have 189 observations. Secondly, we use the Gross Gini instead of the Net Gini as our dependent variable of interest. Thirdly, we omit the rich countries in our sample, which had largely completed their process of structural transformation prior to the beginning year of our analysis.[16] Fourthly, we impute the missing data on community, social and personal services and government services for the countries where the data is missing.[17] Finally, we use data from ILOSTAT, where we have many more countries in our sample (115 countries, with the total number of observations being 475) – however, as we have noted in Section 3, the quality of the ILOSTAT is not high, so we have a trade-off between quality of the data and quantity (that is, number of countries and observations). We present our results in the next section.

6. Results

We present the results of the set of panel regressions that aim to investigate the relationship between the manufacturing employment share and income inequality in Table 4 and the marginal effects of manufacturing employment share on inequality in Table 5. [18]Cols. (I) and (II) present the estimates of equation (1) with and without our basic controls. Cols. (III) and (IV) present the estimates of equation (2), with squared manufacturing employment share included as a regressor, with and without our basic controls. Cols. (V) and VI) present the random effects estimates of equation (3), with country groups interacted with manufacturing employment share.

[15] Data on foreign direct investment and trade over GDP comes from World Bank's World Development Indicators. We use the Chinn-Ito measure to capture financial open-ness, which measures the degree of capital account open-ness in the country (Chinn and Ito 2006).

[16] These countries are Denmark, France, Italy, Japan, Netherland, Spain, Sweden, UK and the USA. When we drop these nine countries, we lose 87 observations.

[17] We impute the missing data by first dividing the total amount of labour in each subsector to the population of the country to get the share of population working in one subsector in the total population, so as to normalize the shares across countries. Then we regressed the missing personal services share on each subsector (excluding the government services share), year dummies and country dummies. By doing so, we obtained the predicted personal shares for the missing observations. We followed the same procedure for the government services sector, but in this case, we included all subsectors since we no longer have missing personal services values. Finally, we calculated the total number of people working in personal and government services by multiplying them back with country populations. Our total number of observations increases to 294.

[18] Descriptive statistics are presented in Table A2.

Table 4. Regression Results I

	I	II	III	IV	V	VI
	FE I	**FE II**	**FE III**	**FE IV**	**RE I**	**RE II**
Manufacturing	-0.21***	-0.29***	-0.67*	-0.74**	-1.31**	-1.00**
	(0.07)	(0.07)	(0.38)	(0.33)	(0.51)	(0.40)
Manufacturing Sq			0.01	0.01		
			(0.01)	(0.01)		
Mining	-0.80	-1.37**	-0.76	-1.33**	-0.32	-0.70
	(0.55)	(0.58)	(0.58)	(0.60)	(0.59)	(0.62)
Utilities	1.54	2.98	1.62	3.05	1.01	2.22
	(2.79)	(2.68)	(2.67)	(2.55)	(2.21)	(2.22)
Construction	0.55**	0.34	0.66**	0.46**	0.66**	0.49**
	(0.26)	(0.22)	(0.28)	(0.22)	(0.29)	(0.24)
Services	-0.14	-0.32**	--0.07	-0.26	-0.07	-0.20
	(0.11)	(0.14)	(0.15)	(0.17)	(0.11)	(0.13)
lnGDP		5.97***		5.95***		4.49**
		(1.96)		(1.95)		(1.90)
Secondary School		-0.09*		-0.10*		-0.09
Comp.		(0.05)		(0.05)		(0.05)
Gov Exp		0.16		0.16		0.05
		(0.15)		(0.16)		(0.15)
Developed					-17.12	-17.60*
					(10.43)	(9.89)
Developing					-5.77	-1.76
					(8.78)	(7.36)
Manufacturing*					1.12**	0.75*
Developed					(0.54)	(0.43)
Manufacturing*					1.19**	0.61
Developing					(0.56)	(0.45)
No. of Obs.	219	219	219	219	219	219
R-squared (within)	0.26	0.32	0.24	0.33	0.25	0.31
F	11.64	8.79	11.12	9.89		
Wald chi^2					165.84	360.61

Dependent variable is Gini (Net). Standard errors in parentheses. Period dummies are included. *, **, ***: Significance in 10, 5, 1% respectively.

Table 5. Marginal Effect of Manufacturing Employment Share

FE IV – Marginal Effects of Manufacturing		RE II – Marginal Effects of Manufacturing	
Share of Manufacturing	**Dy/dx**	**Country Group**	**Dy/dx**
1%	-0.72**	Underdeveloped	-1.00**
5%	-0.63**	Developing	-0.39*
10%	-0.52***	Developed	-0.25***
15%	-0.41***		
20%	-0.30***		
25%	-0.19*		

*, **, ***: Significance in 10, 5, 1% respectively.

The fixed effect estimates in the first and second columns (Cols. (I) and (II)) both suggest that an increase in manufacturing employment share decreases income inequality – the coefficient on the manufacturing employment share is negative and significant at 10 % level of significance or below. The coefficient on Column II implies that a 1 % increase in manufacturing's share in employment reduces income inequality by 0.29 percentage points in the Gini index. Inclusion of the squared manufacturing variable in Columns III and IV allows us to test whether a quadratic Kuznets-type relationship exists between manufacturing and inequality. While the coefficient of the squared variable is insignificant, the effect of share of manufacturing employment share on inequality remains strongly negative. The final two columns in Table 4 display the results of the random effects regressions that aim to distinguish any difference in the marginal impact of manufacturing on inequality between different country groups. We find evidence of clear heterogeneity in the effects of manufacturing employment share on inequality by country group, with the effect of manufacturing employment share on inequality being lower in structurally developing and developed countries as compared to structurally underdeveloped countries.

We present the marginal effect of manufacturing on inequality derived from Columns (IV) and (VI) of Table 4 in Table 5 at different levels of manufacturing employment share and by country groups. We find that the effect of manufacturing employment share on inequality is negative and statistically significant, *irrespective* of the level of manufacturing employment share. Even when manufacturing employment share is close to the maximum of any period average between country groups (25.1 %), it still has a negative impact on inequality. This is a remarkable finding as it suggests that manufacturing driven structural transformation will *unambiguously* decrease income inequality. Similarly, we find the effect of manufacturing employment share on inequality is negative and statistically significant for all country groups, though the effect is the strongest for structurally underdeveloped countries.

With respect to the other sectoral employment variables, construction is the only one with a consistently significant impact on inequality. Mining also has a significant and negative coefficient in fixed effects regressions when we include all the control variables. However, the mining sector is relatively small in most countries, so its overall effect is economically not significant. Employment share in services carries a negative sign in all the regressions, yet it remains insignificant in all but one.

We next estimate the effects of services driven structural transformation on inequality in Table 6. Cols. (I) and (II) present estimates of Equation (4) with and without the basic controls. Cols (III) and (IV) present estimates of Equation (5) with and without the controls. We find that no matter whether we include controls or not, whether we include the quadratic term for services or whether we include fixed effects or random effects, the overall effect of services on inequality is not statistically significant (and the sign changes from positive to negative as we move from the fixed effects to random effects regressions).

Table 6. Regression Results 2

	I	II	III	IV
	FE V	**FE VI**	**RE III**	**RE IV**
Manufacturing	-0.37**	-0.53**	-0.39***	-0.60***
	(0.17)	(0.19)	(0.11)	(0.16)
Mining	-0.94	-1.52***	0.06	0.55
	(0.57)	(0.54)	(0.70)	(0.69)
Utilities	1.31	2.77	-0.06	0.39
	(2.77)	(2.71)	(2.14)	(2.61)
Construction	0.40*	0.12	0.68**	0.50
	(0.24)	(0.22)	(0.26)	(0.31)
Services	0.15	0.07	-0.34	-0.21
	(0.39)	(0.32)	(0.29)	(0.32)
Services Sq	-0.003	-0.005		
	(0.005)	(0.003)		
lnGDP		6.55***		2.95*
		(2.05)		(1.79)
Secondary School		-0.08		-0.02
Comp.		(0.05)		(0.05)
Gov Exp		0.12		-0.32**
		(0.17)		(0.14)
Developed			-2.94	4.95
			(12.17)	(11.24)
Developing			-13.40	-14.20
			(10.67)	(10.33)
Services*			0.11	-0.14
Developed			(0.29)	(0.33)
Services*			0.54*	0.45
Developing			(0.30)	(0.34)
No. of Obs.	219	219	219	219
R-squared (within)	0.24	0.34	0.29	0.30
F	10.00	13.73		
Wald chi^2			153.34	218.50

Dependent variable is Gini (Net). Standard errors in parentheses. . Period dummies are included. *, **, ***: Significance in 10, 5, 1% respectively.

Table 7. Marginal Effect of Services Employment Share

FE VI – Marginal Effects of Services		RE II – Marginal Effects of Services	
Share of Services	**Dy/dx**	**Country Group**	**Dy/dx**
5%	0.02	Underdeveloped	-0.21
15%	-0.08	Developing	0.24*
25%	-0.17	Developed	-0.35***
35%	-0.27*		
45%	-0.36**		
55%	-0.46***		
65%	-0.55***		
75%	-0.65**		

*, **, ***: Significance in 10, 5, 1% respectively.

Table 8. Marginal Effect of Business Services Employment Share

FE VI – Marginal Effects of Business		RE II – Marginal Effects of Business	
Share of Business	**Dy/dx**	**Country Group**	**Dy/dx**
2%	-1.12***	Underdeveloped	1.18
4%	-1.16***	Developing	0.59*
6%	-1.21***	Developed	-1.22***
8%	-1.25***		
10%	-1.30***		
12%	-1.34***		
14%	-1.39***		
16%	-1.44***		
18%	-1.48***		

*, **, ***: Significance in 10, 5, 1% respectively.

We present the marginal effect of the services employment share on inequality at different levels of services employment share and by country group in Table 7 (using the estimates from Cols. (II) and (IV) respectively). We find that only when the services employment share exceeds 35 %, does it start reducing inequality. When we look at the effect of services employment share by country group, we find that for structurally developing countries, the services employment share actually increases inequality while decreasing inequality in structurally developed countries. For structurally underdeveloped countries, the coefficient on services employment share is not statistically significant. Our results suggest if the Kuznets postulate were to hold, it does not do so for manufacturing but does so for services (where inequality increases, at least for countries where a large part of employment is in services, then decreases for the more developed countries).

What may explain the surprising result we get for services driven structural transformation where it increases inequality for structurally developing but not for structurally underdeveloped countries? We had noted from Section III that a key growth sector in services for structurally developing countries as compared to structurally underdeveloped countries was the business services sub-sector. We had also noted the large productivity difference between this sub-sector and other services sub-sectors. In Table 8, we present the marginal effect of business services on inequality by level of employment in the sub-sector and by country group. The left-side columns on the table imply that when the share of the business sector is close to the sample average of 5 %, a further 1 % increase in its share corresponds to a decrease in net income inequality of around 1.2 percentage points. We find that the business services significantly increases inequality in the structurally developing countries, while decreasing it for structurally developed countries (with no discernible effect on structurally underdeveloped countries).[19] This is in accord with our intuition that the growth of the business services sub-sector leads to increases in within-sector inequality increases in the services sector as workers in the business services sub-sector (mostly professionals working in banking, finance and information technology) tend to be paid much better than workers in trade, restaurants and hotels, and other services sub-sectors (where a large proportion of employment is in the informal sector in the structurally underdeveloped and developing countries). However, for structurally developed countries, where productivity and income differences within services sub-sectors are not likely to be as high as in the other country groups, between sector inequality starting dominating within-sector inequality in the overall behaviour of inequality as most workers in the economy are now employed in the services sector (leading to the downward movement in the between-group component of inequality, as captured in Figure 1).

Robustness Tests

We now do a battery of robustness tests to see whether our findings on the inequality decreasing effect of manufacturing employment share and the heterogenous effect of services employment share remain with, inclusion of additional controls, an alternate measure of inequality, and changes in our sample of countries.

We present the marginal effects of manufacturing and services for each robustness test (full results are available on request). First, in Table 9, we include additional controls that capture globalisation – foreign direct investment, trade and financial open-ness. Next, we reports results when we use the Gross Gini as our dependent variable (Table 10). Then, we report results when we exclude the advanced market economies (Table 11). Next, we use an extended sample where we impute missing data for community,

[19] We do similar analysis for the trade and transport sub-sectors but do not obtain the same findings as we do for the business services sub-sector.

social and personal services and government services where we had missing data (Table 12). Finally, we use the ILO data and a larger sample of countries (Table 13).

Remarkably, we find that our main findings – that manufacturing driven structural transformation unambiguously decreases inequality for all country groups and that services driven structural transformation increases inequality in structurally developing countries and decreases it in structurally developed countries – remains intact in all these robustness checks. Even we expand our sample to include more countries (with the proviso that the quality of the data for the ILO sample is subject to some concern), we do not find that our main findings are overturned as far as the signs of the marginal effects are concerned (and the coefficients on the marginal effects remain significant in most specifications).[20]

Table 9. Marginal Effects – Additional Controls

Marginal effects of Manufacturing				**Marginal effects of Services**		
FE XI		**RE VII**		**RE VIII**	**FE XII**	
Share of			**Country Group**		**Share of**	
Manu.	**Dy/dx**	**Dy/dx**		**Dy/dx**	**Serv.**	**Dy/dx**
1%	-1.39***	-1.17**	Underdeveloped	-0.04	5%	0.12
5%	-1.15***	-0.96***	Developing	0.30**	15%	0.04
10%	-0.85***	-0.37***	Developed	-0.42***	25%	-0.05
15%	-0.55***				35%	-0.14
20%	-0.26*				45%	-0.23
25%	0.04				55%	-0.32
					65%	-0.41
					75%	-0.50

*, **, ***: Significance in 10, 5, 1% respectively. Dependent variable: Gini (Net). Independent Variables: Manufacturing (and Manufacturing Squared in FE XI), Mining, Utilities, Construction, Services (and Services Squared in FE XII), lnGDP, Secondary School Completion, Government Expenditure, FDI, International Trade, Financial Openness, Structural Development Dummies (and Manufacturing interactions in RE VII, Services interactions in RE VIII), and year dummies.

[20] The only substantial change is for the marginal effect of manufacturing for structurally developing countries in the ILO sample, which becomes positive but statistically insignificant. However, as most of the new countries in this sample as compared to the GGDC sample are low income structurally underdeveloped countries, it is interesting to note that the marginal effect of manufacturing employment on inequality for structurally underdeveloped countries is negative and significant as in our original estimates.

Table 10. Marginal Effects – Gross Gini

Marginal effects of Manufacturing				Marginal effects of Services		
FE XIII		RE IX		RE X	FE XIV	
Share of Manu.	Dy/dx	Dy/dx	Country Group	Dy/dx	Share of Serv.	Dy/dx
1%	-0.71**	-0.87**	Underdeveloped	-0.04	5%	-0.00
5%	-0.62**	-0.43*	Developing	0.30**	15%	-0.09
10%	-0.52***	-0.26***	Developed	-0.42***	25%	-0.18
15%	-0.41***				35%	-0.26*
20%	-0.30***				45%	-0.35**
25%	0.19*				55%	-0.44**
					65%	-0.52**
					75%	-0.61**

*, **, ***: Significance in 10, 5, 1% respectively. Dependent variable: Gini (Gross). Independent Variables: Manufacturing (and Manufacturing Squared in FE XIII), Mining, Utilities, Construction, Services (and Services Squared in FE XIV), lnGDP, Secondary School Completion, Government Expenditure, Structural Development Dummies (and Manufacturing interactions in RE IX, Services interactions in RE X), and year dummies.

Table 11. Marginal Effects – Sample excluding Rich Countries

Marginal effects of Manufacturing				Marginal effects of Services		
FE XV		RE XI		RE XII	FE XVI	
Share of Manu.	Dy/dx	Dy/dx	Country Group	Dy/dx	Share of Serv.	Dy/dx
1%	-1.06***	-1.41	Underdeveloped	-0.04	5%	-0.05
5%	-0.90***	-1.31***	Developing	0.30**	15%	-0.10
10%	-0.71***	-0.38	Developed	-0.42***	25%	-0.15
15%	-0.51***				35%	-0.20
20%	-0.31***				45%	-0.25
25%	-0.12				55%	-0.30*
					65%	-0.35*
					75%	-0.40*

*, **, ***: Significance in 10, 5, 1% respectively. Dependent variable: Gini (Net). Independent Variables: Manufacturing (and Manufacturing Squared in FE XV), Mining, Utilities, Construction, Services (and Services Squared in FE XVI), lnGDP, Secondary School Completion, Government Expenditure, Structural Development Dummies (and Manufacturing interactions in RE XI, Services interactions in RE XII), and year dummies.

Table 12. Marginal Effects – Full GGDC Sample with Imputations

Marginal effects of Manufacturing				Marginal effects of Services		
FE XVII		RE XIII		RE XIV	FE XVIII	
Share of Manu.	Dy/dx	Dy/dx	Country Group	Dy/dx	Share of Serv.	Dy/dx
1%	-0.60*	-1.47***	Underdeveloped	-0.11	5%	0.18
5%	-0.53**	-0.11	Developing	0.19*	15%	0.10
10%	-0.45**	-0.24***	Developed	-0.09	25%	0.02
15%	-0.36***				35%	-0.06
20%	-0.27***				45%	-0.14
25%	-0.19**				55%	-0.22*
					65%	-0.30*
					75%	-0.38*

*, **, ***: Significance in 10, 5, 1% respectively). Dependent variable: Gini (Net). Independent Variables: Manufacturing (and Manufacturing Squared in FE XVII), Mining, Utilities, Construction, Services (and Services Squared in FE XVIII), lnGDP, Government Expenditure, Structural Development Dummies (and Manufacturing interactions in RE XIII, Services interactions in RE XIV), and year dummies.

Table 13. Marginal Effects – ILO and GGDC Sample

Marginal effects of Manufacturing				Marginal effects of Services		
FE XIX		RE XV		RE XVI	FE XX	
Share of Manu.	Dy/dx	Dy/dx	Country Group	Dy/dx	Share of Serv.	Dy/dx
1%	-0.52**	-1.00**	Underdeveloped	-0.27	5%	0.13
5%	-0.44**	0.03	Developing	0.12	15%	0.08
10%	-0.36***	-0.20***	Developed	-0.06	25%	0.03
15%	-0.28***				35%	-0.01
20%	-0.19***				45%	-0.06
25%	-0.11*				55%	-0.11*
					65%	-0.16
					75%	-0.20

*, **, ***: Significance in 10, 5, 1% respectively). Dependent variable: Gini (Net). Independent Variables: Manufacturing (and Manufacturing Squared in FE XIX), Mining, Utilities, Construction, Services (and Services Squared in FE XX), lnGDP, Government Expenditure, Structural Development Dummies (and Manufacturing interactions in RE XV, Services interactions in RE XVI), and year dummies.

7. Conclusions

Structural transformation is at the core of the process of economic development. While a rapid pace of structural transformation can lead to sustained economic growth, it can contribute to growing inequality, as had been suggested by Kuznets. In this paper, we examine whether structural transformation leads to higher inequality. We first document the very different paths of structural transformation that different countries have followed in the past five decades. Countries show different paths of structural transformation, being either structurally under-developed, structurally developing or structurally developed. We then investigate whether these different paths of structural transformation have had differential impacts on inequality, using a panel of developing and developed countries for the period 1960-2012. In contrast to the Kuznets hypothesis, we find that the movement of workers to manufacturing unambiguously *decreases* income inequality, irrespective of the stage of structural transformation that a particular country is in. We also find that while the movement of workers into services has no discernible overall impact on inequality across our set of countries, there is clear heterogeneity in the impact of services driven structural transformation on inequality. In particular, we find that structural transformation relating to services increases inequality in structural developing countries and decreases inequality in structurally developed countries. Thus, our findings suggest that the Kuznets postulate seems to apply more to services than to manufacturing driven structural transformation.

A large literature has previously documented the beneficial effects that manufacturing driven structural transformation can have on the economic development process through its positive effect on sustained economic growth and productive job creation (e.g., Rodrik 2013, UNIDO 2013, Felipe et al. 2015). In this paper, we establish another mechanism by which manufacturing can be beneficial to development – employment creation in manufacturing can reduce overall inequality as well. This suggests a *double dividend* of manufacturing driven structural transformation - through increased growth and reduced inequality. However, for the vast majority of low income countries which would fall into the structurally underdeveloped category, the data suggests that the prospects for a manufacturing driven structural transformation seem unlikely. For these countries, where the realistic possibility of structural transformation is the movement of workers from agriculture to services, our findings suggest that for these countries, inequality will increase with further structural transformation.

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Data Appendix

Structural Transformation: Groningen Growth and Development Centre's (GGDC) 10-Sector Database provides annual employment data in 10 different sectors for 41 countries. Time spans for available data vary between countries, however most countries in the database have observations going as far back as 1960, and up to 2012. The 10 sectors, with their ISIC Revision 3.1 codes and definitions are:

Table A1. Description of Sectors

ISIC 3.1 code	Sector Name	Description
AtB	Agriculture	Agriculture, Hunting and Forestry, Fishing
C	Mining	Mining and Quarrying
D	Manufacturing	Manufacturing
E	Utilities	Electricity, Gas and Water supply
F	Construction	Construction
G+H	Trade services	Wholesale and Retail trade; repair of motor vehicles, motorcycles and personal and household goods, Hotels and Restaurants
I	Transport services	Transport, Storage and Communications
J+K	Business services	Financial Intermediation, Renting and Business Activities (excluding owner occupied rents)
L,M,N	Government services	Public Administration and Defence, Education, Health and Social work
O,P	Personal services	Other Community, Social and Personal service activities, Activities of Private Households

Agriculture is the primary sector. The secondary industry sector can be divided into two groups: Manufacturing and non-manufacturing industry, which comprises of mining, utilities and construction. The tertiary services sector consists of trade, transport, business, government and personal services. The ISIC classification of manufacturing includes primary processed products, and employment in each category is defined as all persons engaged in labour, and hence encompasses self-employed and family workers both in formal and informal sectors.

Appendix A2: Alternate Sources of Employment Data

There are two additional sources for data, apart from the GGDC database, on sectoral employment at the country level. The first is World Bank's *World Development Indicators* (WDI), which covers more countries than the GGDC. However, the WDI only reports total share of labour in agriculture, industry and services. The industry sector consists of mining, construction, public utilities and manufacturing, while the services sector consists of wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services. The WDI data-set does not break down industry employment data by manufacturing and non-manufacturing (mining, construction, utilities) and services employment by sub-sectors. The aim of our analysis is to examine the impact of manufacturing as well as service sub-sectors on inequality. Since WDI does not offer information on sub-sectoral allocations of employment, we are unable to use the data they provide.

A second source of employment data is the International Labour Organisation's ILOSTAT database. ILOSTAT provides detailed information on the number of people working in each sector, for majority of the countries since 1950s. The data is based mostly on labour force surveys and supplemented by censuses and other minor sources. However, even though ILOSTAT offers the largest sample size and time scale, comparability of this dataset is limited as concept definitions and population coverage differ between countries and over time. The frequency of the data collected also varies between countries and disregard all impacts of seasonality on the labour force. For these reasons, the GGDC 10-Sector dataset is our preferred data source. Nevertheless, we use the available ILOSTAT data as a robustness check since it vastly increases our sample size.

Appendix A3. Control Variables

Economic Development: The natural logarithmic values of Gross Domestic Product (GDP) per capita in 2011 US Dollars taken from the Penn World Table 9.0 are used to proxy economic development of countries.

Human Capital: Percentage of people aged 15 and over who completed secondary school is the preferred proxy to control for the level of human capital endowment in countries. Data is taken from the Barro-Lee Educational Attainment Dataset.

Government Expenditure: Government expenditure is the final government consumption expenditure as a share of the total GDP. Data for Taiwan is taken from the National Statistics Agency's website, while data for the rest of the countries are provided by the World Development Indicators of the World Bank.

In order to obtain consistent and comparable results between our regression estimates, we only include observations without any missing values for any of our dependent or independent variables. Doing so generates an unbalanced panel dataset that consists of 29 countries, with 5-year averaged periods between 1960 and 2012. Only Japan, the United Kingdom and the United States have data for all the 11 periods, while Malawi has the least number of observations, covering only four periods. Descriptive statistics for the 219 observations for the 29 countries in the sample can be seen in Table 1. It demonstrates that the countries in our sample differ widely in their macroeconomic characteristics and structural composition. The share of employment in agriculture, an indicator for economic development, has a standard deviation of 24%, with a minimum and maximum range of 0.2% to 87%.