Kuznets Revisited: What Do We Know about the Relationship between Structural Transformation and Inequality?

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This paper revisits the Kuznets postulate that structural transformation will be associated with increasing inequality using comparable time series data for 32 developing and recently developed economies for the post-1950 period. We find that structural transformation in the majority of our economies has resulted in the movement of workers from agriculture to services, and not to manufacturing. Economies show different paths of structural transformation that cut across geographical regions, being either structurally underdeveloped, structurally developing, or structurally developed. We see clear differences in the structural transformation–inequality relationship depending on the stage of structural transformation that a particular economy is in, as well as across regions. We do not see a Kuznets-type relationship between manufacturing employment share and inequality when we take into account the different paths of industrialization that economies in our dataset have followed. On the other hand, inequality unambiguously increases with structural transformation if the movement of workers from agriculture is to services.

Keywords: agriculture, inequality, Kuznets, manufacturing, services, structural transformation
JEL codes: O50

I. Introduction

In recent decades, most developing and emerging economies have seen large shifts of workers from agriculture to the manufacturing and service sectors (Dabla-Norris et al. 2013; Felipe, Mehta, and Rhee 2015). At the same time, in several economies, inequality has increased (Berg and Ostry 2011, United Nations Development Programme 2013, Milanović 2016). In a famous 1955 paper, Kuznets argued that as low-income economies industrialize, inequality will increase over time as workers move from low-productivity agriculture to high-productivity

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manufacturing, which may lead to an increase in overall inequality, though the process of industrialization will also accelerate economic growth (Lewis 1954).

Two complications arise when considering Kuznets' thesis from the viewpoint of today. Firstly, very few economies have followed successful industrialization strategies since Kuznets published his article, and some economies may well be undergoing "premature deindustrialization" (Rodrik 2016). It is not clear what would be the inequality implications of the mixed record on industrialization in developing economies. Secondly, as we will show in this paper, much of the shift of workers from agriculture has been to services and not to manufacturing. Services, in general, tend to have lower levels of productivity than manufacturing, so it is not obvious that structural change that is biased toward services is necessarily as inequality enhancing as the agriculture-to-manufacturing shift in employment.

In this paper, we revisit the stylized facts of structural transformation and inequality, using comparable data on these measures for a range of low-, middle-, and (now) high-income economies in Asia, Africa, and Latin America for the period 1950–2010.[1] We ask whether there is a positive relationship between structural transformation and inequality, as hypothesized by Kuznets, and whether this relationship differs across economies that have followed different paths of structural transformation, and across regions.

In section II, we first provide a summary of the main theoretical underpinnings of the Kuznets process. In section III, we describe the data used in the paper. In section IV, we document the patterns of structural transformation across economies and classify them according to their stage of structural transformation. In section V, we present the stylized facts on the relationship between structural transformation and inequality. In section VI, we look at the regional differences in the structural transformation–inequality relationship. In section VII, we present our conclusions.

II. 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:

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[1]The end year is 2012 in some cases and the start year differs across economies, depending on data availability. By structural transformation, we mean the movement of workers from low-productivity agriculture to higher-productivity services and manufacturing (McMillan, Rodrik, and Verduzco-Gallo 2014).

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 equal, 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 (Kuznets 1955, 7–8).

The Kuznets process of widening inequality with structural transformation—that is, the movement of workers away from agriculture—can be described as comprising two subprocesses: (i) the movement of the population from a sector characterized by lower mean income to a sector characterized by higher mean income, and (ii) the movement of the population from a sector with low within-sector inequality to a sector with higher within-sector inequality. If both subprocesses 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 a low mean but higher variance in income to a sector with a higher mean but lower variance in income, then it is less obvious that inequality will necessarily increase.

In Kuznets' view, the sector from which workers were moving out from is clearly agriculture. However, the sector that is absorbing the labor movement is left ambiguous in the 1955 paper; while it is most likely industry, it could be services as well. The two defining features of this sector are that it should have both higher mean income and within-sector inequality than the agricultural sector for the Kuznets process to hold. Both these features may not hold for any particular economy in the process of structural transformation. For example, if the movement

of workers away from agriculture is mostly to the informal service sector such as retail trade and restaurants, it is not clear that such a transfer is necessarily a move to a sector with higher mean income. It is also possible that the agricultural sector in any particular economy has high inequality if the land distribution is concentrated among a few elites. In this case, if the movement of workers is from agriculture to a sector with relatively low inequality such as a labor-intensive manufacturing, inequality may not increase with structural transformation and may even decline.

What the above discussion shows is that whether the Kuznets process holds for any particular economy depends on the specific characteristics of the path of structural transformation that the economy follows. For example, are workers moving from an agricultural sector that has high land inequality or is the agricultural sector in this economy characterized by more equal land distribution? And, is the movement of workers to a sector with relatively low mean incomes such as low-productivity services or to a sector with high within-sector inequality such as mining or capital-intensive manufacturing? Previous empirical research on the Kuznets process does not have an unambiguous finding 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, much of this literature has focused on the growth–inequality relationship, and there is a large gap in the literature on understanding the structural transformation–inequality relationship. This is a crucial omission, given the relevance of the debates around structural transformation and inequality in contemporary development policy.

III. Data

In this section, we describe the data used in the analysis of structural transformation, inequality, and poverty.

A.   Structural Transformation

Data on structural transformation in economies are taken from the Groningen Growth and Development Centre's (GGDC) 10-Sector Database. The GGDC database includes data from 42 economies covering the 1950–2012 period. We have excluded advanced market economies from Europe, along with Japan and the United States, which left us with 32 economies from four geographic regions. Table 1 provides a list of economies in our sample with the time period that the data cover for each economy. The GGDC database consists of annual series for the gross value-added output and the number of people employed in agriculture, mining, manufacturing, utilities, construction, trade services, transport services,

Table 1. **List of Economies in the Sample**

Region	Abbreviation	Economy	Value Added Data Period	Employment Data Period
Africa	BWA	Botswana	1964–2010	1964–2010
	EGY	Egypt	1960–2012	1960–2012
	ETH	Ethiopia	1961–2010	1961–2010
	GHA	Ghana	1960–2010	1960–2010
	KEN	Kenya	1964–2010	1969–2010
	MWI	Malawi	1966–2010	1966–2010
	MUS	Mauritius	1970–2010	1970–2010
	MOR	Morocco	1960–2012	1960–2012
	NGA	Nigeria	1960–2010	1960–2011
	SEN	Senegal	1970–2010	1970–2010
	ZAF	South Africa	1960–2010	1960–2010
	TZA	Tanzania	1960–2010	1960–2010
	ZMB	Zambia	1965–2010	1965–2010
Asia	HKG	Hong Kong, China	1974–2011	1974–2011
	IND	India	1950–2012	1960–2010
	INO	Indonesia	1960–2012	1961–2012
	MAL	Malaysia	1970–2011	1975–2011
	PRC	People's Republic of China	1952–2010	1952–2011
	PHI	Philippines	1971–2012	1971–2012
	KOR	Republic of Korea	1953–2011	1963–2011
	SIN	Singapore	1960–2012	1970–2011
	TAP	Taipei,China	1961–2012	1963–2012
	THA	Thailand	1951–2011	1960–2011
Latin America	ARG	Argentina	1950–2011	1950–2011
	BOL	Bolivia	1950–2011	1950–2010
	BRA	Brazil	1950–2011	1950–2011
	CHL	Chile	1950–2011	1950–2012
	COL	Colombia	1950–2011	1950–2010
	CRI	Costa Rica	1950–2011	1950–2011
	MEX	Mexico	1950–2011	1950–2012
	PER	Peru	1950–2011	1960–2011
	VEN	Venezuela	1950–2012	1950–2011

Source: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018).

business services, government services, and personal services. We have grouped these 10 sectors into four main categories:

(i)   Agricultural sector = agriculture

(ii)   Manufacturing industry = manufacturing

(iii) Nonmanufacturing industry = mining + utilities + construction

(iv)   Service sector = trade services + transport services + business services + government services + personal services

Gross value-added data are taken from national income accounts of the various economies and compiled according to the United Nations System of National Accounts. The 10 sectors have been classified using the International Standard Industrial Classification, Revision 3.1. Using this classification of manufacturing instead of the narrower Standard International Trade Classification implies that primary processed products are also included in the definition of manufacturing. Employment is defined as "all persons engaged," thus including all paid employees as well as self-employed and family workers. This implies that the GGDC employment data include both the formal and informal sectors. The primary source of the employment data is the population census, supplemented by labor force and business surveys (Timmer and de Vries 2009; Timmer, de Vries, and de Vries 2016).

The share of employment for the four main categories is calculated by dividing the number of people employed in each category by the total number of people employed in the economy in a given year. Productivity in each category is calculated by dividing the value-added output in constant 2005 local currency by the number of people employed.

As noted by Diao, McMillan, and Rodrik (2017), GGDC provides the highest quality data available on sectoral output and employment for developing economies. However, it is also subject to certain limitations, which can raise concerns when the data are used to calculate productivity. The first set of limitations relates to the quality of the source data and the extent to which they include the informal sector. The quality of data on the sectoral value-added output published by national statistical agencies of underdeveloped economies can be unsatisfactory, and whether the data successfully account for the informal sector depends on the quality of the national sources. On the other hand, as the annual series on the number of people employed in each sector are obtained from census data and household surveys by the GGDC researchers, they are more likely to capture informal employment. (Appendix 1 discusses other sources of sectoral employment data and their limitations.)

B.   Income Inequality

Income inequality data are taken from the standardized income inequality dataset computed by Baymul and Shorrocks (forthcoming). The Gini coefficient, calculated from household surveys, is the most commonly used measure of inequality. However, due to conceptual and methodological differences between household surveys, the comparability of inequality data is an issue that troubles empirical researchers. The standardized dataset used in this research tries to enhance comparability by adjusting all available data that exceeds a quality threshold from various sources through a regression adjustment method that

Figure 1.   **Shifts in Employment between Sectors and Relative Labor Productivity**
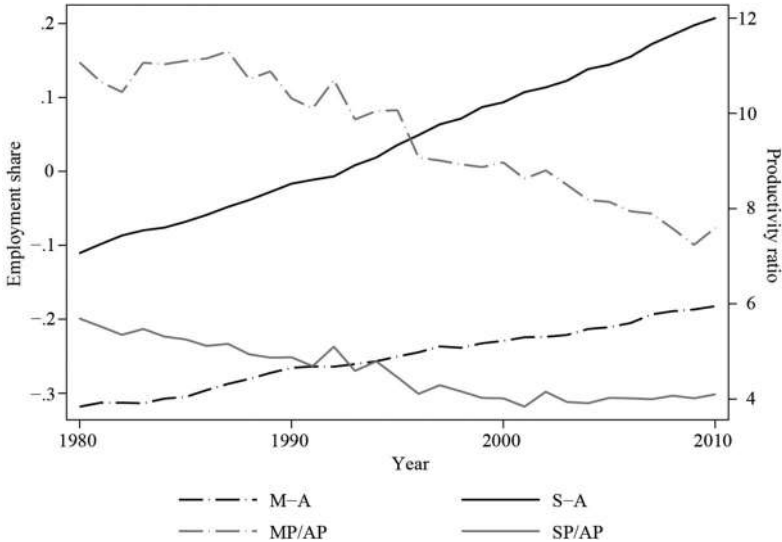
M–A = share of (manufacturing–agriculture), S–A = share of (services–agriculture), MP/AP = manufacturing productivity/agriculture productivity, SP/AP = services productivity/agriculture productivity.
Source: Groningen Growth and Development Centre.

includes an extensive list of independent variables. Despite generating the highest number of individual annual observations per economy compared with any other available dataset, the number of observations still varies between economies.

In this paper, we use Gini coefficients that indicate the net income per capita inequality.[2] However, standardized income inequality data are prone to measurement errors made in source data. Measurement errors could be especially problematic in least developed economies where the quality of the data collection methods is questionable.

IV. Patterns of Structural Transformation

A striking feature of structural transformation in our sample of 32 economies is that the movement of employment from agriculture has been mostly to services (Figure 1). We observe an agriculture-to-manufacturing shift in employment for an appreciably long period only for East and Southeast Asian economies and for Mauritius. Even for this set of economies, the share of manufacturing in total

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[2]We confine our analysis to using net income Gini as the measure of inequality as the relationship between structural transformation and other measures of inequality such as the income share of the top 10% or bottom 40% of the population is broadly similar to the relationship between structural transformation and net income Gini (results available upon request).

employment shows a hump shape in the case of Hong Kong, China; Malaysia; Mauritius; the Republic of Korea; Singapore; and Taipei,China; which suggests that the share of employment in manufacturing has reached its peak and is now falling steadily over time.

A second striking feature of structural transformation is that the shift of employment from agriculture to services has been accompanied by falling productivity in the service sector compared with agriculture (Figure 1).[3] The large shift of employment from agriculture to services accompanied by the falling relative productivity of services suggests that structural transformation in most developing economies (barring a few economies in Asia) has not been growth enhancing. This has implications for the possible effects that structural transformation may have on inequality, which we explore in the next section. We also observe a similar falling ratio of manufacturing to agricultural productivity, though the relative productivity of manufacturing is far higher than that of services.

Economies in our sample show three different paths or stages of structural transformation. There are economies 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 economies are Ethiopia, India, Kenya, Malawi, Nigeria, Senegal, Tanzania, and Zambia. These economies are all in Sub-Saharan Africa except for India. We call these economies structurally underdeveloped. The next set of economies are where more people are employed in the service sector than in agriculture, with agriculture being the second-largest sector. These economies are Bolivia, Botswana, Brazil, Colombia, Costa Rica, Egypt, Ghana, Indonesia, Morocco, the People's Republic of China, Peru, the Philippines, Thailand, and South Africa. We call them structurally developing economies. These economies span all three continents included in our study: Africa, Asia, and Latin America. The final set of economies has more people employed in the manufacturing sector than in agriculture. These economies are Argentina; Chile; Hong Kong, China; Malaysia; Mauritius; Mexico; the Republic of Korea; Singapore; Taipei,China; and Venezuela. These economies are either in East Asia or Latin America, with the exception of Mauritius, which is in Africa. We call these economies structurally developed.

Figure 2 presents summary graphs of the path of structural transformation between 1980 and 2010 by level of structural development. We see that the share of employment in services in structurally developed economies surpasses the share of employment in agriculture prior to 1980, while the share of employment in the manufacturing sector has stayed relatively stable with a slight decrease in the relative productivity of manufacturing. Despite decreasing relative productivity compared with agriculture, the labor share of both services

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[3]The figures on productivity would be sensitive to price movements such as a terms-of-trade shock to agriculture. However, purchasing power parity measures of sectoral output are not available in the GGDC data.

Figure 2. **Shifts in Employment between Sectors and Relative Labor Productivity by Stage of Structural Transformation**
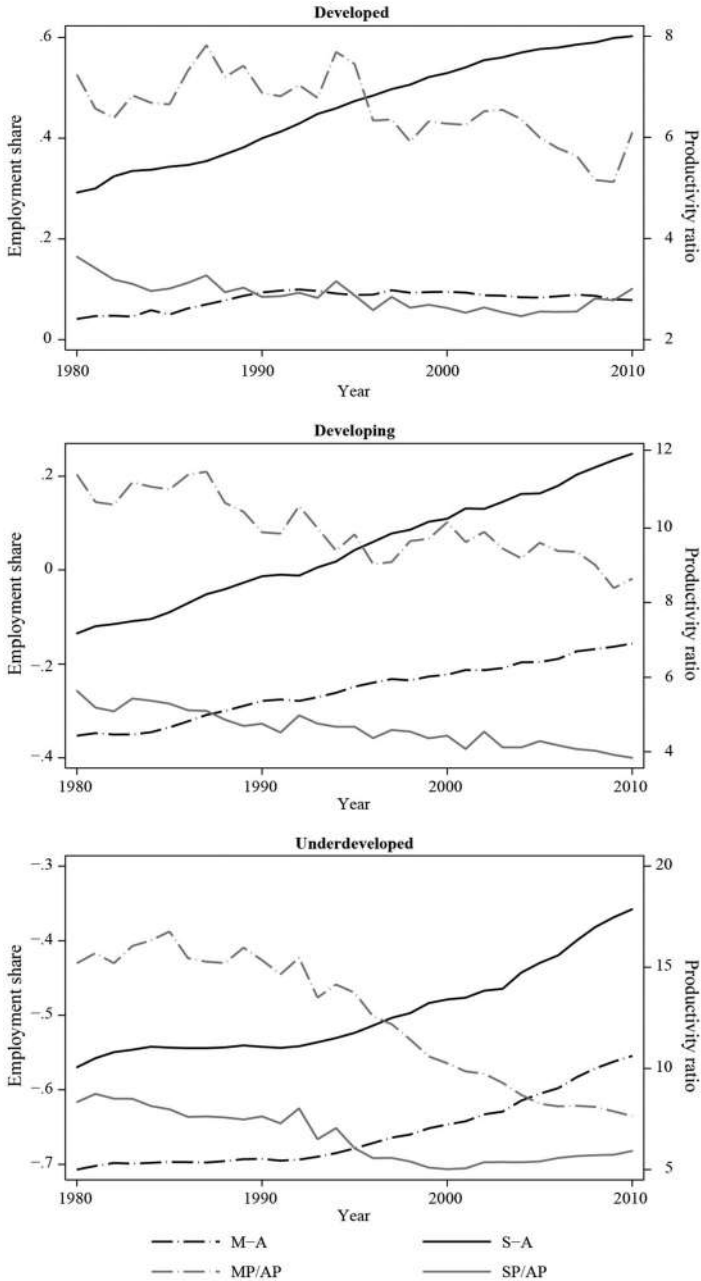
M–A = share of (manufacturing–agriculture), S–A = share of (services–agriculture), MP/AP = manufacturing productivity/agriculture productivity, SP/AP = services productivity/agriculture productivity.
Source: Groningen Growth and Development Centre.

and manufacturing increases over the 30-year period for structurally developing and underdeveloped economies. Structurally underdeveloped economies started to experience significant labor shifts from agriculture to other sectors only from the middle of the 1990s onward.

V. Structural Transformation and Inequality

As we have noted in the previous section, the movement of labor away from agriculture in the process of economic development can either be toward manufacturing or services. We first look at the relationship between structural transformation and inequality when the share of employment in agriculture is falling. We then look at the manufacturing employment–inequality relationship, followed by the services employment–inequality relationship. In each case, we first look at the pooled relationship between structural transformation and inequality, where we measure inequality by the net income per capita Gini. We then focus on our three economy groups, which we have categorized by their stage of structural transformation: (i) structurally developed, (ii) structurally developing, and (iii) structurally underdeveloped.[4]
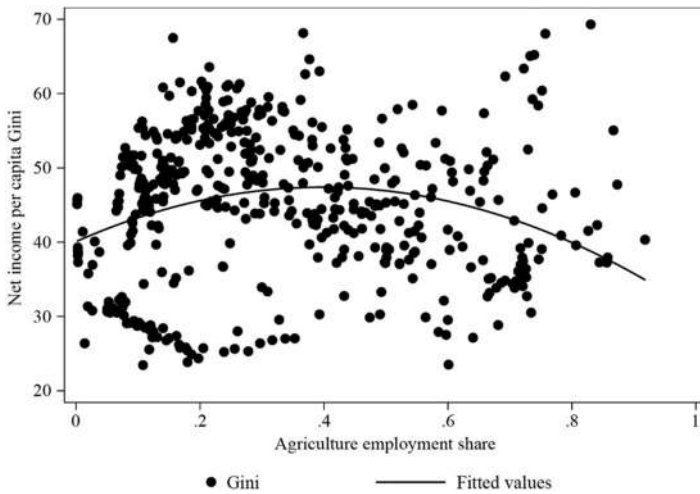
A.   Agriculture versus Inequality

In the overall sample, we see evidence of the Kuznets curve with an increase in inequality, whether measured by the net income Gini or the income share of the bottom 40% of the population, and then a decrease with a fall in the share of employment in agriculture (Figure 3). In structurally developed economies, we see that as the share of agriculture in employment decreases, inequality follows an inverted U-shaped pattern (Figure 4). It first increases, peaking when agriculture's employment share is around 20% of total employment. Inequality declines once its share drops below this level. In structurally developing and underdeveloped economies, we only witness the first half of the transformation, where agriculture's share has not declined below 20% yet for most economies and inequality has been increasing while agriculture's share drops.

B.   Manufacturing versus Inequality

In the overall sample, we see a clear negative relationship between the share of employment in manufacturing and inequality (Figure 5). As the share of manufacturing increases in structurally developed economies, inequality decreases (Figure 6). There is weaker evidence of this relationship for developing and underdeveloped economies; the likely reason being that they have not yet reached

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[4]All estimates of group averages presented in this section use unweighted averages.

Figure 3. **Agriculture Employment Share versus Income Inequality**

Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

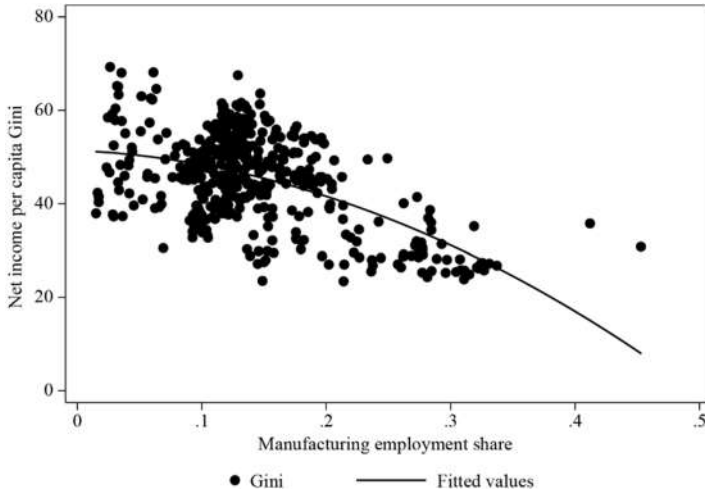Figure 4. **Agriculture Employment Share versus Income Inequality by Development Level**
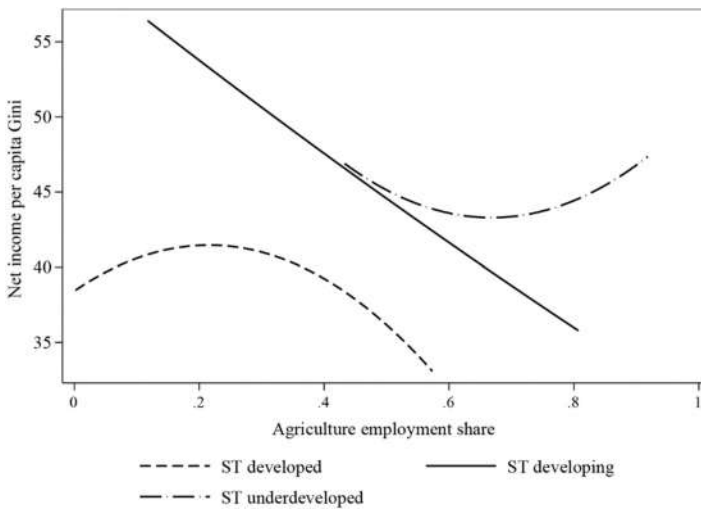
ST = Structurally.
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

the level of development that is necessary to foster a more equal distribution of income.

Figure 7 shows that the marginal effect of an increase in manufacturing employment share on inequality is very different, depending on whether the

Figure 5.   **Manufacturing Employment Share versus Income Inequality**

Figure 6.   **Manufacturing Employment Share versus Income Inequality by Development Level**
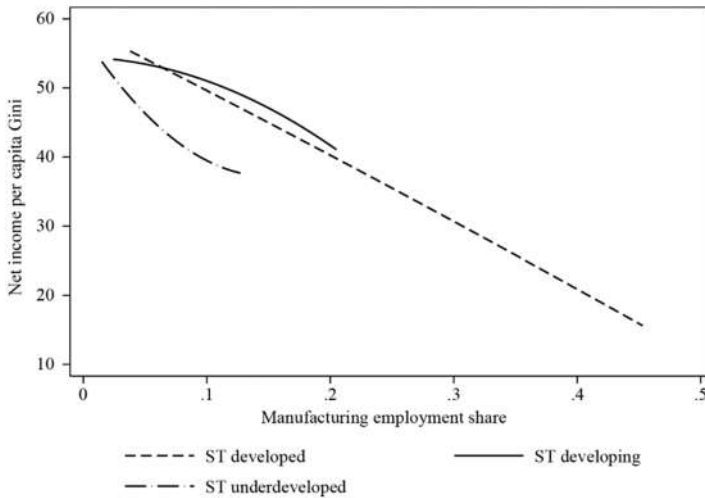
Figure 7. **Marginal Effect of Manufacturing Employment Share on Inequality by Stage of Structural Transformation**
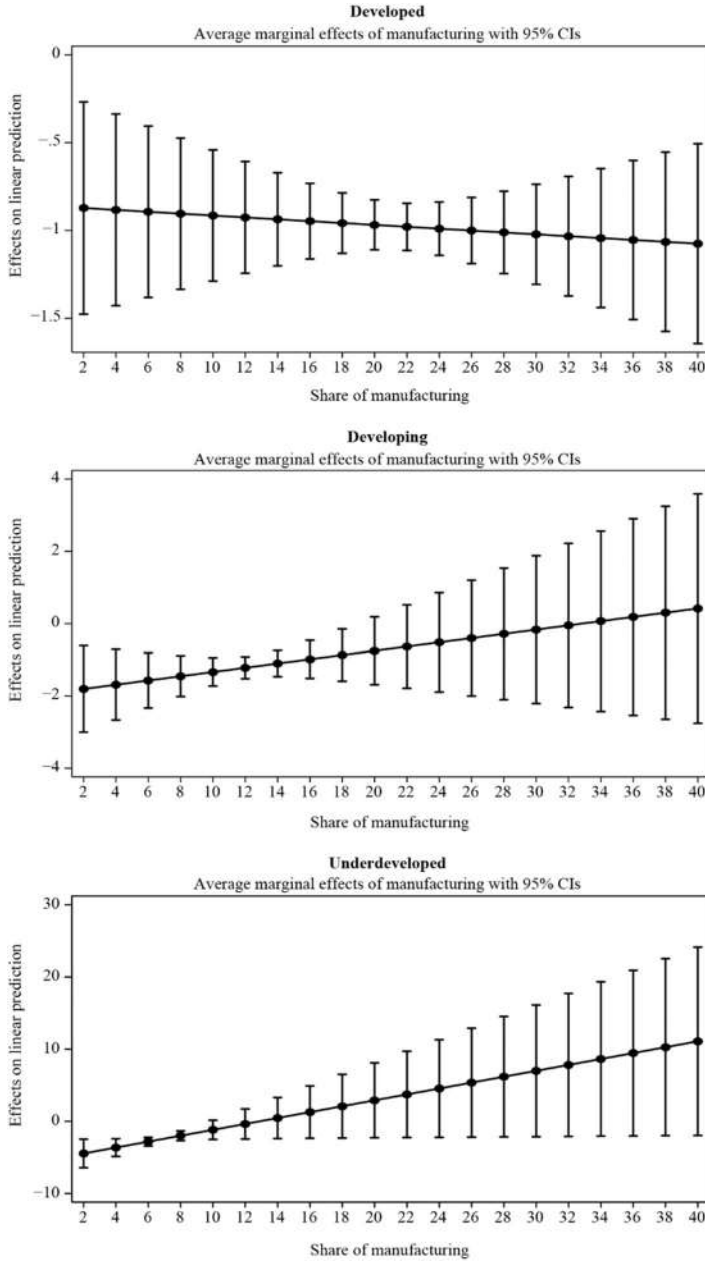
CIs = confidence intervals.
Note: Both Gini (dependent variable) and share of manufacturing (manfindustry_share) are measured as a percentage.
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

economy is structurally developed, developing, or underdeveloped. Marginal effects are calculated through ordinary least squares regressions, with estimates presented in columns (I) and (III) of Table A2.1. Samples for regression models are given in Table A2.5. For structurally developed economies, an increase in the manufacturing employment share unambiguously decreases inequality, and there is a relative fall in the marginal effect of the manufacturing employment share on inequality as this share increases over time. For structurally developing economies where the manufacturing employment share ranges from around 2% to 20%, an increase in the manufacturing employment share decreases inequality. We see a similar phenomenon for structurally underdeveloped economies where the manufacturing employment share varies from around 2% to 10%. This indicates that, on the whole, structural transformation that is related to an increase in the manufacturing employment share is associated with decreasing inequality.

However, one problem in assessing the relationship between manufacturing employment share and inequality is that the share of manufacturing in total employment does not show a clear monotonic relationship with time. This is in contrast with the behavior of the shares of agriculture and services in total employment, both of which show a clear monotonic relationship with time. (In the case of agriculture, its share in total employment falls over time for our sample economies; in the case of services, its share increases more or less continuously over time for our sample economies.)

Economies exhibit the following patterns in the share of manufacturing in total employment over time: (i) a "hump" (increasing, then decreasing); (ii) continuously increasing; (iii) continuously decreasing; and (iv) no discernible movement. This suggests that a scatter plot of inequality against the manufacturing employment share may simply be capturing cross-sectional differences in the relationship of inequality with the manufacturing employment share across the sample economies, in contrast to the scatters of inequality against the agricultural and services employment shares, which capture both time series and cross-sectional variation in the relationship. (In the case of the inequality–agriculture scatter, a movement in the graph from right to left in the horizontal axis is a movement in time; in the case of the inequality–services scatter, a movement in the graph from left to right in the horizontal axis is a movement in time.)

In order to further analyze the relationship between inequality and manufacturing employment share, we have separated the economies in which we observe a hump in manufacturing employment. We define these humps as a steady increase in manufacturing from time t to time $t + 1$, and then a decrease from $t + 1$ onward. Hence, economies reach the peak level of employment in manufacturing at $t + 1$, where t can be different for each economy. We call the increase in manufacturing in time period t, Development Stage 1; the peak at $t + 1$, Development Stage 2; and the subsequent decline, Development Stage 3.

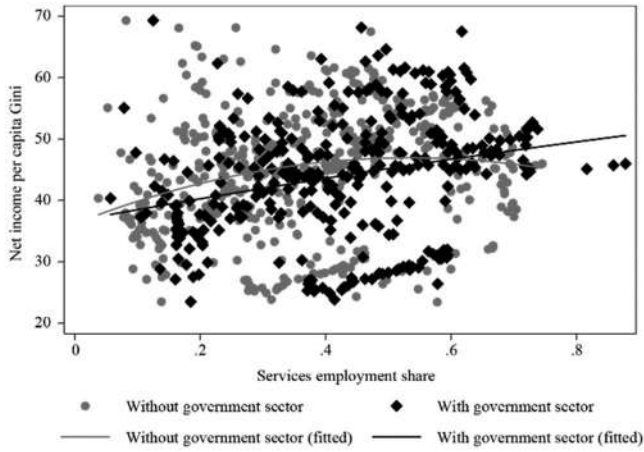Figure 8.   **Inequality in Different Development Stages**
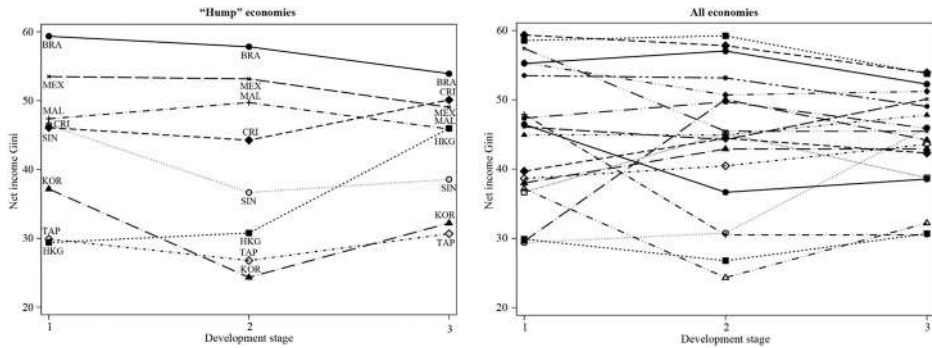
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

Taking the closest net income Gini coefficients corresponding to each stage for each economy, we produced the graphs in Figure 8. Graphs on the left-hand side show the movement of Gini coefficients through the three development stages for economies in which we observe the hump. Other economies might be on the first or third stage of development during the entire time period of the sample. Graphs depicting the same relationship are on the right-hand side for all economies. We do not observe any meaningful relationship between income inequality and the development stages of different economies. Whether we confine our analysis to the economies with a hump shape in their manufacturing employment share or include all economies for which we have inequality data over the time period, we do not observe a common relationship between the manufacturing employment share and inequality over time across our sample economies. This clearly shows the lack of a Kuznets-type inverted U-shaped relationship across all economies, with a great deal of heterogeneity in the response of inequality to manufacturing-driven structural transformation across economies. In fact, we do not see a Kuznets-type relationship for any of the 32 economies in our sample.[5] In addition, in the cases of the Republic of Korea; Singapore; and Taipei,China; we see a decrease in inequality as the manufacturing employment share increases to its peak level, which is then followed by an increase.

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[5]We supplement our analysis of the relationship between the manufacturing employment share and inequality by including economies in the database on manufacturing employment shares compiled by Felipe and Mehta (2016). In this database, smaller economies in the Pacific and Central America, and some other South Asian economies such as Bangladesh and Pakistan, are included. However, our findings on the lack of a relationship between the manufacturing employment share and inequality remains the same with this expanded data (results available on request).

Figure 9. **Services Employment Share versus Income Inequality**

Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

Figure 10. **Services Employment Share versus Income Inequality by Development Level**
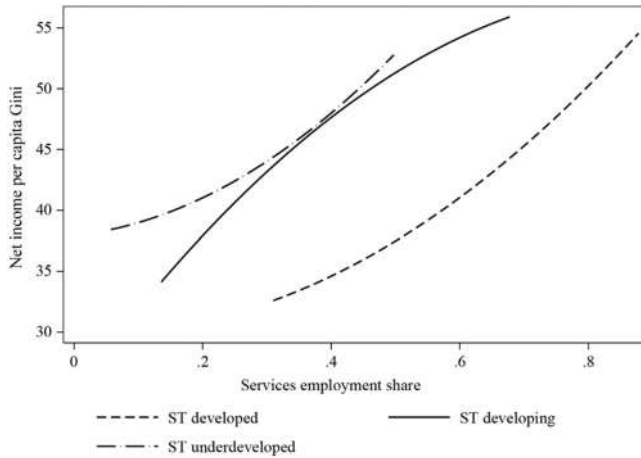
ST = structurally.
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database." https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

C.   Services versus Inequality

A higher share of service sector employment is associated with higher inequality in all economy groups, with the correlation being especially strong in structurally developing economies (Figures 9, 10).

Thus, we observe a very different behavior of inequality to increases in the services employment share compared with what we observed with the increases in the manufacturing employment share.

Looking at the marginal effects, the effect of an increase in the services employment share on inequality is unambiguously positive, irrespective of an economy's stage of structural transformation (Figure 11). Secondly, even though the overall effect of services-driven structural transformation is positive, there is a decline in the marginal effect of the increase in the services employment share on inequality across all economy groups. In other words, as the service sector employment share increases, inequality increases at a decelerating rate.

Robustness Tests

We conduct three further tests to check the robustness of our results. Firstly, we use the gross Gini instead of the net Gini to see the direct effect of structural transformation on market inequality, prior to taxes and transfers. We present the regression results in Table A2.2. Next, we confine our analysis to the post-1970 period as there was not a significant structural transformation in most developing economies during the 1960s. We present the regression results in Table A2.3. Finally, we use the sectoral employment data from the International Labour Organization (ILO). These data are seen as being poor quality as they are directly obtained from the statistical agencies of the economies concerned and are not subject to consistency checks in the same way as the GGDC data. (For a discussion of the weaknesses of these data, see Diao, McMillan, and Rodrik [2017].) By using these data, we more than double the number of observations to 1,148. We present the regression results in Table A2.4 and the plots of the marginal effects of manufacturing and services on inequality in Figures A2.1 and A2.2, respectively.

When we use gross Gini instead of net Gini, we do not find any difference in our results in terms of the manufacturing and services employment shares on inequality, either by structural transformation group or region. The sign and significance of the coefficients of the manufacturing employment share and its square, and the interaction of these two variables with structural transformation groups and with regions, generally remain the same compared with the results in Table A2.1 and columns (I) and (II) in Table A2.2. Similarly, we do not find any discernible difference in the sign and significance of the coefficients of the services employment share and its square and the interaction of these two variables with structural transformation groups and with regions compared with Table A2.1 and columns (III) and (IV) in Table A2.2. We also get identical results with the post-1970 employment data (Table A2.3).

When we use the ILO data, we find that the marginal effect of the manufacturing employment share on inequality changes from negative to positive for structurally developed economies, but that there is no change in the effect of the

Figure 11.   **Marginal Effect of Services on Inequality by Economy Groups**
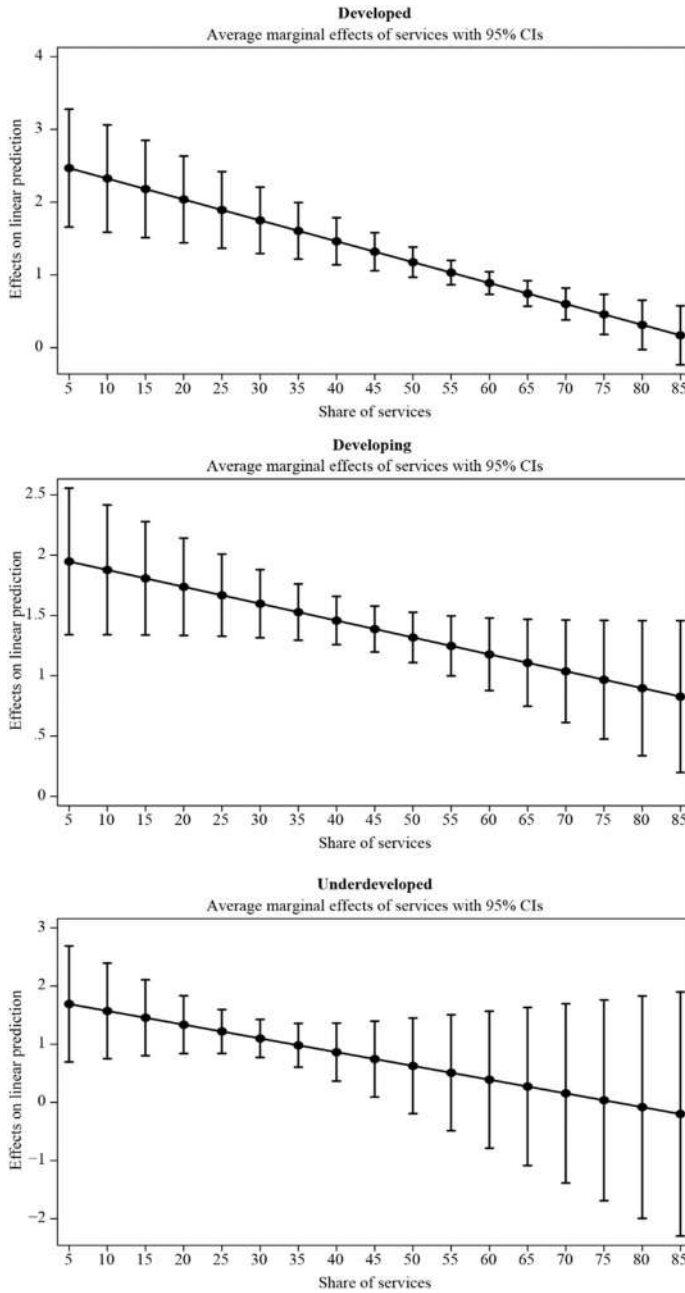
CIs = confidence intervals.
Note: Both Gini (dependent variable) and share of services (servwithgov_share) are measured as a percentage.
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database."
https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

manufacturing employment share on inequality for structurally underdeveloped and developing economies for relevant ranges of the manufacturing employment shares compared with Figure 7 (Table A2.4 and Figures A2.1, A2.2).

## VI. Regional Differences in the Relationship between Structural Transformation and Inequality

Are there differences in the relationship between structural transformation and inequality across regions? In particular, is the relationship for Asia different than for Africa and Latin America? With respect to manufacturing, we see that the marginal effect of the manufacturing employment share on inequality is very similar for Asia and Africa (Figure 12).[6] An increase in the manufacturing employment share is first associated with a decrease in inequality, though every percentage point increase in the manufacturing employment share leads to a smaller decrease in inequality, up to a point where a further increase in the manufacturing employment share is not associated with any decrease in inequality (that is, the marginal effect turns from negative to zero).[7] However, in the case of Latin America, an increase in the manufacturing employment share is initially associated with an increase in inequality, though after this share reaches a critical level of 10%, inequality starts decreasing with an increase in the manufacturing employment share. Though Asia and Africa show similar paths of inequality with respect to manufacturing-driven structural transformation, it is important to note that African economies have witnessed far lower levels of industrialization than Asian economies. The highest maximum level of manufacturing employment share for an African economy is 32.2% (Mauritius in 1990), while the average manufacturing employment share for our sample of African economies for the last year for which data are available is 18.5%. In contrast, the highest maximum level of manufacturing employment share for an Asian economy is 45.3% (Hong Kong, China in 1976), while the average manufacturing employment share for the last year in which data are available is 27.5%. This suggests that for most African economies, a 1 percentage point increase in the manufacturing employment share will be associated with a large decline in inequality, compared with most Asian economies where further manufacturing-driven structural transformation is unlikely to be associated with declining inequality.

With respect to services, we see something completely different: we now observe that the relationship of services-driven structural transformation and inequality is very similar for Asia and Latin America (Figure 13). An increase in the service sector share of employment is associated with an increase in

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[6]We include Middle East and North African economies in the African region, along with Sub-Saharan African economies.

[7]Figures 12 and 13 are based on regression estimates presented in columns (II) and (IV) of Table A2.1.

Figure 12.   **Marginal Effect of Manufacturing on Inequality by Region**
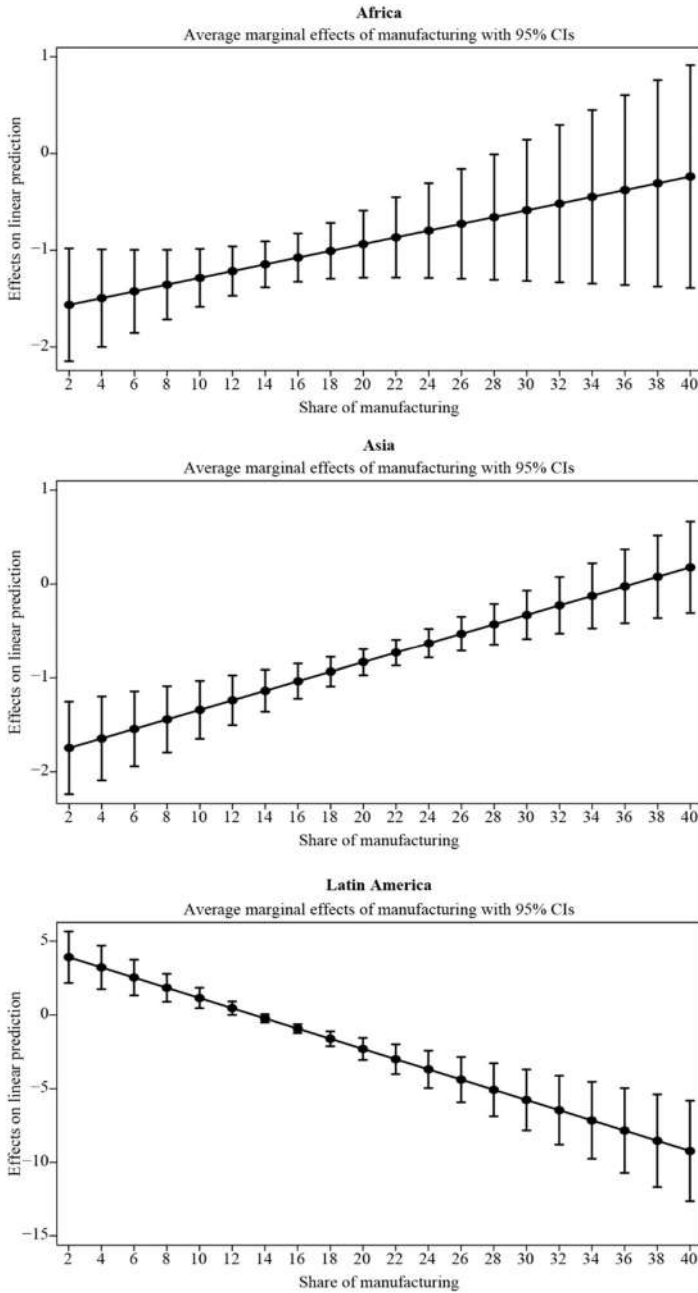
CIs = confidence intervals.
Note: Both Gini (dependent variable) and share of services (servwithgov_share) are measured as a percentage.
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database."
https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

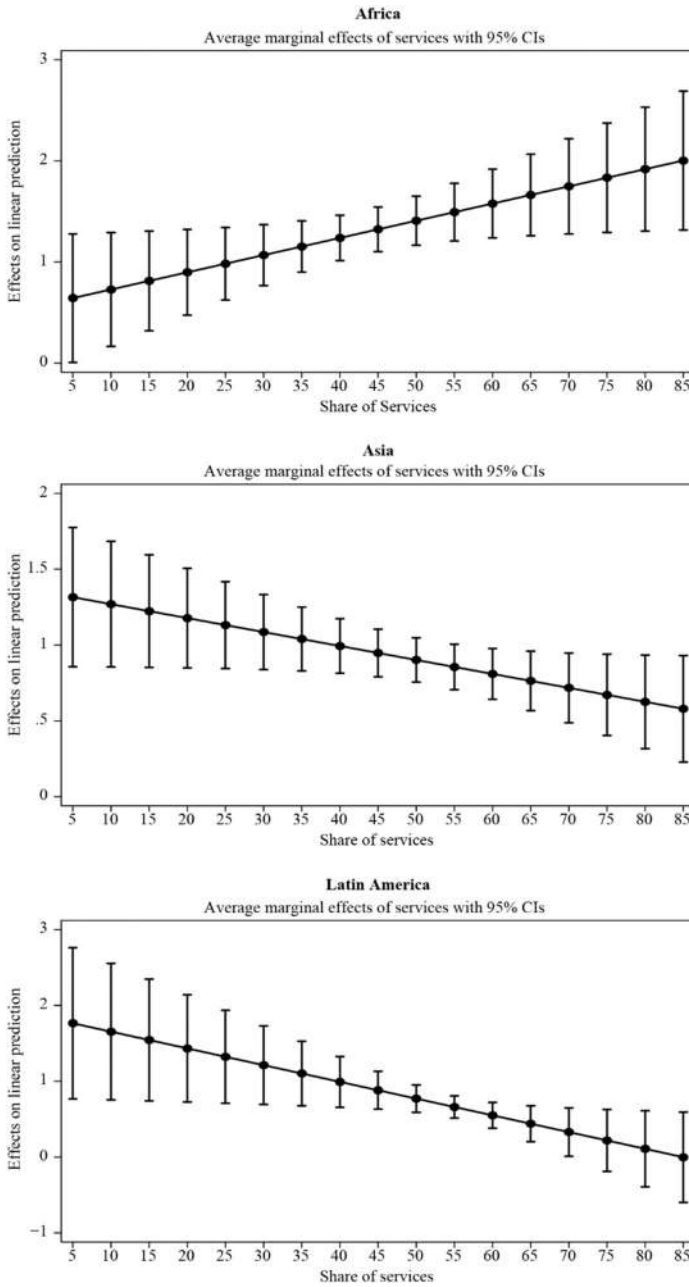Figure 13.   **Marginal Effect of Services on Inequality by Region**

CIs = confidence intervals.
Note: Both Gini (dependent variable) and share of services (servwithgov_share) are measured as a percentage.
Sources: Groningen Growth and Development Centre (GGDC). 1950–2012. "GGDC 10-Sector Database."
https://www.rug.nl/ggdc/productivity/10-sector/ (accessed March 1, 2018); Baymul and Shorrocks (forthcoming).

inequality in both regions. However, the marginal effect of services-driven structural transformation on increases in inequality declines over time. Given the large and steady increases in the share of services in employment in most Latin American and Asian economies in recent years, this suggests that inequality will increase in these economies for some time, but that the rate of change of inequality will fall over time.[8] In contrast, in Africa, services-driven structural transformation is associated with increasing inequality, and the rate of change of inequality with an increase in the services employment share is actually increasing. This suggests that for many African economies, as workers gradually move from agriculture to services (with stagnant manufacturing employment in most economies), inequality will increase at an increasing rate for some time to come.

VII. Conclusions

A long-held view in the literature on economic development is that inequality increases with structural transformation as workers move from a low-inequality sector such as agriculture to high-inequality sectors such as manufacturing and services. This is commonly known as the Kuznets process. We revisit the relationship between structural transformation and inequality using comparable data for 32 developing and recently developed economies for the period 1950–2010.

Firstly, we find that structural transformation in the majority of our 32 economies has entailed a move of workers from agriculture to services, and not to manufacturing. Further, the move of workers from agriculture to services (and, wherever it has occurred, to manufacturing) has been accompanied by a fall in the relative productivity of services and manufacturing compared with agriculture (barring a few economies in East and Southeast Asia). The economies in our sample have shown different paths of structural transformation that cut across geographical regions. A set of economies can be categorized as structurally developed if the number of workers employed in manufacturing exceeds the number of workers employed in agriculture. Five Asian economies figure in this list—Hong Kong, China; Malaysia; the Republic of Korea; Singapore; and Taipei,China—along with Argentina, Chile, Mauritius, Mexico, and Venezuela. Structurally underdeveloped economies have agriculture as the largest sector in terms of the number of people employed in the most recent time period available. In our sample, only one Asian economy figures in this list, India, along with Ethiopia, Kenya, Malawi, Nigeria, Senegal, Tanzania, and Zambia. Structurally developing economies are those where more people are employed in the service sector than in agriculture, with agriculture being the second-largest sector. Four Asian economies figure in this list—Indonesia, the People's Republic of China, the Philippines, and Thailand—along with Bolivia,

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[8]Following the referee's suggestion, we have excluded Singapore and Hong Kong, China from our analysis with no change in our findings.

Botswana, Brazil, Colombia, Costa Rica, Egypt, Ghana, Morocco, Peru, and South Africa.

If we look at the relationship of the employment share of agriculture in total employment and inequality, we see a Kuznets-type, inverted-U relationship for structurally developed economies. For structurally developing and underdeveloped economies, a lower employment share in agriculture is accompanied by higher inequality. However, we do not observe a Kuznets-type relationship between the share of manufacturing in total employment and inequality. This is particularly evident when we take into account the different paths of industrialization that developing economies have followed. In fact, in contrast to what was postulated by Kuznets, there is a fall in inequality with an increase in the manufacturing employment share for all economies. We also see clear regional differences in the structural transformation–inequality relationship in the case of manufacturing, with an increase in the employment share of the latter associated with falling inequality in Africa and Asia, but with increasing inequality in Latin America.

In the case of services, we see that the effect of an increase in the services employment share on inequality is unambiguously positive, irrespective of an economy's stage of structural transformation. However, we also find that there is a decline in the marginal effect of the increase in the services employment share on inequality across all economy groups, so that the rate of increase in inequality as the services employment share increases declines over time. We also find that an increase in inequality with services-driven structural transformation is evident for Africa, Asia, and Latin America. However, the rate of increase in inequality falls over time in Asia and Latin America, in contrast with Africa where the rate of change of inequality increases over time, suggesting that the evolution of inequality will be very different in Asia and Latin America compared with Africa as all three regions see significant shift of workers from agriculture to services.

Our paper did not attempt to explain why we see such a heterogeneous response of inequality to structural transformation across economies, and why the effect of manufacturing-driven structural transformation on inequality is different from that of services-driven structural transformation. For Asia, the high rates of manufacturing-driven structural transformation and the relatively benign effect of such a pattern provides more of a win–win scenario of structural transformation into manufacturing, leading to both economic growth and falling inequality. This is a scenario that is very different from that envisaged by Kuznets and many others in the development community in which structural transformation was inevitably associated with rising inequality. Why Asia has had such a favorable scenario is an avenue for further research.

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Appendix 1. Alternate Sources of Employment Data

There are two additional sources of data, apart from the GGDC database, on sectoral employment at the economy level. The first is the World Bank's World Development Indicators (WDI), which covers more economies than the GGDC. However, the WDI only reports total shares of labor in agriculture, industry, and services. The industry sector consists of mining, construction, public utilities, and manufacturing. The service 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 dataset does not break down industry employment data by manufacturing and nonmanufacturing (e.g., mining, construction, utilities) and services employment by subsectors. The aim of our analysis is to examine the impact of manufacturing and service subsectors on inequality. Since the WDI does not offer information on subsectoral allocations of employment, we are unable to use the data it provides.

A second source of employment data is the ILO's database, ILOSTAT, which provides detailed information on the number of people working in each sector for a majority of the economies in our sample since the 1950s. The data are based mostly on labor force surveys and supplemented by censuses and other minor sources. However, even though ILOSTAT offers the largest sample size and time scale, the comparability of this dataset is limited as concept definitions and population coverage differ between economies and over time. The frequency of the data collected also varies between economies and disregards all impacts of seasonality on the labor force. For these reasons, the GGDC 10-Sector Database is our preferred data source.

Appendix 2. Tables and Figures

Table A2.1. **Regression Results; Dependent Variable: Net Gini**

	I	II		III	IV
Agriculture	0.11	0.30***	Agriculture	1.01***	0.99***
	(0.07)	(0.05)		(0.15)	(0.09)
Agriculture^2	−0.0052***	−0.0056***	Agriculture^2	−0.0014	−0.0036**
	(0.0009)	(0.0007)		(0.0019)	(0.0015)
Manufacturing (Man)	−1.92***	−1.63***	Services	2.02***	0.56
	(0.72)	(0.34)		(0.34)	(0.36)
Manufacturing^2	0.0292	0.0175	Services^2	−0.0070*	0.0085**
	(0.0289)	(0.0111)		(0.0037)	(0.0039)
Developed	−13.36**		Developed	−13.77	
	(5.79)			(13.57)	
Underdeveloped (Und)	14.41**		Underdeveloped	6.29	
	(5.96)			(7.34)	

Continued.

Table A2.1.   *Continued.*

	I	II		III	IV
Developed × Man	1.06		Developed ×	0.59	
	(0.79)		Services	(0.55)	
Developed × Man^2	−0.0319		Developed ×	−0.0074	
	(0.0298)		Services^2	(0.0053)	
Und × Man	−3.34**		Und × Services	−0.21	
	(1.55)			(0.50)	
Und × Man^2	0.1752*		Und × Services^2	−0.0048	
	(0.1036)			(0.0088)	
Asia		−5.06*	Asia		−15.93***
		(2.78)			(4.72)
Latin America (LAM)		−45.93***	Latin America		−15.69
		(7.71)			(15.82)
Asia × Man		−0.21	Asia × Services		0.80***
		(0.38)			(0.26)
Asia × Man^2		0.0079	Asia × Services^2		−0.0131***
		(0.0066)			(0.0034)
LAM × Man		6.25***	LAM × Services		1.31**
		(1.07)			(0.60)
LAM × Man^2		−0.1905***	LAM × Services^2		−0.0195***
		(0.0361)			(0.0059)
No. of observations	478	478		330	330
R–squared	0.55	0.66		0.57	0.66

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Column (I) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with a structural transformation group. Column (II) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with the region the economy is in. Column (III) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group. Column (IV) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group.
Source: Authors' calculations.

Table A2.2.   **Regression Results, Dependent Variable: Gross Gini**

	I	II		III	IV
Agriculture	0.073	0.28***	Agriculture	0.89***	1.00***
	(0.075)	(0.05)		(0.17)	(0.11)
Agriculture^2	−0.005***	−0.006***	Agriculture^2	−0.00	−0.004**
	(0.001)	(0.0007)		(0.002)	(0.002)
Manufacturing (Man)	−2.11***	−1.65***	Services	1.91***	0.43
	(0.74)	(0.36)		(0.38)	(0.41)
Manufacturing^2	0.037	0.017	Services^2	−0.01*	−0.01***
	(0.03)	(0.012)		(0.00)	(0.004)
Developed	−10.05*		Developed	−13.79	
	(5.96)			(15.01)	
Underdeveloped (Und)	11.21*		Underdeveloped	0.17	
	(6.12)			(8.12)	
Developed × Man	0.79		Developed ×	0.50	
	(0.81)		Services	(0.60)	

Table A2.2. *Continued.*

	I	II		III	IV
Developed × Man^2	−0.030		Developed ×	−0.006	
	(0.031)		Services^2	(0.006)	
Und × Man	−3.01*		Und × Services	−0.03	
	(1.59)			(0.55)	
Und × Man^2	0.160		Und × Services^2	−0.01	
	(0.107)			(0.01)	
Asia		−2.66	Asia		−14.71***
		(2.94)			(5.35)
Latin America (LAM)		−44.29***	Latin America		−17.52
		(8.12)			(17.93)
Asia × Man		−0.47	Asia × Services		0.74**
		(0.40)			(0.29)
Asia × Man^2		0.014	Asia × Services^2		−0.013***
		(0.012)			(0.004)
LAM × Man		6.00***	LAM × Services		1.37**
		(1.13)			(0.68)
LAM × Man^2		−0.183***	LAM × Services^2		−0.020***
		(0.038)			(0.007)
No. of observations	478	478		330	330
R–squared	0.55	0.64		0.51	0.60

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Column (I) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with a structural transformation group. Column (II) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with the region the economy is in. Column (III) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group. Column (IV) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group. Source: Authors' calculations.

Table A2.3. **Regression Results, Dependent Variable: Net Gini; Sample Confined to Post-1970s Period**

	I	II		III	IV
Agriculture	0.094	0.30***	Agriculture	1.08***	1.02***
	(0.080)	(0.05)		(0.16)	(0.10)
Agriculture^2	−0.005***	−0.006***	Agriculture^2	−0.003	−0.004***
	(0.001)	(0.0007)		(0.002)	(0.002)
Manufacturing (Man)	−1.90**	−1.66***	Services	1.87***	0.39
	(0.73)	(0.35)		(0.35)	(0.39)
Manufacturing^2	0.029	0.018	Services^2	−0.006	−0.01**
	(0.03)	(0.011)		(0.004)	(0.004)
Developed	−13.36**		Developed	−22.76	
	(6.11)			(15.29)	
Underdeveloped (Und)	16.29**		Underdeveloped	9.83	
	(6.56)			(8.67)	
Developed × Man	1.03		Developed ×	0.91	
	(0.83)		Services	(0.59)	

Table A2.3. *Continued.*

	I	II		III	IV
Developed × Man^2	−0.032		Developed × Services^2	−0.01*	
	(0.031)			(0.006)	
Und × Man	−3.69**		Und × Services	−0.34	
	(1.66)			(0.57)	
Und × Man^2	0.19*		Und × Services^2	−0.003	
	(0.109)			(0.01)	
Asia		−5.10*	Asia		−18.13***
		(3.07)			(5.56)
Latin America (LAM)		−48.34***	Latin America		−27.38
		(8.67)			(19.96)
Asia × Man		−0.16	Asia × Services		0.91***
		(0.41)			(0.29)
Asia × Man^2		0.006	Asia × Services^2		−0.014***
		(0.012)			(0.004)
LAM × Man		6.65***	LAM × Services		1.74**
		(1.23)			(0.74)
LAM × Man^2		−0.21***	LAM × Services^2		−0.023***
		(0.04)			(0.007)
No. of observations	455	455		312	312
R–squared	0.56	0.66		0.58	0.66

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Column (I) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with a structural transformation group. Column (II) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with the region the economy is in. Column (III) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group. Column (IV) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group.
Source: Authors' calculations.

Table A2.4. **Regression Results, Dependent Variable: Net Gini Using ILO Data**

	I	II		III	IV
Agriculture	0.774***	0.403***	Agriculture	1.40***	0.64***
	(0.043)	(0.035)		(0.07)	(0.07)
Agriculture^2	−0.011***	−0.006***	Agriculture^2	−0.006***	−0.001
	(0.001)	(0.001)		(0.001)	(0.001)
Manufacturing (Man)	7.33***	−0.343	Services	−6.64***	1.63***
	(1.73)	(0.241)		(1.43)	(0.21)
Manufacturing^2	−0.33***	0.012	Services^2	0.075***	−0.01***
	(0.07)	(0.008)		(0.013)	(0.001)
Developed	58.13		Developed	−204.80***	
	(10.24)			(38.87)	
Underdeveloped (Und)	52.01***		Underdeveloped	−183.78***	
	(10.36)			(38.90)	
Developed × Man	−9.29***		Developed × Services	8.70***	
	(1.74)			(1.44)	

Table A2.4. *Continued.*

	I	II		III	IV
Developed × Man^2	0.36***		Developed × Services^2	−0.087***	
	(0.07)			(0.013)	
Und × Man	−9.05**		Und × Services	7.03***	
	(1.80)			(1.44)	
Und × Man^2	0.35***		Und × Services^2	−0.063***	
	(0.07)			(0.013)	
Asia		8.388*	Asia		9.17*
		(4.72)			(5.48)
Latin America (LAM)		−14.93***	Latin America		2.71
		(4.81)			(9.45)
Asia × Man		−1.85***	Asia × Services		−0.78***
		(0.45)			(0.23)
Asia × Man^2		0.05***	Asia × Services^2		−0.008***
		(0.01)			(0.002)
LAM × Man		−0.02	LAM × Services		−0.30
		(0.49)			(0.34)
LAM × Man^2		0.01	LAM × Services^2		0.001
		(0.01)			(0.003)
No. of observations	1141	1141		1141	1141
R-squared	0.46	0.59		0.52	0.59

ILO = International Labour Organization.
Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Column (I) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with a structural transformation group. Column (II) is a regression with manufacturing employment share, the square of manufacturing employment share, and the interaction of these two variables with the region the economy is in. Column (III) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group. Column (IV) is a regression with services employment share, the square of services employment share, and the interaction of these two variables with the structural transformation group.
Source: Authors' calculations.

Table A2.5. **Regression Sample**

Region	Economy	Regression 1 and Regression 2	Regression 3 and Regression 4	First and Last Year
Africa	Botswana	8	8	1985–2010
	Egypt	6		1975–2012
	Ethiopia	5	5	1995–2011
	Ghana	8	8	1987–2006
	Kenya	5	5	1992–2006
	Malawi	5	5	1985–2009
	Mauritius	6	6	1980–2007
	Morocco	10		1960–2007
	Nigeria	8	8	1975–2010
	Senegal	5	5	1990–2010
	South Africa	8	8	1990–2011
	Tanzania	6	6	1969–2011
	Zambia	8		1991–2010

*Continued.*

Table A2.5. *Continued.*

Region	Economy	Regression 1 and Regression 2	Regression 3 and Regression 4	First and Last Year
Asia	Hong Kong, China	6	6	1976–2011
	India	32	32	1960–2010
	Indonesia	17	17	1984–2012
	Malaysia	10	10	1979–2009
	People's Republic of China	21	21	1981–2011
	Philippines	12	12	1971–2012
	Republic of Korea	19		1965–2010
	Singapore	10		1974–2011
	Taipei,China	43	43	1964–2012
	Thailand	23	23	1962–2011
Latin America	Argentina	29	29	1969–2011
	Bolivia	17		1989–2009
	Brazil	29	29	1979–2011
	Chile	16		1968–2011
	Colombia	20		1991–2010
	Costa Rica	25	25	1981–2011
	Mexico	19	19	1963–2012
	Peru	19		1969–2011
	Venezuela	23		1981–2011

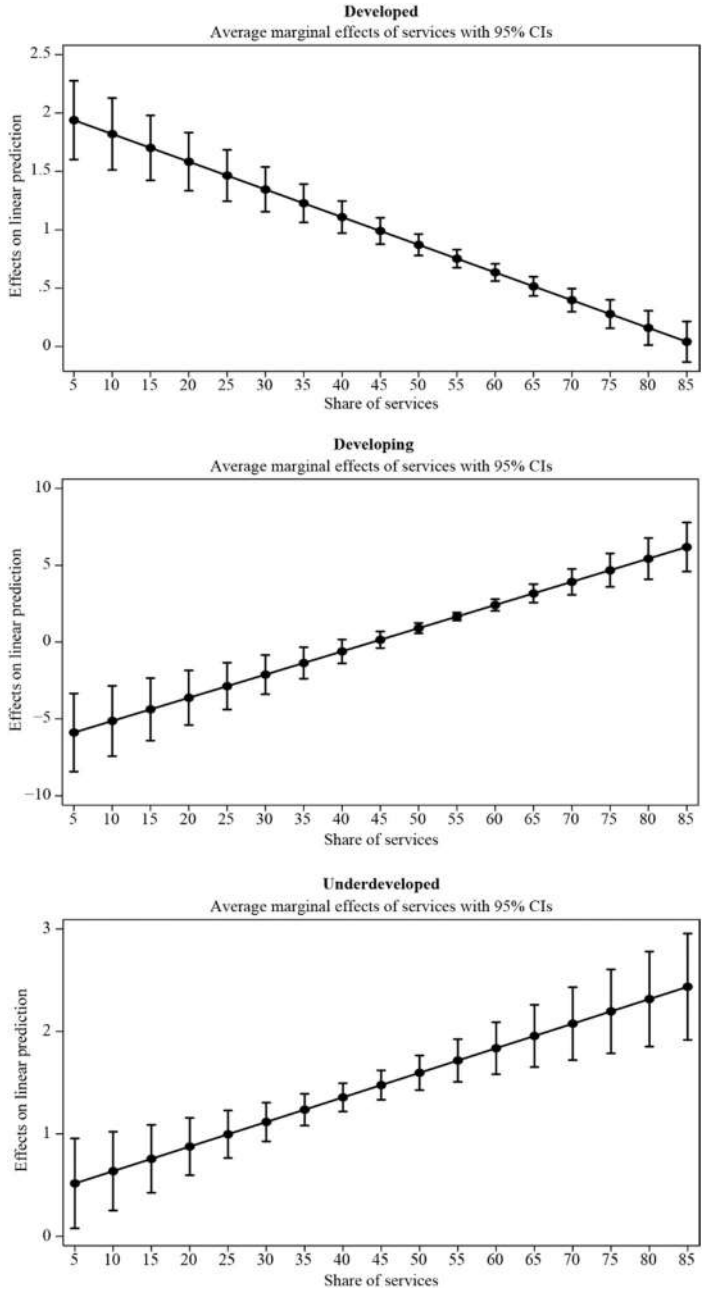Source: Authors' compilation.

Figure A2.1. **Marginal Effect of Manufacturing Employment Share on Inequality by Stage of Structural Transformation Using ILO Data**
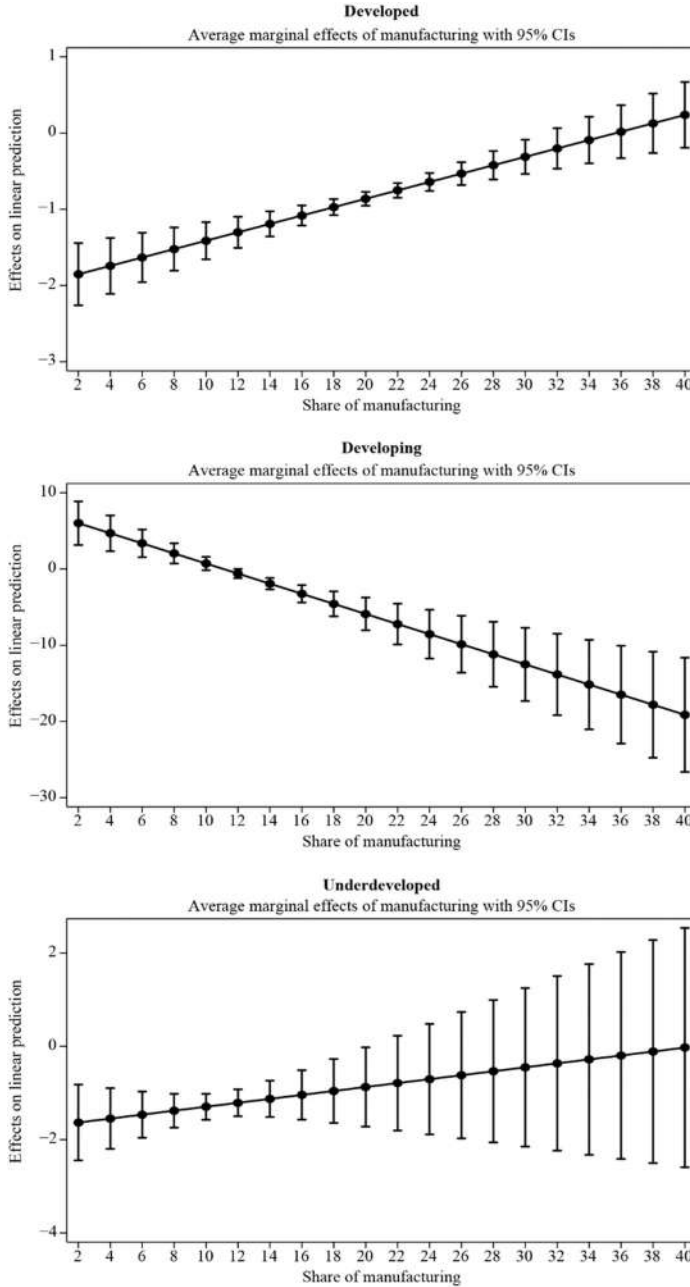
CIs = confidence intervals.
Source: International Labour Organization (ILO). 1950–2012. "ILOSTAT." https://www.ilo.org/ilostat/ (accessed October 13, 2017).

Figure A2.2.   **Marginal Effect of Services Employment Share on Inequality by Stage of Structural Transformation Using ILO Data**

CIs = confidence intervals.
Source: International Labour Organization (ILO). 1950–2012. "ILOSTAT." https://www.ilo.org/ilostat/ (accessed October 13, 2017).