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Pro-employment manufacturing development in large countries

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1. Introduction

A previous UNIDO working paper (Haraguchi & Rezonja, 2011) describes the patterns of manufacturing structural change and depicts how comparative advantages, technological capability and country specific conditions together influence manufacturing development. This paper incorporates employment aspects into structural change analysis to highlight the interaction between the output, productivity and employment growth rates of large countries and to illustrate manufacturing industries' different development stages associated with periods of employment enhancement and contraction.[1]

While a "fundamental identity" at macro-level linking employment, labour productivity and aggregate output suggests the following relationship, there is no clear evidence of causality or patterns of change in the relationships among the three variables (Landmann, 2004). In the short term, Landmann argues that both the rate of employment growth and productivity growth are pro-cyclical, meaning that both drop in times of recession and surge during a boom. However, in the long term, there is no clear trend in the relationship.

Output growth ≈ employment growth rate + productivity growth rate

At the level of manufacturing industries, the relative importance of the rate of employment growth and productivity growth in terms of their contribution to output performance may differ from industry to industry and change within an industry along the stages of a country's development. The key issue addressed in this paper are the growth patterns of manufacturing industries identified in past studies (Haraguchi and Rezonja, 2010; 2011) with reference to output (value added per capita) and how the relative significance of the two right-hand side variables changes. Based on the findings, this paper suggests a pro-employment path of manufacturing development.

In the period of a given industry's expansion, i.e. when its value added increases, the growth rate of labour productivity is usually positive as it is a function of learning, capital accumulation and economies of scale. Hence, the key questions we address are *when*, to *what extent* and for *how long* employment increases during an industry's expansion, and how the contribution of employment and productivity growth in relation to that of value added changes along the path of a country's development.

[1] Due to space limitations, this study focuses on the analysis of large countries with a population of more than 12.5 million.

Based on the above equation, Rada and von Arnim (2011) identified three different relationships among the variables. In the case of profit-led growth, output, productivity and employment all grow strongly. As a result of the investment of rising profits, the industry's output and employment expand, leading to greater efficiency and competitiveness and, hence, resulting in increasing demand volume for the industry's products.

In the case of wage-led growth, both employment and output decline while only labour productivity expands. Wage rises as a result of productivity growth, but the drop in the employment rate is faster than the rate of productivity growth, which inevitably translates into output decline. Essentially, wage-led industries are in a declining stage of development where efficiency gains from labour productivity increases cannot even prevent the fall in the industries' output (Ocampo, Rada and Taylor, 2009). Finally, Rada and von Arnim speak of weak profit-led growth when output growth lies in a positive range, even though it is not growing as fast as the rate of labour productivity (Rada and von Arnim, 2011).

The above categorization is useful for identifying the three different stages of an industry based on its output, employment and productivity relationships. However, it does not provide any clues on how such relationships are likely to evolve for different manufacturing industries as countries develop. This study looks at the changes in the relationships from the perspective of manufacturing structural change in large countries and links these relationships with different stages of industries' development. Analyses of the industrial transformation that takes place across industries and a comparison thereof provides insights for developing policies that support the expansion of and employment generation in manufacturing industries at different stages of a country's development.

2. Data, variables and estimations

To illustrate the structural change of manufacturing industries, this study uses real GDP per capita adjusted for purchasing power parity (base year 2005) as the independent variable while the dependent variable is represented by one of the following three—value added per capita, employment-population ratio (EP ratio) and labour productivity.[2]

To measure the size of an industry or its output level, value added is a better indicator than gross output, as the former reflects only what the industry actually produced and excludes purchased inputs. Furthermore, to estimate the patterns of changes in the variables using industrial panel data of different countries, we normalized value added and employment by expressing both in per capita terms. Each of the three dependent variables is examined in relation to the changes in GDP per capita. Our approach differs from that of Rada and von Arnim (2011), who use the

[2] EP ratio, as it is, will be very small numbers. Thus, in this paper we express it in percentage by multiplying by 100.

elasticities of output and employment in terms of labour productivity. In our study, the elasticity of each variable is calculated in terms of GDP per capita, and the three elasticities are compared at different levels of GDP per capita.

The analysis is conducted for the manufacturing industries at the two-digit level of the International Standard Industrial Classification (ISIC) revision 3. There are 23 industrial categories in total. However, as countries often report industries 18 and 19, 29 and 30, 31 and 32, and 34 and 35 together, we combined each pair into one industrial category to have a consistent data set across countries. Furthermore, we dropped industry 37, recycling, as it has only been reported by a very limited number of countries. The following table presents the industrial classifications used in this study. Ideally, real value added should be calculated for the two dependent variables used in the analysis—value added per capita and labour productivity—as an output in constant price excluding various purchases from other industries valued in constant prices. However, such price-adjusted data are not available for a large number of countries, in particular for developing countries, to reliably estimate the development patterns of manufacturing industries. Alternatively, to adjust changes in price, we use the Index of Industrial Production (IIP) which is available at the two-digit level of the ISIC. Some countries have already begun reporting their industrial data based on the latest ISIC revision (revision 4); however, we use the IIP based on revision 3 of the ISIC, which has been widely used since the mid-1980s. To obtain a longer time series data, UNIDO has combined the IIP of ISIC revision 2—which goes back to the early 1960s—with revision 3 to arrive at an IIP that covers the years 1963 to 2004 based on revision 3 of the ISIC. By multiplying such a series of volume indices by the value added of a given base year, we are able to approximate real value added for a time series.[3] However, the IIP is only available for around 70 countries; hence, when using this approach, approximately 50 countries which do not have an IIP, but for which the nominal value added data for their manufacturing industries is available, cannot be included in the regressions to estimate manufacturing development patterns. Since many countries without an IIP are developing and emerging countries, it is important to also reflect their development trajectories in the estimations of manufacturing structural change.

[3]Depending on the given country, changes in the weight of quality and products in an industry may not necessarily be regularly updated in IIP. The gradual changes in the value added share in output may not be appropriately reflected in the IIP despite regular adjustments.

Table 1: Manufacturing data classification used in this study

ISIC description	*Abbreviation*	*ISIC code*
Food and beverages	Food and beverages	15
Tobacco products	Tobacco	16
Textiles	Textiles	17
Wearing apparel, and fur &leather products, and footwear	Wearing apparel	18 & 19
Wood products (excluding furniture)	Wood products	20
Paper and paper products	Paper	21
Printing and publishing	Printing and publishing	22
Coke, refined petroleum products, and nuclear fuel	Coke and refined petroleum	23
Chemicals and chemical products	Chemicals	24
Rubber and plastic products	Rubber and plastic	25
Non-metallic mineral products	Non-metallic minerals	26
Basic metals	Basic metals	27
Fabricated metal products	Fabricated metals	28
Machinery and equipment n.e.c. & office, accounting, computing machinery	Machinery and equipment	29 & 30
Electrical machinery and apparatus & radio, television, and communication equipment	Electrical machinery and apparatus	31 & 32
Medical, precision and optical instruments	Precision instruments	33
Motor vehicles, trailers, semi-trailers & other transport equipment	Motor vehicles	34 & 35
Furniture; manufacturing n.e.c.	Furniture, n.e.c.	36

Source: Created by the authors.

Manufacturing sector-wide value added (MVA) deflators are available for most of the countries without an IIP. However, applying an MVA deflator across manufacturing industries might produce biases, as inflation rates from one industry to another may differ significantly (e.g., between the food and beverages industry and the petrochemical industry) for given years.[4] To reflect the industry-specific inflation trend, we decompose the respective country's manufacturing-wide deflation using an inflation structure based on the same year's IIP of another country located in the same region and at a relatively similar development stage. Using

[4] The authors first determined whether a manufacturing value added deflator (MVA deflator), i.e. a manufacturing sector-wide deflator, could be used for the 70 countries with an IIP. Where this was found to be suitable, a country's MVA deflator could be used to deflate the valued added across manufacturing sub-sectors within a country for all 120 countries with MVA deflators. To check this, the manufacturing development patterns were estimated for the 70 countries with an IIP and MVA deflators, using both their IIP and MVA deflator. The two estimated patterns based on the IIP and MVA deflator approaches were compared to determine whether the differences between the two were statistically significant. The two patterns significantly varied for many industries, and we were therefore not able to adjust nominal values by using MVA deflators, which were available for 120 countries.

this approach, we try to reflect industry-specific inflation trends by equalling the sum of the nominal value added divided by the sum of the real value added of manufacturing industries with the country's MVA deflator. This approach allows us to include around 70 countries with and 50 countries without an IIP in our estimations. A UNIDO working aper (Haraguchi, 2012) explains this procedure in detail in Appendix A.

Past studies acknowledge that country size has an overarching influence on economic structural change (Chenery and Taylor, 1968; Perkins and Syrquin, 1989) with effects on both the intercepts as well as the slope of the estimated patterns. Thus, instead of including population in the equation as an additional explanatory variable, many studies resort to dividing countries into size groups, applying a given population size as a threshold. The problem related to this approach in past studies has been that this threshold was often arbitrarily used without determining whether such groups statistically differ in terms of their development patterns. To classify countries into three groups of different sizes, we apply thresholds to divide them into small, medium and large countries, and examine at which threshold level the maximum number of manufacturing industries is obtained, whose development patterns statistically differ from one another in terms of value added per capita. This is achieved by applying the Wald test. Based on our test results, we use thresholds of 3 million and 12.5 million to divide countries into small, medium and large countries. In accordance with these thresholds, medium-sized countries with a population between 3 million to 12.5 million have different development patterns than small-sized countries with a population of less than 3 million for 13 out of 18 manufacturing industries. The development patterns of all industries in large-sized countries with a population of over 12.5 million differ from those in medium-sized countries.

It does not suffice to divide countries into three groups using the above method to unequivocally claim that a distinct pattern emerges for each group. Ideally, countries in the same group should at least have statistically equal coefficients for the slopes. To determine whether countries within the same group have similar development patterns, we examine the statistical significance of both the individual country intercepts and slopes of the explanatory variables used in the equations to estimate the value added per capita. Individual country intercepts are significant across most of the countries and industries, therefore, it can be inferred that countries differ in terms of intercept levels. Individual slopes are statistically insignificant for the majority of countries across all industries, which indicates that countries in the same size group do not significantly differ from each other in terms of slope. Given the three size groups of countries classified by the aforementioned measures, this study focuses on the large country group due to the space required for the analysis of manufacturing industries at a disaggregated level.

In the long term, it is assumed that industries undergo three development stages—pre-takeoff, growth and decline—following a pattern of a cubic function. However, those industries which can sustain growth over a long period of time may have a more linear development trajectory, while other industries which experience growth from a very early stage of development and only decline at a later stage, may indicate a more quadratic pattern. Hence, in addition to GDP per capita, we include cubic and square terms of GDP per capita in the equation in order for the results to denote possible patterns of manufacturing development, depending on the statistical significance of these GDP per capita terms. To control for the effect of unobserved country-specific conditions, we apply the fixed effect estimation procedure. For this purpose, the following equations are used for each manufacturing industry in the group of large countries.

$$\ln RVA_{ct}^{i} = \alpha_1 + \alpha_2 * \ln RGDP_{ct} + \alpha_3 * \ln RGDP_{ct}^2 + \alpha_4 * \ln RGDP_{ct}^3 + \alpha_c + e_{ct}^{\ i} \quad (1)$$

$$\ln EMP_{ct}^{i} = \alpha_1 + \alpha_2 * \ln RGDP_{ct} + \alpha_3 * \ln RGDP_{ct}^2 + \alpha_4 * \ln RGDP_{ct}^3 + \alpha_c + e_{ct}^{\ i} \quad (2)$$

$$\ln LP_{ct}^{i} = \alpha_1 + \alpha_2 * \ln RGDP_{ct} + \alpha_3 * \ln RGDP_{ct}^2 + \alpha_4 * \ln RGDP_{ct}^3 + \alpha_c + e_{ct}^{\ i} \quad (3)$$

where:

- *RVA* indicates real value added per capita
- *EMP* represents real employment-population ratio
- *LP* means labour productivity
- *RGDP* stands for real GDP per capita
- $RGDP^2$ denotes real GDP per capita square
- $RGDP^3$ signifies real GDP per capita cubic
- α_c is country fixed effect
- $e_{ct}^{\ i}$ refers to unexplained residual.

Both dependent and explanatory variables are expressed in logarithmic terms to measure the elasticity of each variable. The regression results are presented in Appendix A.

3. Results

3.1 Value added growth as a function of the labour productivity and employment growth rates

Based on the identity discussed in the introduction, this section will look into the relationships between the rate of labour productivity growth and employment growth and how they together influence value added growth (Figure 4 – 6 and Appendix B1 and B2). The 18 manufacturing industries studied in this paper are classified into early, middle and late industries depending on whether an industry reaches its highest share in total MVA before a GDP per capita of US$ 5,000, between US$ 5,000 and US$ 20,000 or after US$ 20,000, respectively. Table 2 presents the changes in the shares of manufacturing industries every US$ 1,000 of GDP per capita. The highest shares of the industries are indicated by a box. The early industries include food and beverages (ISCI code: 15), tobacco (16), textiles (17), wearing apparel (18), wood products (20), printing and publishing (22), coke and refined petroleum (23), non-metallic minerals (26), and furniture, n.e.c (36). The middle industries are paper (21), basic metals (27), fabricated metals (28) and precision instruments (33). The late industries comprise chemicals (24), rubber and plastic (25), machinery and equipment (29), electrical machinery and apparatus (31) and motor vehicles (34).

Table 2: Value added shares in total MVA for large countries

	GDP per capita (in thousands)																			
ISIC	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
15	20.2	21.2	20.3	19.6	18.9	18.4	17.9	17.5	17.0	16.6	16.3	15.9	15.6	15.2	14.9	14.6	14.4	14.1	13.8	13.6
16	6.6	6.1	5.0	4.2	3.6	3.1	2.7	2.4	2.2	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	1.0	1.0	0.9
17	13.4	9.7	8.8	8.5	8.3	8.1	7.9	7.6	7.3	6.9	6.6	6.2	5.9	5.6	5.2	4.9	4.6	4.3	4.1	3.8
18	1.3	5.0	7.1	7.8	7.8	7.5	7.0	6.4	5.9	5.4	4.9	4.5	4.1	3.8	3.4	3.2	2.9	2.7	2.5	2.3
20	6.6	4.3	3.2	2.6	2.2	1.9	1.7	1.5	1.4	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6
21	3.2	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.4	3.4
22	3.3	4.1	4.1	4.0	3.8	3.6	3.5	3.4	3.2	3.1	3.0	2.9	2.8	2.7	2.7	2.6	2.5	2.4	2.4	2.3
23	4.7	4.1	3.8	3.7	3.6	3.6	3.5	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.0	2.9	2.9	2.8	2.7	2.7
24	6.2	8.8	9.7	10.2	10.6	11.0	11.3	11.5	11.7	11.9	12.1	12.3	12.4	12.6	12.7	12.9	13.0	13.2	13.3	13.4
25	2.7	3.7	4.0	4.2	4.2	4.3	4.4	4.4	4.5	4.5	4.5	4.6	4.6	4.6	4.7	4.7	4.7	4.8	4.8	4.8
26	4.0	6.9	7.5	7.4	7.2	6.9	6.7	6.4	6.2	5.9	5.7	5.6	5.4	5.2	5.1	5.0	4.8	4.7	4.6	4.5
27	5.7	4.6	4.7	5.1	5.6	6.0	6.5	6.8	7.2	7.5	7.7	7.9	8.1	8.2	8.3	8.3	8.4	8.4	8.3	8.3
28	6.7	4.0	3.7	3.9	4.1	4.3	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.4	5.4	5.4	5.4	5.3	5.3	5.2
29	4.3	3.1	2.9	3.0	3.2	3.5	3.7	4.0	4.3	4.6	4.8	5.1	5.4	5.7	5.9	6.2	6.4	6.7	6.9	7.2
31	1.0	2.3	3.2	4.0	4.7	5.3	5.9	6.5	7.1	7.6	8.1	8.7	9.2	9.7	10.2	10.7	11.2	11.7	12.2	12.7
33	0.8	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
34	6.0	3.5	3.5	3.9	4.5	5.1	5.7	6.3	7.0	7.6	8.2	8.7	9.2	9.7	10.1	10.5	10.8	11.1	11.4	11.6
36	3.2	4.5	4.2	3.8	3.4	3.0	2.8	2.6	2.4	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5

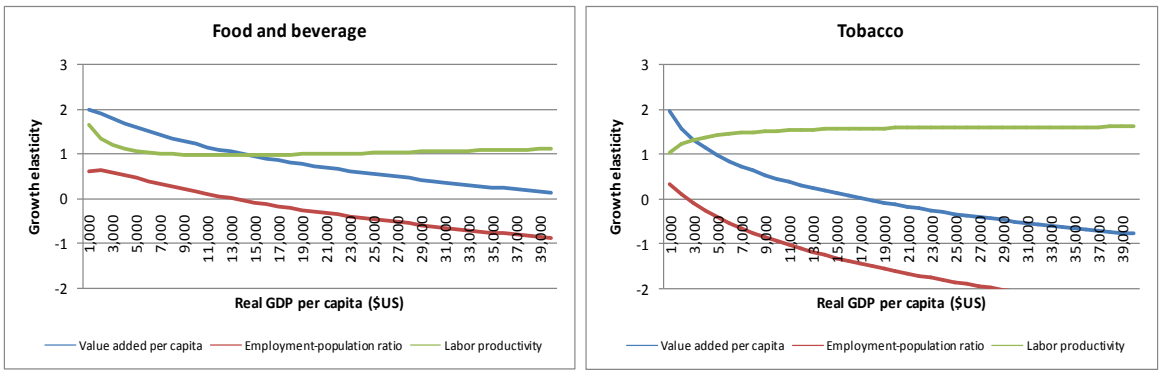
ISIC	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
15	13.4	13.1	12.9	12.7	12.5	12.3	12.1	11.9	11.8	11.6	11.4	11.3	11.1	10.9	10.8	10.6	10.5	10.3	10.2	10.0
16	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
17	3.6	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
18	2.1	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7
20	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2
21	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.2	3.2	3.2	3.2	3.2	3.2
22	2.3	2.2	2.2	2.1	2.1	2.1	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.6
23	2.6	2.6	2.5	2.4	2.4	2.3	2.3	2.2	2.2	2.1	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.7	1.7	1.6
24	13.6	13.7	13.8	14.0	14.1	14.2	14.4	14.5	14.6	14.7	14.9	15.0	15.1	15.2	15.3	15.4	15.6	15.7	15.8	15.9
25	4.9	4.9	4.9	5.0	5.0	5.0	5.1	5.1	5.1	5.2	5.2	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.5	5.5
26	4.5	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.6
27	8.3	8.2	8.1	8.0	7.9	7.8	7.7	7.6	7.5	7.3	7.2	7.1	6.9	6.8	6.6	6.5	6.3	6.2	6.0	5.9
28	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.0	3.9	3.8	3.7	3.5	3.4	3.3	3.2	3.1	3.0
29	7.4	7.6	7.9	8.1	8.3	8.5	8.7	8.9	9.1	9.3	9.5	9.7	9.8	10.0	10.2	10.3	10.5	10.6	10.7	10.9
31	13.3	13.8	14.3	14.8	15.3	15.9	16.4	16.9	17.5	18.0	18.6	19.1	19.6	20.2	20.8	21.3	21.9	22.4	23.0	23.5
33	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6
34	11.8	12.0	12.1	12.2	12.3	12.3	12.4	12.4	12.3	12.3	12.2	12.2	12.1	12.0	11.8	11.7	11.6	11.4	11.2	11.1
36	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3

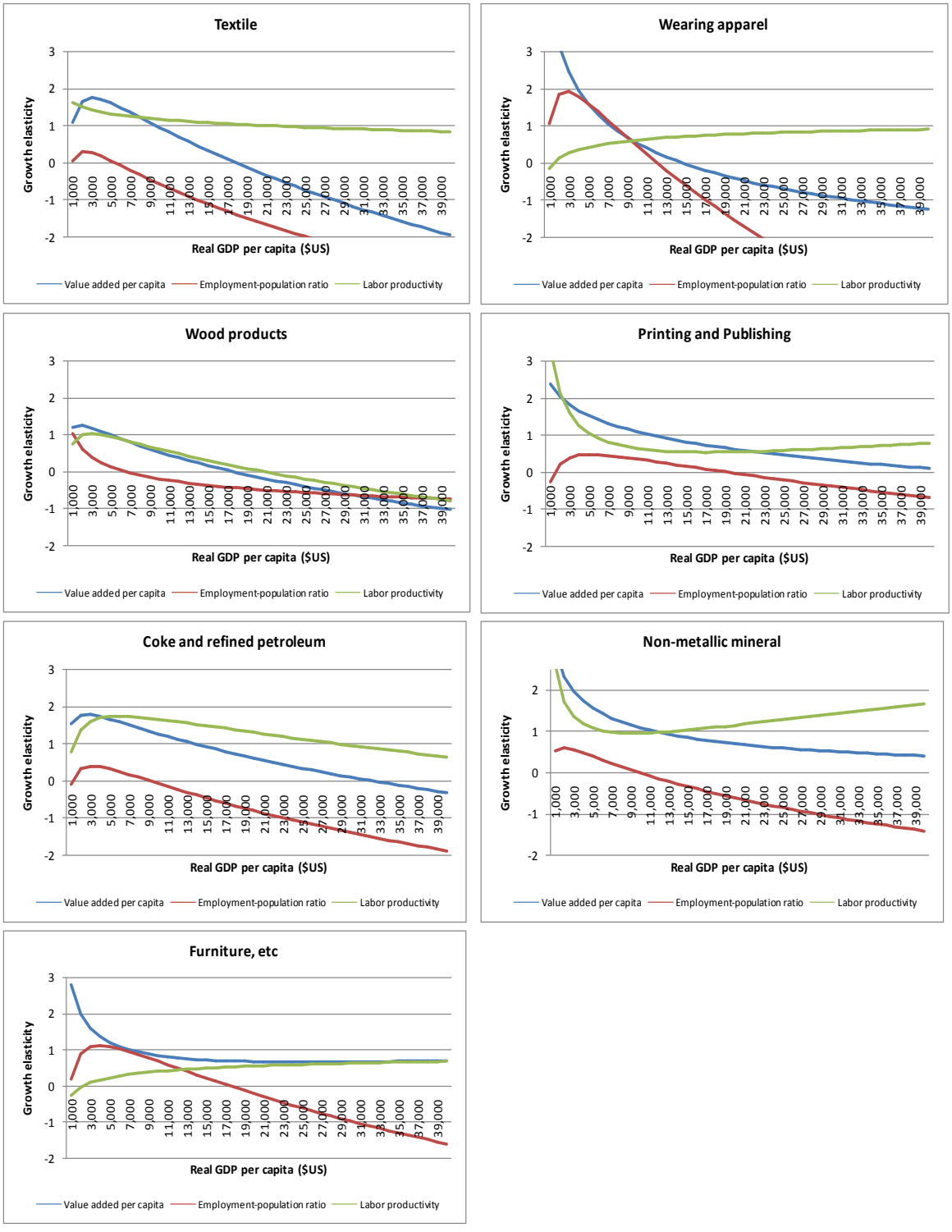
Note: For the descriptions of ISIC codes, refer to Table 1. ISIC codes 15, 16, 17, 18, 20, 22, 23, 26, and 36 are early industries (in red). ISIC codes 21, 27, 28, and 33 are middle industries (in green). ISIC codes 24, 25, 29, 31, and 34 are late industries (in sky blue).
Source: Created by the authors based on INDSTAT 2012 data.

The early industries

Up to around US$ 10,000 GDP per capita, the early industries, especially the food and beverages, textiles, wearing apparel, and non-metallic mineral industries carry significant weight in total MVA (Table 2). However, early industries increase their value added per capita (industry size) through different combinations of both the labour productivity and employment growth rates. The food and beverages industry, usually the largest manufacturing industry in this early stage, increases production on account of the steady growth of the productivity and a slow decline of the employment growth rate. The non-metallic mineral industry displays a similar pattern, but experiences both a faster productivity growth rate and a faster decline of the employment growth rate. The textiles industry may experience fast growth up to US$ 5,000, mainly due to the decelerating employment rate but fast productivity growth. Given the declining trend of labour productivity, the rapid drop in the employment growth rate causes the fast decline of the value added per capita growth rate in the textiles industry from around US$ 6,000 per capita. In the case of the wearing apparel industry, the very high value added per capita growth rate at an early stage of a country's development (from US$ 1,000 to US$ 4,000 GDP per capita) is attributable to the high employment growth rate. Thus, the rapid fall of the value added per capita growth rate coincides with the precipitate decline of the employment growth, though the former's decline is eventually tempered by a gradual increase in the rate of labour productivity growth. The wearing apparel industry's growth rate, therefore, largely depends on labour's cost competitiveness, as the wearing apparel industry does not seem to render much room for the substitution of labour for capital.

Figure 1: Value added as a function of the labour productivity and employment growth rate - early industries





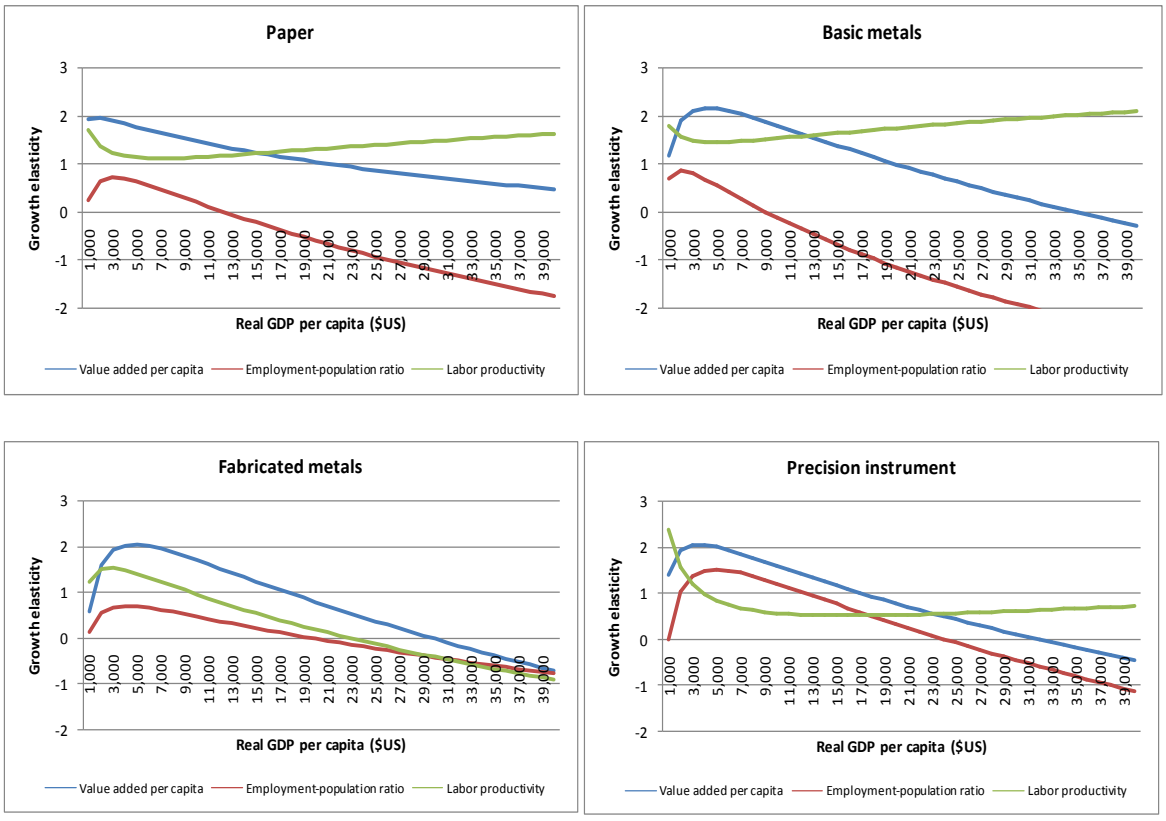
Source: Created by the authors based on INDSTAT 2012 data.

The middle industries

Among the four middle industries, our estimation indicates that the basic metals and fabricated metals industries have the potential to occupy a sizeable share in the manufacturing industry following the decline of the early industries, and up to around US$ 20,000 GDP per capita

(Table 2). Between the two, the fabricated metals industry is a more labour intensive and employment-generating industry while the basic metals industry is capital intensive and oriented towards adding value without adding much labour (Appendix D). The two industries have a similar development pattern as shown in Figure 5, but the relationship between the labour productivity and the employment growth rate underlying the pattern differs between the two industries. The fabricated metals industry decreases both the rate of labour productivity as well as the employment growth rate, but slower decline of the employment growth rate prolongs the growth of value added per capita. The basic metals industry, in turn, tends to experience relatively rapid decline with regard to the employment growth rate; however, the fast increase in labour productivity helps sustain the growth of value added faster than the rate of the economy-wide average up to around US$ 20,000 (the point where the growth elasticity of value added per capita reaches one).

Figure 2: Value added as a function of the labour productivity and employment growth rate - middle industries

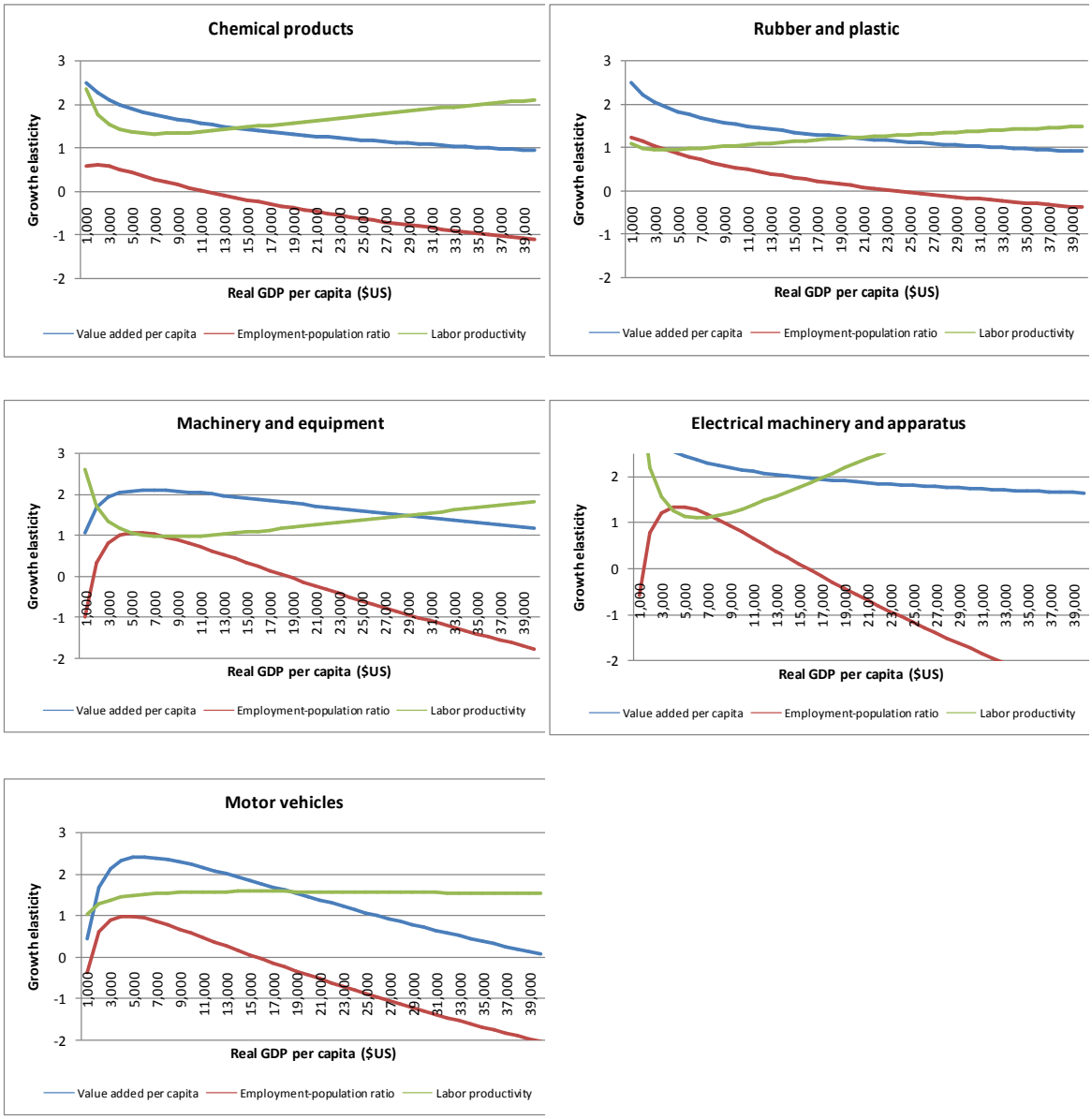


Source: Created by the authors based on INDSTAT 2012 data.

The late industries

After reaching US$ 15,000 GDP per capita, apart from a high value added share of the food and beverages industry, the manufacturing industry of large countries is usually dominated by late industries such as the electrical machinery and apparatus, chemicals, motor vehicles and machinery and equipment industries (Table 2). Among these, the electrical machinery and apparatus and the chemicals industries, in particular, are expected to become the two largest manufacturing industries at a high income level after US$ 30,000 GDP per capita as shown in Table 2. The main reason behind the rapid growth of the electrical machinery and apparatus industry is its unrivalled capacity to sustain the fast growth rate of labour productivity, while the factors underlying the steady growth of the chemicals industry seem to be a slower decline of the employment growth rate, combined with a relatively high growth of labour productivity, especially during a high income stage of a country's development. The value added of the motor vehicle industry could expand as rapidly as that of the electrical machinery and apparatus—the industry with the fastest growth potential—up to around US$ 15,000, and could thereafter continue to grow at a speed similar to that of the chemicals industry—the industry with the second fastest growth potential—until the country reaches a GDP per capita of around US$ 23,000. However, the growth rate of the motor vehicles industry slows down relatively quickly, and the difference in the value added of the motor vehicles and of the two fastest growing industries continues to increase as the country's income level rises further. This slowdown of the motor vehicles industry is mainly attributable to its limited capacity to increase labour productivity at higher GDP levels relative to those of the electrical machinery and apparatus and chemicals industries. Another late and potentially major industry in terms of value added share in total MVA is the machinery and equipment industry. The growth trend of the industry's labour productivity and employment are similar to that of the chemicals industry, but compared with the latter, the initial development of the machinery and equipment industry is much more likely to be driven by the employment growth rate than by that of productivity growth. The labour productivity growth rate starts to play an important role in sustaining the value added growth rate at a later development stage than in other late industries, but its relatively high growth rate after reaching the lowest point helps sustain the rapid growth of value added, which is expected to eventually surpass the motor vehicles industry's value added level.

Figure 3: Value added as a function of the labour productivity and employment growth rate - late industries



Source: Created by the authors based on INDSTAT 2012 data.

The above analysis elucidates the role of both the employment and labour productivity growth rate in the development paths of major manufacturing industries associated with the different stages of a country's development. Each manufacturing industry has its unique combination of employment and productivity growth rate patterns, which underlie the level of the given manufacturing industry's value added. To return to the main theme of this paper, the following sections will focus on the employment potential of manufacturing industries based on our estimates.

3.2 Employment[5]

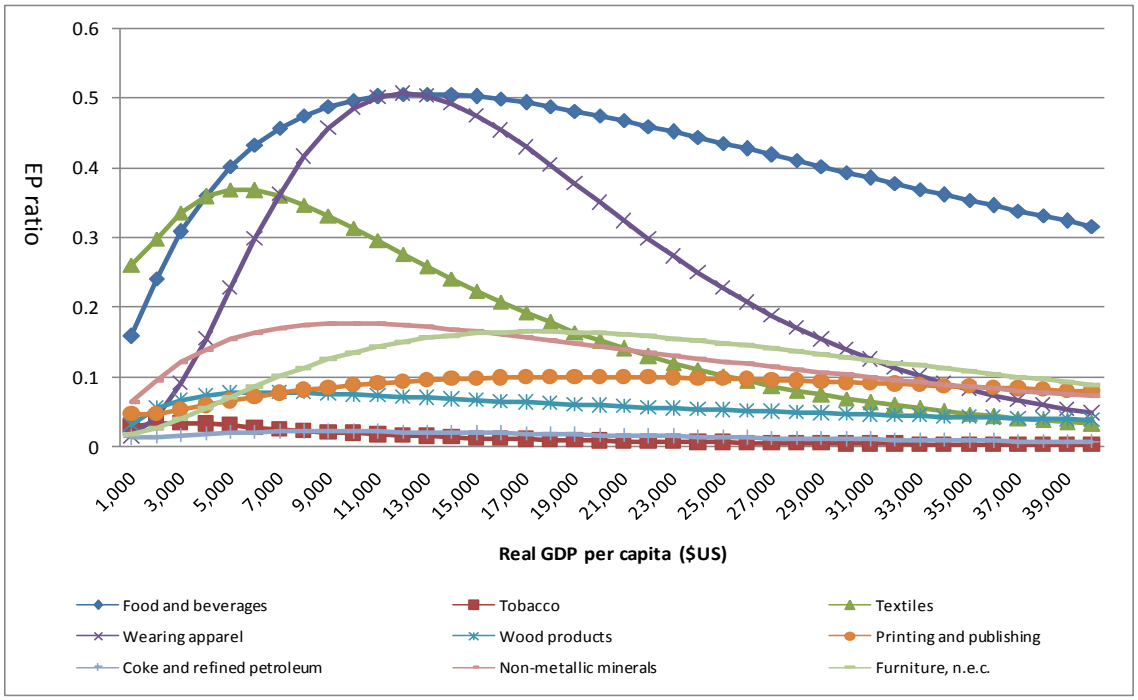
The early industries

Among the early industries, the major contributors to employment are the food and beverages, textiles and wearing apparel industries. Indeed, none of the other industries reach the employment level of these three industries. As shown in Figure 7, both the food and beverages and the wearing apparel industries reach their highest levels of employment with EP ratios of 0.5056 and 0.5063, respectively, when the country reaches a GDP per capita of around US$ 12,000. The difference between the two industries is that the food and beverages industry always has a large rate of employment, while the wearing apparel industry employs a large number of workers during a relatively short period of a country's development only. The EP ratio of the food and beverages industry is 0.1575at a GDP per capita of US$ 1,000. The EP ratio gradually rises, and the level of employment becomes three times larger at the highest level to subsequently slowly decline, yet still maintaining an EP ratio of 0.3159, i.e. 62 percent of its highest level at a GDP per capita of US$ 40,000.

In contrast, the wearing apparel industry starts with a very small EP ratio of 0.0146, and the level of employment rapidly increases 35 times before it reaches its highest level at 0.5063 – a level other industries do not usually reach. Reaching this level at a GDP per capita of US$ 12,000, the level of employment of the wearing apparel industry declines rapidly and shrinks 30 percent by the time the country reaches a GDP per capita of US$ 20,000. As for the food and beverages industry, which also experiences its highest level of employment at US$ 13,000, the same scale of employment reduction only occurs when a country's GDP per capita rises to around US$ 37,000. This indicates that the wearing apparel industry could experience a substantial employment growth rate at a low income stage, but once a country loses its comparative advantage at a GDP per capita level of around US$ 8,000, the industry's employment level reaches its peak and then rapidly declines.

[5]UNIDO's industrial statistics usually only include those engaged in formal enterprises and, depending on reporting country, small enterprises and employment therein are excluded from the statistics.

Figure 4: Employment growth elasticity – early industries



Source: Created by the authors based on INDSTAT 2012 data.

The textiles industry, another major contributor to total manufacturing employment at an early stage of a country's development, combines the trends of both the food and beverages and the wearing apparel industries. From a very early stage of a country's development, the textiles industry, like the food and beverages industry, employs a relatively large number of workers, as the EP ratio of 0.2605 at a GDP per capita of US$ 1,000 indicates (Appendix C). Subsequently, the level of employment increases slowly and reaches its peak with an EP ratio of 0.3676 at a GDP per capita level of around US$ 5,000. After reaching this peak level, the industry, to a large extent, follows the trend of the wearing apparel industry. The level of employment declines rapidly, and by the time the country reaches a GDP per capita level of US$ 13,000, the level of employment reduces by 30 percent compared with the peak level.

Besides the three above-mentioned industries, the non-metallic minerals industry could, as an early industry, make a sizeable contribution to the level of employment. It starts with an EP ratio of 0.0635 at a GDP per capita level of US$ 1,000, about one quarter of the initial textile industry's level of employment. At that stage of a country's development, the non-metallic minerals industry is the third largest employment source after the food and beverages and the textiles industries. From this initial level, the level of employment increases three-fold to reach its peak with an EP ratio of 0.1768 at a GDP per capita of US$ 9,000. By then, the country has developed other industries to increase manufacturing employment, and the non-metallic mineral

industry is no longer the third but eighth out of 18 industries in terms of employment size. As is the case of the food and beverages industry, the employment size of the non-metallic minerals industry also only declines gradually. Its employment size therefore surpasses that of the textiles and wearing apparel industries at a GDP per capita of US$ 22,000 and US$ 35,000, respectively, as the latter two industries' employment size reduces much faster than the non-metallic minerals industry's. This industry produces bricks, cement and glass, which are primarily used for construction. Compared with many other industries, yet similar to the food and beverages industry, the non-metallic minerals industry is more domestic oriented and serves demands that are relatively income inelastic. These factors seem to contribute to the stability of the industry's employment size.

Other early industries employ a small number of workers. At a GDP per capita of US$ 19,000, the printing and publishing industry reaches its highest level of employment with an EP ratio of 0.0996, which is around one-fifth and only 60 percent of the highest level of employment for the wearing apparel and non-metallic minerals industries, respectively. The unique feature of the printing and publishing industry, however, is the stability of its employment. The industry only doubles its employment size from its initial and lowest size at a GDP per capita level of US$ 1,000 by undergoing a long period of development, reaching the highest employment level at a GDP per capita of US$ 19,000. Thereafter, the employment level decreases very slowly and at a GDP per capita of US$ 40,000 sustains 80 percent of its highest level of employment. The printing and publishing industry shares the characteristics of the non-metallic minerals industry, but the former is likely to be even more domestic oriented and income inelastic, making it the most stable manufacturing industry in terms of employment change.

The coke and refined petroleum industry employs the smallest number of workers in the early, and in fact, among all manufacturing industries. The industry's employment size is only 4 percent of that of the wearing apparel industry when comparing the two industries' highest levels of employment. The coke and refined petroleum industry is very capital intensive. The industry's production process only requires a small number of workers relative to the output it produces. For example, at a GDP per capita of US$ 28,000, both the coke and refined petroleum and the textiles industries produce about the same amount of value added per capita, but the employment size of the former is only 14 percent of the latter's. The coke and petroleum industry could make a substantial contribution to the economy in terms of value added when it reaches its peak, which is comparable to that of other early industries such as the textiles and wearing apparel industries, but in terms of employment, its contribution is very limited (Appendix B).

The tobacco industry, which is the second lowest employment source after the coke and refined petroleum industry, reaches its highest level of employment when a country's GDP per capita is only US$ 2,000. The difference between the two industries is that the tobacco industry's contribution is limited in terms of both value added and employment, while only employment is noticeably low for the coke and refined petroleum industry.

Finally, the wood products industry is the smallest industry based on estimations of the peak value added per capita a manufacturing industry can reach. However, due to its relatively labour intensive production, the level of employment is approximately two and three times larger, respectively, than the highest levels of employment of the tobacco and the coke and refined petroleum industries. Although the wood products industry's contribution to both value added and employment are relatively small, they are stable throughout a country's development. For example, due to the rapid decline of the level of employment in the textiles industry, the wood products industry's level of employment may actually exceed that of the textile industry.

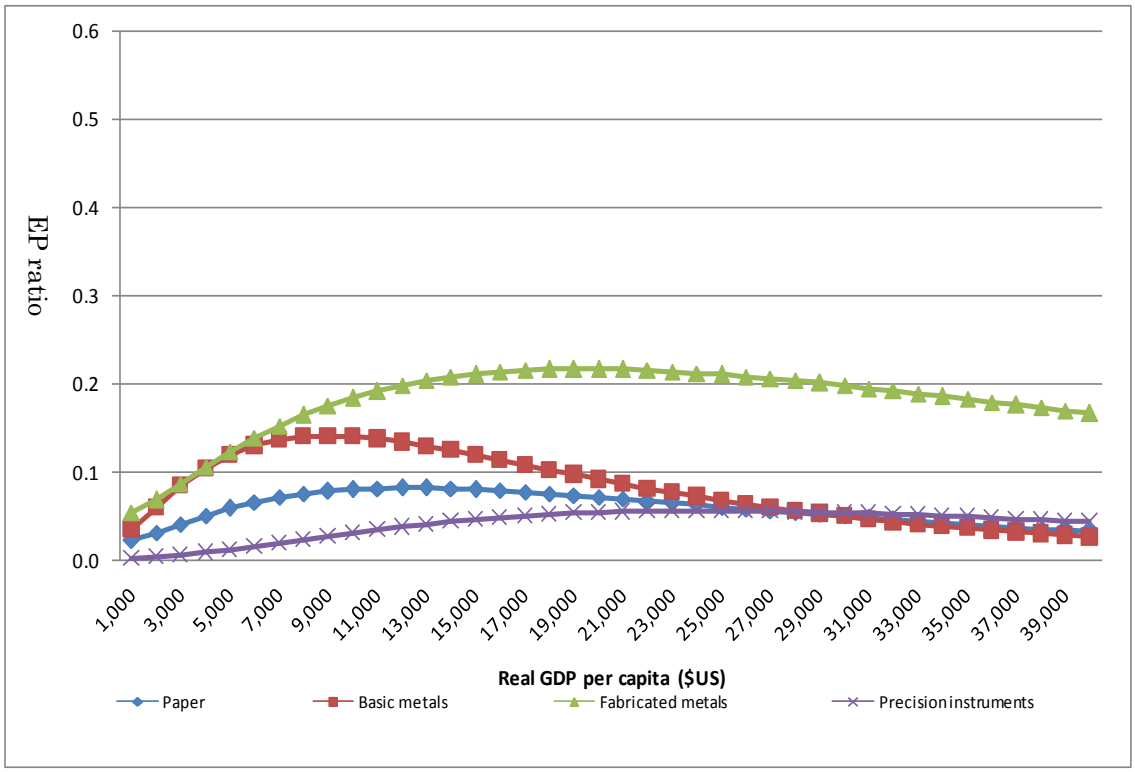
The middle industries

The industries in this group are defined here as those whose share of valued added in total manufacturing reaches its highest level when a country's GDP per capita is between US$ 5,000 and US$ 20,000. The paper, basic metals, fabricated metals and precision instruments industries fall into this category (Figure 8).

Among the four industries, the fabricated metals industry makes the largest contribution to a country's level of employment. At a low income level of US$ 1,000 GDP per capita, the industry already employs a relatively large number of workers with an EP ratio of 0.0533, the largest among the middle and late industries and the fifth largest among all 18 manufacturing industries at that income level. The level of employment continues to rise until the country reaches a GDP per capita of around US$ 19,000. At its peak with an EP ratio of 0.2164, the level of employment of the fabricated metals industry is around half of that of the highest level reached by the food and beverages or the wearing apparel industries, or around 20 percent higher than the peak level of employment of the non-metallic minerals industry. Although a comparison of the peak levels of employment among manufacturing industries places the fabricated metals industry sixth in terms of employment size, the industry's weight in total manufacturing employment increases as a country's income rises because of the relative stability of the fabricated metals industry's level of employment and the rapid decline in the employment levels of other industries (e.g. textiles and wearing apparel) which employ more workers than the fabricated metals industry. Consequently, as a country's GDP per capita moves

beyond US$ 25,000, the fabricated metals industry becomes the second largest employer after the food and beverages industry.

Figure 5: Employment growth elasticity – middle industries



Source: Created by the authors based on INDSTAT 2012 data.

The basic metals industry is the next largest source of employment among the middle industries. At its peak, the industry employs around 65 percent and a quarter of the peak levels of employment of the fabricated metals and the wearing apparel industries, respectively. The industry reaches its highest level of employment at a relatively early stage of a country's development at a GDP per capita of US$ 9,000, the earliest among the middle and late industries. As the country's income level increases further, the level of employment of the basic metals industry shrinks rapidly down to half of the highest employment level at a GDP per capita of US$ 24,000, and to one third at a GDP per capita of US$ 31,000. The main reason why the basic metals industry has a lower level of employment than the fabricated metals industry—another metals-related industry—is the capital intensiveness of the former industry relative to the latter one. To produce the same amount of value added, the basic metals industry only needs around half of the workers required for the fabricated metals industry. During the course of a country's development, the basic metals industry can be twice the size of the fabricated metals

industry in terms of value added, but the former industry reaches only half of the latter's level of employment when comparing their peak levels.

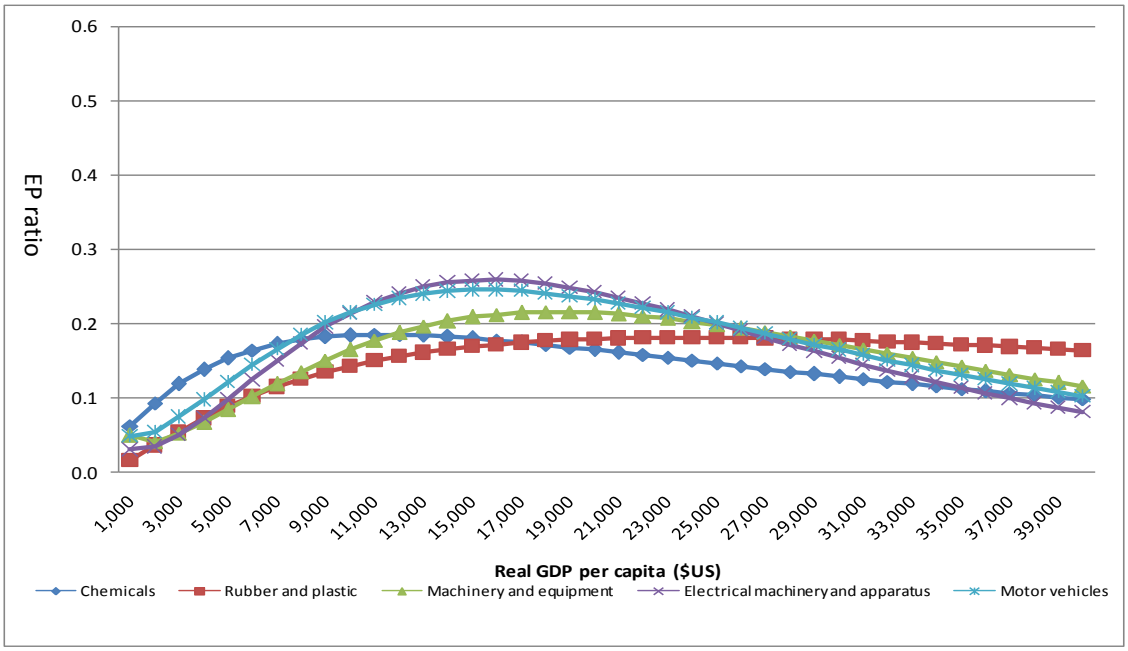
The paper industry has limited potential to absorb a country's labour force. At its peak, the industry employs slightly more workers than the wood products industry or around one-sixth of the wearing apparel industry, which is the largest industry in terms of level of employment. Although the paper industry's output could grow ten times larger than the highest output level the wood products industry could ever attain, in terms of employment growth the paper industry follows a pattern similar to that of the wood products industry which is slow in both periods of employment growth and reduction. Due to the paper industry's capital intensive production process, it can achieve a much higher level of output than the wood products industry; however, the two industries generally face similar demand characteristics which are domestic oriented and income inelastic, making the employment trends of both industries relatively stable.

The precision instruments industry is the smallest among the middle industries and the third smallest among all manufacturing industries after the coke and petroleum and the tobacco industries, when comparing the highest level of employment they can reach throughout the course of a country's development. The precision instruments industry starts with a very small level of employment at a GDP per capita of US$ 1,000, far smaller than any other industry, and increases the level of employment relatively rapidly for a long period of a country's development, reaching its highest level of employment at a late development stage only, namely at US$ 24,000. The industry seems to be a skills and technology intensive industry, which could keep output and employment growing even after a country's income rises to a fairly high level, though both of them are very small in terms of share in total manufacturing due to the specialized nature of the precision instruments industry.

The late industries

The industries in this group reach their highest value added shares in total manufacturing after a country's GDP per capita surpasses US$ 20,000. There are no industries in this category which have a very high level of employment comparable to that of some of the early industries, such as the wearing apparel, food and beverages and textiles industries, but they cannot be considered small either, because at their peaks they employ around one-third to half of the peak level of employment of the wearing apparel industry which attains the highest level of employment among all manufacturing industries.

Figure 6: Employment level (EP ratio) – late industries



Source: Created by the authors based on INDSTAT 2012 data.

Among the late industries, the electrical machinery and apparatus industry is expected to make the largest contribution to a country's level of employment and be the fourth largest employment source of all manufacturing industries, after the wearing apparel, food and beverages and textiles industries (Appendix C). The industry's level of employment at an early stage of a country's development is low and does not expand much until a country's GDP per capita rises to around US$ 3,000 (Figure 8). Subsequently, employment expands rapidly, reaching the highest level at a GDP per capita of US$ 16,000. At its peak, the industry's level of employment represents around half of the peak level the wearing apparel and food and beverages industries can reach in their developments. Although the output (in terms of value added) of the electrical machinery and apparatus industry continues to grow much faster than the economy's average, even at a high income stage of a country's development, the level of employment decreases rather quickly, more rapidly than the levels of other late industries (Appendix B).

The motor vehicle industry reaches its peak level of employment at the same GDP per capita level as the electrical machinery and apparatus industry, namely US$ 16,000, with a slightly lower level of employment. The difference between the two industries is that employment in the motor vehicle industry is more stable and changes more slowly than the electrical machinery and apparatus industry. Therefore, even though the electrical machinery and apparatus industry could reach a higher level of employment than the motor vehicle industry, the latter is likely to

have a higher level of employment than the electrical machinery and apparatus industry at income levels lower than US$ 10,000 and higher than US$ 25,000 GDP per capita.

The machinery and equipment industry employs 12 percent and 17 percent less workers than the electrical machinery and apparatus and the motor vehicle industries, respectively, based on a comparison of their highest levels of employment (Appendix C). After the peak level of employment is reached in the machinery and equipment industry, employment decreases even more slowly than that of the motor vehicle industry. At a GDP per capita income of US$ 40,000, the level of employment of the equipment and machinery industry will be 47 percent lower than at its highest level, while the level of employment of the motor vehicle and electrical machinery and apparatus industries drops by 60 percent and 70 percent, respectively, after reaching their peaks.

In terms of employment, the chemicals industry and rubber and plastic industry are the two smallest of the five late industries. Among all manufacturing industries, however, their levels of employment are medium sized, ranking 8th and 9th out of 18 industries. The chemicals industry employs slightly more workers than the rubber and plastic industries at their highest levels. After reaching the highest level of employment at a GDP per capita of US$ 11,000, earlier than other late industries, the chemicals industry gradually reduces its level of employment. The chemicals industry differs from other late industries on account of its high employment size at a relatively early stage of a country's development. At a GDP per capita of between US$ 6,000 and US$ 7,000, the industry's level of employment becomes the fourth highest after that of the food and beverages, textiles and wearing apparel industries.

Finally, the rubber and plastic industry is notable for its contribution to a country's level of employment at very higher income levels. After reaching its peak level of employment at US$ 24,000, employment decreases very slowly and remains at around 90 percent of its highest level at US$ 40,000. Thus, even though other late industries may employ more workers than the rubber and plastic industry at its peak level, the rubber and plastic industry becomes the largest employment source among the late industries at higher income levels, and the third largest among all manufacturing industries after the food and beverages and fabricated metals industries. In terms of value added, the rubber and plastic industry is not likely to grow as large as other late industries. Thus, the rubber and plastic industry is the most labour intensive late industry, similar to the fabricated metals industry in the middle industry group (Appendix D).

4. Analysis

Throughout a country's development, the food and beverages industry is a major source of employment. Except for a brief period of a country's early development stage in which the industry's level of employment may be surpassed by that of the textiles and wearing apparel industries, the food and beverages industry usually employs the largest number of workers at all income levels. As noted above, at a relatively early stage of development, i.e. less than US$ 10,000 GDP per capita, the wearing apparel and textiles industries together with the food and beverages industry constitute the three largest contributors to a country's manufacturing employment. Other manufacturing industries usually do not reach the level of employment of any of these three industries during the course of their development. Therefore, from a very early stage of a country's development up to a GDP per capita of around US$ 10,000, a country may experience a rapid increase in manufacturing employment, as the three largest employment sources in manufacturing industry develop during that income range. Starting from a very low income level, the textiles and food and beverages industries employ a relatively large number of workers. These are industries related to basic needs, i.e. even before industrialization takes off, e.g., at a GDP per capita of US$ 1,000 or less, a country usually has a non-negligible number of firms in these industries, employing more workers than other manufacturing industries. While the number of workers in the food and beverages and textiles industries increases 3.2 times and 40 percent, respectively, from their initial levels at a GDP per capita of US$ 1,000 by the time they reach their peak levels, the wearing apparel industry could increase the number of employees 35 times, thus surpassing the level of employment of the food and beverages at its peak to become the largest industry in terms of employment.

This development pattern of large countries indicates that the wearing apparel industry is the first major industry which basically needs to be developed from scratch (at least for formal enterprises) in order to increase manufacturing employment and to absorb surplus labour from agriculture to put a country on a steady path of industrialization. Considering the sizeable contribution of the wearing apparel industry to a country's value added, whether a country's wearing apparel industry can experience rapid and steady growth is likely to have a significant influence on the country's economic and social progress in a relatively early stage of development.

With regard to the characteristics of employment trends described in the previous section, the level of employment in both the textiles and wearing apparel industries declines rapidly after their highest level of employment has been reached. As Appendix B indicates, the end of employment growth in the three major employment sources of a country's early development

occurs when a country's per capita income rises to around US$ 12,000, when both the wearing apparel and food and beverages industries reach their highest levels of employment.[6] In the case of the wearing apparel industry, the beginning of the decline in the level of employment roughly coincides with the decline of industry size in terms of value added, because there is little potential to substitute capital for labour. In contrast, there is some room in the textiles industry for sustaining the rapid growth of the value added through factor substitution, which may take place when the employment increase comes to an end, i.e. around a GDP per capita of US$ 5,000 to a GDP per capita of US$ 9,000 (Appendix B).

The increase and decline of the food and beverages, textiles and wearing apparel industries in terms of employment and value added denote that the middle and late industries have to be ready to assume the role of engine of manufacturing growth before the early industries begin to decline, which may occur around US$ 12,000 for employment and at a somewhat higher GDP level for value added per capita. Due to the rapid decline in particular of the level of employment in the early industries after reaching its peak, the steady growth of the middle and late industries before the level of employment begins to decline in the early industries is essential for keeping the momentum of industrialization.

Because there are no middle and late industries which are comparable to the wearing apparel and textiles industries of the early industries in terms of labour absorption capacity, a country needs at least four or five middle and late industries to develop continually in order to compensate for the decline of the major employment sources of the early industries. For example, if a country can follow the typical development patterns of large countries identified in this study, the combined level of employment of the four middle and late industries—fabricated metals, machinery and equipment, electrical machinery and apparatus and motor vehicle industries—could surpass total employment from the wearing apparel, electrical machinery and apparatus and textiles industries at a GDP per capita of around US$ 11,000. Which industries a country should pay particular attention to and possibly provide support to facilitate growth depends on the balance the country aims to strike between economic and social progress and its demographic and geographic conditions, which have positive or negative effects on certain industries' growth (Haraguchi and Rezonja 2011). Based on this study's results, the following section suggests possible paths of manufacturing development in favour of employment creation and economic growth.

[6] The textiles industry tends to reach its highest level of employment at a much lower income level, at approximately US$ 5,000.

4.1 Pro-employment path of manufacturing development

Ideally, rapid economic growth leads to broad-based employment generation, raising the level of employment in all industries to create quantitatively high and qualitatively diverse jobs, most likely not proportionally across industries, but in accordance with a country's shifting endowment structures. This will open job opportunities for a country's labour force, requiring different skills and experiences which correspond to the given stage of development to reduce structural unemployment. However, countries that face difficulties reducing high unemployment or that need to create more productive jobs (e.g. the majority of manufacturing activities), may have to pursue a more strategic approach to job creation. Most countries fall into this category and we address them in this section.

Three conditions need to be considered for illustrating a pro-employment path of development – growth potential, labour intensiveness and patterns of structural change within manufacturing industries. On the one hand, if we only look at industries' labour intensiveness in terms of job creation without giving due consideration to the growth potentials of these industries, we might erroneously direct a country to pursue industries which use relatively more labour, but might have limited growth potential. These industries might have high labour intensity in terms of production, but their absolute volume of employment might remain small if the industry size remains small. On the other hand, the consequence of the reverse situation, i.e. only taking growth potential into consideration, is clear, which is equivalent to the situation that no consideration is given to pro-employment manufacturing development. Finally, neither industries' growth potential nor their labour intensiveness is static. They change as a country develops and its comparative advantages shift. When a country increases its per capita income, it may be futile to attempt sustaining the growth of early industries, although they may be more labour intensive. Moreover, within an industry, labour intensiveness changes because factor substitution of capital with labour might occur as a country develops. Hence, as both the structure within the manufacturing industry and the structure of production within industries changes, the relative importance of industries for job creation shifts from one industry to another.

At a very early stage of a country's development, the food and beverages and textiles industries should be the two major sources of manufacturing employment as well as of value added, because their activities relate to the basic needs of citizens. At an income level of less than US$ 2,000, a limited number of formal enterprises will be engaged in other industries. At a very low income level, there are two other industries that could substantially contribute to employment, namely the chemicals and the non-metallic minerals industry. In the early development of a

country, the chemicals industry produces basic materials, including fertilizers, which are required by the dominant sector of the early economy, agriculture. The non-metallic industry also develops from an early stage of development because it produces building materials, such as glass, cement and bricks, for which there is a certain level of demand regardless of income level. The chemicals industry's labour intensity is not high, but due to the high output level from an early stage of development, the number of workers employed in the industry is relatively large. These four industries could support the expansion of manufacturing employment at a very low income level, providing higher productivity jobs than those in the agrarian sector. There is relatively high domestic demand for these industries, as they relate to citizens' basic needs; therefore, countries seek to meet these demands through domestic production without too much dependence on imports. The food and beverages and the chemicals industries, in particular, could grow in terms of both employment and value added over longer periods of development. Building a solid foundation for these industries early on is important for a country's sustainable development.

The four industries mentioned above are, in a sense, 'original' industries, because they usually existed in most countries to meet citizens' basic needs even before industrialization took place, although their production processes and products most likely differed from modern ones. Therefore, the first challenge for countries aiming to follow the pro-employment path of manufacturing development is to diversify manufacturing from the four 'original' industries and establish a new labour intensive industry while promoting the further growth and development of those initial industries. From this perspective, the successful establishment of the wearing apparel industry is crucial and demonstrates whether a country can actually create a vibrant manufacturing industry which absorbs a substantial number of workers. The wearing apparel industry (including fur, leather products and footwear in our data) is not part of the 'original' industries and must therefore be developed by the country, but, if successful, has the potential of tremendous growth in terms of value added and employment in a relatively short period of time. The development of this industry might therefore represent a first experience of how industrialization can make a difference in a country's development due to its capacity to employ a large number of workers in higher productive activities than those required by the agricultural and subsistence sectors, which could consequently lead to a reduction in poverty.

Until around US$ 4,000, the rapid growth of the level of employment of both the wearing apparel and the food and beverages industries can contribute to the increase in manufacturing employment. From US$ 4,000 to US$ 9,000, the continued rapid employment generation in the wearing apparel industry is likely to be the single most important source of labour absorption in

highly productive manufacturing jobs. At their peak, the wearing apparel or the food and beverages industry has the potential to employ at least twice as many workers as the highest level of employment of any other manufacturing industry, except for the textiles industry which, at its peak, can reach two-thirds of the highest employment levels of the two industries. For low income countries, successful development of the new wearing apparel industry could provide an initial boost at the start of the industrialization process, providing productive and higher income jobs to a large number of people and, hence, increasing personal income, firm profits and government revenue for investment in better education, training and infrastructure. In this sense, the continual development of the wearing apparel industry, including leather and footwear production, is important not only for the country's industry on the whole, but also in terms of initial institutional, policy and managerial learning from this early industrialization experience, and laying the foundation for continuous industrial upgrading through increasing investment in human and capital resources. For most countries, the rapid growth of the wearing apparel industry in a country's early stage of development could become the first test for whether the process of industrialization can take off and attain continual progress.

As Appendix B indicates, one unique characteristic of the wearing apparel industry is the limited possibility for the substitution of production factors. In other words, the technology in the wearing apparel industry will always be labour intensive, offering little opportunity for the substitution of capital with labour. Therefore, when the increase in wage level makes the industry uncompetitive, the decline of the industry's value added soon follows because the growth cannot be sustained by using more capital in place of labour. This is the only industry in which the decline of employment nearly coincides with that of value added per capita.

Even though the wearing apparel industry has the potential to become a major source of manufacturing employment, especially at a relatively low income level, countries must prepare alternative sources of employment long before the wearing apparel industry begins to decline for two reasons: first, the speed of the industry's employment slowdown and decline tend to be faster than that of any other industry. The industry maintains a fast growth rate of employment until it nearly reaches its peak. Therefore, once the industry's employment generation starts slowing down, it does so quickly and, after the peak level of employment has been reached, it declines rapidly. It would be too late to start developing alternative manufacturing sources once the wearing apparel industry starts showing signs of a slowdown in employment growth. Second, other industries with higher labour productivity and, hence, wage levels, could become larger than the wearing apparel industry in terms of value added starting at around US$ 7,000 GDP per capita, even though the level of employment in the wearing apparel industry will

continue to be one of the largest up to a fairly high income level. Thus, to attain personal income growth and sustained economic development, countries need to increase the shares of employment in higher productivity industries, even when the level of employment of the wearing apparel industry is still rapidly increasing.

Due to the impending slowdown of the labour intensive industries and the possibility of providing higher value-adding jobs, the middle and late industries need to play an increasingly important role as alternative employment sources from around US$ 7,000 onward. As discussed above, it is estimated that no industry in the middle and late industries will generate as many jobs as the food and beverages, textiles or wearing apparel industries at any income level. Therefore, to maintain the level of manufacturing employment or to slow the rate of its decline, several middle and late industries have to develop simultaneously and start providing alternative and higher paying jobs to replace declining labour intensive industries. From US$ 7,000 to US$ 16,000, the motor vehicle and electrical machinery and apparatus industries may be likely to provide more job opportunities than other middle and late industries and could compensate the reduction in employment of the early industries, which, taken as a whole, would start from around US$ 11,000 (Appendix C). From around US$ 16,000, the level of employment of the motor vehicle and electrical machinery and apparatus industries reduces not due to output decline, but due to the substitution of capital with labour. Of the two industries, the electrical machinery and apparatus industry offers greater opportunities for factor substitution, as seen in the continued rapid growth of value added up to a very high income level, despite the reduction in employment (Appendix B). Two other industries, the fabricated metals and machinery and equipment industries could emerge as major employment sources at a relatively late stage of a country's development. Our results indicate that they would reach their highest levels of employment at around US$ 20,000 GDP per capita after the level of employment of the electrical machinery and apparatus and motor vehicles industries begins to decline, hence contributing to the sustainment of manufacturing employment. Finally, the rubber and plastic industry could be an important source of manufacturing employment at a very high income level, i.e. over US$ 30,000. Although the industry's employment level would probably not reach the levels of employment of the electrical machinery and apparatus, motor vehicles and fabricated metals industries, the significance of the rubber and plastic industry as a source of manufacturing employment is likely to increase due to its relatively high labour intensive production and very slow decline of employment during the high income stage when most of the manufacturing industries' level of employment is rapidly decreasing (Appendix D and B).

5. Conclusion

Based on the fundamental identity discussed in the introduction, the paper first illustrated the relationship between the growth of value added, employment and labour productivity at the sub-sector level in the manufacturing sector using our estimation results. The growth of employment and productivity play different roles in the rise and fall of value added across manufacturing industries and throughout the stages of development within an industry. Although the value added per capita of manufacturing industries usually follows a pattern of rapid increase, slowdown and decline, the unique characteristics of each industry are determined in terms of underlying changes in the growth rates of and relationships between employment and labour productivity.

After setting employment growth within the context of its relationship with value added and labour productivity growth, this study focused on the patterns of employment changes and, based on these patterns, delineated the pro-employment path of manufacturing development of large countries taking the changing structures of industries into consideration.

Our analysis highlights three critical developments that need to take place during manufacturing development in order to create manufacturing jobs, increase the wage level and sustain manufacturing employment or slow its decline. The initial challenge is to develop the wearing apparel industry (including fur and leather products and footwear), which has great potential to increase manufacturing employment at an early stage of a country's development, but is often not part of the "original" industries which have existed since the pre-modern period. Successful development of the wearing apparel industry along with the modernization of the food and beverages, textiles and non-metallic minerals industries would help absorb surplus labour from the agricultural and subsistence sectors and contribute to poverty reduction. The next challenge a country must tackle is the development of multiple middle and late industries to offset the decline of employment in labour intensive industries from around US$ 7,000 GDP per capita onwards. A middle or late industry with the largest employment potential can only employ around half of the workers that either the wearing apparel or food and beverages industries can. Thus, in terms of the number of jobs, the decline in employment of the early industries has to be offset by the concurrent development of several middle and late industries. From the viewpoint of welfare, this shift in manufacturing employment from labour intensive to more capital or skill intensive industries would help increase the country's income level and economic growth due to the rise in domestic demand. Finally, at a very high income level (i.e. above around US$ 25,000 GDP per capita), when most of the manufacturing industries' level of employment declines, a country needs to know which industries are likely to maintain the given level of employment or

slow the pace of employment decline. The production processes inherent in the food and beverages, rubber and plastic, fabricated metals, machinery and equipment, motor vehicle and chemicals industries seem to provide countries with the possibility of retaining employment relatively longer than other industries. To realize this, each of these industries must undergo structural changes to sustain their expansion, which partially compensates for the reduction in labour arising from the increasing substitution of labour with capital.

Appendix A Regression results

Value added per capita

ISIC code[7]	GDPpc	(GDPpc)^2	(GDPpc)^3	Constant	N	R2 (overall)
15	-3.41	0.81	-0.04*	-0.88	835	0.84
16	2.34	0.20	-0.02	-18.66	726	0.59
17	-34.00***	4.46***	-0.19***	83.60***	863	0.69
18	24.02**	-1.83	0.04	-93.83***	760	0.65
20	-11.37	1.70**	-0.08**	22.30	787	0.64
21	-5.53	1.02*	-0.05**	3.77	789	0.91
22	3.56	0.06	-0.01	-23.76	763	0.84
23	-15.32**	2.18**	-0.09***	31.72	574	0.70
24	3.61	0.00	-0.01	-22.75	849	0.88
25	4.83	-0.14	-0.00	-26.94	818	0.86
26	14.79**	-1.18*	0.03	-57.10***	837	0.87
27	-31.54***	4.04***	-0.16***	77.91***	682	0.84
28	-41.19***	5.11***	-0.20***	106.88***	804	0.87
29	-20.40**	2.56**	-0.10**	50.16*	783	0.82
31	8.02	-0.44	0.01	-39.48*	828	0.84
33	-26.12***	3.45***	-0.14***	59.75**	538	0.79
34	-45.21***	5.49***	-0.21***	119.47***	794	0.84
36	21.58**	-2.06*	0.07	-74.02**	661	0.80
* p<0.10						
** p<0.05						
*** p<0.01						

Source: Calculations by the authors

Labour productivity

ISIC code	GDPpc	(GDPpc)^2	(GDPpc)^3	Constant	N	R2 (overall)
15	10.39*	-1.00	0.04	-28.39*	830	0.55
16	-2.91	0.42	-0.01	12.55	720	0.47
17	1.98	0.02	-0.00	-6.79	858	0.54
18	-4.57	0.44	-0.01	22.93	758	0.10
20	-15.19*	2.04**	-0.09**	43.28*	785	0.25
21	13.41**	-1.40*	0.05*	-36.04*	782	0.54
22	32.90***	-3.32***	0.11***	-100.00***	750	0.45
23	-21.20*	2.64*	-0.10*	62.16*	572	0.46
24	22.18***	-2.35***	0.09***	-63.10***	846	0.65
25	7.01	-0.74	0.03	-15.25	815	0.49
26	28.68***	-3.04***	0.11***	-83.03***	832	0.61
27	11.61	-1.20	0.05	-31.68	682	0.58
28	-19.13**	2.62***	-0.11***	50.52**	808	0.48
29	30.02***	-3.21***	0.12***	-86.56***	766	0.37
31	66.89***	-7.54***	0.29***	-191.46***	813	0.52
33	23.41*	-2.37*	0.08	-68.82*	541	0.25
34	-4.99	0.68	-0.02	16.87	794	0.41
36	-3.58	0.32	-0.01	21.19	653	0.03
* p<0.10						
** p<0.05						
*** p<0.01						

Source: Calculations by the authors

[7]ISIC descriptions are as follows: 15 – Food and beverages, 16 –Tobacco, 17 – Textiles, 18 – Wearing apparel, and fur & leather products, and footwear, 20 – Wood products, 21 – Paper. 22 - Printing and publishing, 23 - Coke and refined petroleum, 24 – Chemicals, 25 - Rubber and plastic, 26 - Non-metallic minerals, 27 - Basic metals, 28 - Fabricated metals, 29 - Machinery and equipment n.e.c. & office, accounting, computing machinery, 31 - Electrical machinery and apparatus & radio, television, and communication equipment, 33 - Precision instruments, 34 - Motor vehicles, trailers, semi-trailers & other transport equipment, 36 - Furniture, n.e.c.

Employment-population ratio

ISIC code	GDPpc	(GDPpc)^2	(GDPpc)^3	Constant	N	R2 (overall)
15	-7.77***	1.13***	-0.05***	10.02	1456	0.21
16	-4.49	0.82*	-0.05**	-1.20	1426	0.28
17	-23.50***	3.08***	-0.13***	53.21***	1508	0.28
18	-52.46***	6.88***	-0.29***	120.97***	1506	0.46
20	7.09	-0.57	0.01	-34.01**	1491	0.06
21	-23.99***	3.07***	-0.13***	52.63***	1486	0.22
22	-19.54***	2.34***	-0.09***	45.69***	1473	0.09
23	-22.68***	2.86***	-0.12***	50.14***	1354	0.09
24	-9.11***	1.31***	-0.06***	12.46	1488	0.21
25	-2.96	0.64*	-0.03**	-8.21	1496	0.37
26	-11.21***	1.58***	-0.07***	17.96*	1501	0.18
27	-20.92***	2.87***	-0.13***	41.18***	1464	0.19
28	-18.81***	2.34***	-0.09***	41.54***	1489	0.15
29	-51.88***	6.15***	-0.24***	135.77***	1436	0.19
31	-58.98***	7.17***	-0.28***	150.73***	1450	0.31
33	-42.05***	5.13***	-0.20***	101.41***	1382	0.25
34	-42.92***	5.23***	-0.21***	107.66***	1474	0.21
36	-33.39***	4.17***	-0.17***	78.32***	1491	0.24
* p<0.10						
** p<0.05						
*** p<0.01						

Source: Calculations by the authors

Appendix B-1 Changes in the growth rate of value added per capita, employment-population ratio and labour productivity (from US$ 1,000 to US$ 20,000 GDP per capita)

ISIC code	Variable	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	20,000
15	VAPC	++	++	++	++	++	+	+	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
15	EP	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	0.5056	–	–	–	–	–	–	–	–
15	LP	++	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
16	VAPC	++	++	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	15.70	–	–	–
16	EP	Δ	0.034	–	–	–	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
16	LP	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	++
17	VAPC	+	++	++	++	++	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	66.39	–	–	–
17	EP	Δ	Δ	Δ	Δ	0.368	–	–	–	–	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
17	LP	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
18	VAPC	+++	+++	+++	++	++	+	+	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	42.50	–	–	–	–	–	–
18	EP	+	++	++	++	++	+	+	ΔΔ	ΔΔ	Δ	Δ	0.5063	–	–	– –	– –	– –	– – –	– – –	– – –
18	LP	–	Δ	Δ	Δ	Δ	Δ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
20	VAPC	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	10.36	–	–	–
20	EP	+	ΔΔ	Δ	Δ	Δ	0.077	–	–	–	–	–	–	–	–	–	–	–	–	–	–
20	LP	ΔΔ	ΔΔ	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
21	VAPC	++	++	++	++	++	++	++	++	++	+	+	+	+	+	+	+	+	+	+	+
21	EP	Δ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	0.0813	–	–	–	–	–	–	– –	– –
21	LP	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
22	VAPC	+++	+++	++	++	++	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
22	EP	–	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	0.0996	–
22	LP	+++	+++	++	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
23	VAPC	++	++	++	++	++	++	+	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
23	EP	–	Δ	Δ	Δ	Δ	Δ	Δ	Δ	0.021	–	–	–	–	–	–	– –	– –	– –	– –	– –
23	LP	ΔΔ	+	++	++	++	++	++	++	++	++	++	++	++	++	+	+	+	+	+	+
24	VAPC	+++	+++	+++	++	++	++	++	++	++	++	++	++	+	+	+	+	+	+	+	+
24	EP	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	0.1843	–	–	–	–	–	–	–	–	–
24	LP	+++	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++
25	VAPC	+++	+++	+++	++	++	++	++	++	++	++	+	+	+	+	+	+	+	+	+	+
25	EP	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
25	LP	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	+	+	+	+	+	+	+	+	+	+	+	+	+
26	VAPC	+++	+++	++	++	++	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
26	EP	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	0.177	–	–	–	–	–	–	–	–	– –	– –	– –
26	LP	+++	++	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	+	+	+	+	+	+	+
27	VAPC	+	++	+++	+++	+++	+++	+++	++	++	++	++	++	++	+	+	+	+	+	+	ΔΔ
27	EP	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	0.141	–	–	–	–	–	– –	– –	– –	– –	– –	– – –	– – –
27	LP	++	++	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	++
28	VAPC	Δ	++	++	+++	+++	+++	++	++	++	++	++	++	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ
28	EP	Δ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	0.2164	–
28	LP	+	++	++	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ
29	VAPC	+	++	++	+++	+++	+++	+++	+++	+++	+++	+++	++	++	++	++	++	++	++	++	++
29	EP	–	Δ	ΔΔ	ΔΔ	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	0.2154	–	–
29	LP	+++	++	+	+	+	+	c	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	+	+	+	+	+	+	+	+
31	VAPC	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	++	++	++	++	++	++
31	EP	–	ΔΔ	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	0.2584	–	–	–	–	– –
31	LP	+++	+++	++	+	+	+	+	+	+	+	+	+	++	++	++	++	++	+++	+++	+++
33	VAPC	+	++	+++	+++	+++	++	++	++	++	++	++	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ
33	EP	–	+	+	+	+	+	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ
33	LP	+++	++	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
34	VAPC	Δ	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	++	++	++	++	++	++	+
34	EP	–	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	0.2449	–	–	–	–	–
34	LP	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
36	VAPC	+++	++	++	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
36	EP	Δ	ΔΔ	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	0.1648	–	–	–
36	LP	–	–	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ

Note: Blue indicates that growth elasticity is greater than 1, and +, ++ and +++ correspond to elasticity (e), $1 \leq e < 1.5$, $1.5 \leq e < 2$, and greater than 2, respectively. Yellow means that the elasticity is between 0 and 1, and Δ and ΔΔ signifies that the elasticities lie within the range of $0 \leq e < 0.5$ and $0.5 \leq e < 1$, respectively. Red indicates the range in which the elasticity is negative (negative growth). –, – –, and – – – denote that the elasticities are $0 > e \geq -0.5$, $-0.5 > e \geq -1$, and less than -1, respectively. The numbers in the table show the highest actual level (not growth rate) of the corresponding variables that industries are estimated to reach during the course of a large country's development from US$ 1,000 to US$ 40,000 GDP per capita.

Source: Created by the authors.

Appendix B-2: Changes in the growth rate of value added per capita, employment-population ratio and labour productivity (from US$ 21,000 to US$ 40,000 GDP per capita)

ISIC code	Variable	21,000	22,000	23,000	24,000	25,000	26,000	27,000	28,000	29,000	30,000	31,000	32,000	33,000	34,000	35,000	36,000	37,000	38,000	39,000	40,000
15	VAPC	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	318.45
15	EP	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	
15	LP	ΔΔ	ΔΔ	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
16	VAPC	–	–	–	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
16	EP	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
16	LP	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
17	VAPC	–	–	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
17	EP	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
17	LP	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
18	VAPC	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
18	EP	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
18	LP	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
20	VAPC	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– – –	– – –
20	EP	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
20	LP	–	–	–	–	–	–	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –
21	VAPC	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	100.32
21	EP	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
21	LP	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++
22	VAPC	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	51.66
22	EP	–	–	–	–	–	–	–	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –
22	LP	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
23	VAPC	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	53.67	–	–	–	–	–	–	–	–
23	EP	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
23	LP	+	+	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
24	VAPC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	502.98
24	EP	–	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –
24	LP	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	+++	+++	+++	+++	+++
25	VAPC	+	+	+	+	+	+	+	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	174.52
25	EP	Δ	Δ	0.1807	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25	LP	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
26	VAPC	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	113.84
26	EP	– –	– –	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
26	LP	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++
27	VAPC	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	190.73	–	–	–	–	–	–
27	EP	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
27	LP	++	++	++	++	++	++	++	++	++	++	++	++	++	++	+++	+++	+++	+++	+++	+++
28	VAPC	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	105.18	–	–	–	–	–	–	–	– –	– –	– –	– –
28	EP	–	–	–	–	–	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– –
28	LP	Δ	Δ	–	–	–	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– –
29	VAPC	++	++	++	++	++	++	++	+	+	+	+	+	+	+	+	+	+	+	+	344.43
29	EP	–	–	–	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
29	LP	+	+	+	+	+	+	+	+	+	++	++	++	++	++	++	++	++	++	++	++
31	VAPC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	746.23
31	EP	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
31	LP	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
33	VAPC	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	20.11	–	–	–	–	–	–	–	–
33	EP	Δ	Δ	Δ	0.0559	–	–	–	–	–	–	– –	– –	– –	– –	– –	– –	– –	– –	– – –	– – –
33	LP	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ
34	VAPC	+	+	+	+	+	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	Δ	Δ	Δ	Δ	Δ	Δ	350.77
34	EP	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
34	LP	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
36	VAPC	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	42.20
36	EP	–	–	–	– –	– –	– –	– –	– –	– –	– –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –	– – –
36	LP	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ	ΔΔ

Note: Blue indicates that growth elasticity is greater than 1, and +, ++, and +++ correspond to elasticity (e), $1 \leq e < 1.5$, $1.5 \leq e < 2$, and are greater than 2, respectively. Yellow means that the elasticity is between 0 and 1, and Δ and ΔΔ signifies that the elasticities lie within the range of $0 \leq e < 0.5$ and $0.5 \leq e < 1$, respectively. Red indicatesthe range in which the elasticity is negative (negative growth). –, – –, and – – – denote that the elasticities are $0 > e \geq -0.5$, $-0.5 > e \geq -1$, and less than -1, respectively. The numbers in the table show the highest actual level (not growth rate) of the corresponding variables that industries are estimated to reach during thecourse of a large country's development from US$ 1,000 to US$ 40,000 GDP per capita.

Source: Created by the authors.

Appendix C:

Changes in the level of employment (EP ratio) US$ 1,000 to US$ 20,000 GDP per capita

ISIC code	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000	19000	20000
15	0.158	0.241	0.308	0.360	0.401	0.432	0.456	0.474	0.487	0.496	0.502	0.505	0.506	0.505	0.502	0.498	0.493	0.487	0.481	0.474
16	0.029	0.034	0.034	0.032	0.030	0.027	0.025	0.023	0.021	0.019	0.017	0.016	0.014	0.013	0.012	0.011	0.010	0.009	0.008	0.008
17	0.261	0.298	0.336	0.358	0.368	0.367	0.359	0.347	0.331	0.313	0.295	0.276	0.258	0.240	0.223	0.207	0.192	0.177	0.164	0.151
18	0.015	0.042	0.091	0.155	0.227	0.298	0.362	0.416	0.457	0.485	0.501	0.506	0.503	0.491	0.474	0.453	0.429	0.403	0.377	0.350
20	0.031	0.055	0.067	0.073	0.076	0.077	0.077	0.077	0.076	0.074	0.073	0.071	0.069	0.068	0.066	0.064	0.063	0.061	0.060	0.058
21	0.022	0.031	0.041	0.050	0.058	0.065	0.070	0.075	0.078	0.080	0.081	0.081	0.081	0.081	0.080	0.078	0.077	0.075	0.073	0.071
22	0.046	0.046	0.052	0.059	0.065	0.071	0.076	0.081	0.085	0.088	0.091	0.093	0.095	0.097	0.098	0.099	0.099	0.100	0.100	0.100
23	0.013	0.014	0.016	0.018	0.019	0.020	0.021	0.021	0.021	0.021	0.021	0.021	0.020	0.020	0.019	0.019	0.018	0.017	0.017	0.016
24	0.061	0.093	0.118	0.138	0.153	0.164	0.172	0.178	0.181	0.183	0.184	0.184	0.183	0.182	0.180	0.177	0.174	0.171	0.168	0.164
25	0.015	0.035	0.054	0.072	0.088	0.102	0.114	0.125	0.134	0.142	0.149	0.155	0.160	0.165	0.168	0.172	0.174	0.176	0.178	0.179
26	0.064	0.095	0.121	0.140	0.154	0.164	0.170	0.174	0.176	0.177	0.176	0.174	0.172	0.168	0.165	0.161	0.157	0.153	0.148	0.144
27	0.034	0.060	0.084	0.104	0.119	0.129	0.136	0.140	0.141	0.140	0.137	0.134	0.129	0.124	0.119	0.113	0.108	0.102	0.097	0.091
28	0.053	0.068	0.087	0.105	0.122	0.138	0.152	0.164	0.174	0.184	0.191	0.198	0.203	0.207	0.211	0.213	0.215	0.216	0.216	0.216
29	0.049	0.040	0.051	0.066	0.083	0.101	0.118	0.135	0.150	0.164	0.177	0.187	0.196	0.203	0.208	0.212	0.214	0.215	0.215	0.214
31	0.029	0.033	0.050	0.072	0.097	0.124	0.149	0.173	0.195	0.213	0.229	0.240	0.249	0.255	0.258	0.258	0.257	0.253	0.248	0.242
33	0.002	0.003	0.005	0.008	0.011	0.015	0.019	0.023	0.027	0.030	0.034	0.037	0.041	0.043	0.046	0.048	0.050	0.052	0.053	0.054
34	0.048	0.054	0.074	0.097	0.121	0.144	0.165	0.184	0.201	0.214	0.225	0.234	0.239	0.243	0.245	0.245	0.244	0.241	0.237	0.232
36	0.018	0.027	0.040	0.055	0.071	0.086	0.100	0.113	0.125	0.135	0.143	0.150	0.155	0.159	0.162	0.164	0.165	0.165	0.164	0.162
early	0.633	0.851	1.064	1.250	1.410	1.543	1.648	1.726	1.778	1.808	1.818	1.812	1.792	1.761	1.721	1.675	1.625	1.572	1.518	1.463
middle	0.112	0.162	0.217	0.267	0.311	0.347	0.377	0.401	0.419	0.433	0.443	0.450	0.454	0.455	0.455	0.453	0.449	0.445	0.439	0.433
late	0.203	0.255	0.347	0.445	0.542	0.634	0.719	0.795	0.861	0.917	0.964	1.000	1.028	1.047	1.059	1.064	1.063	1.056	1.046	1.032

Changes in the level of employment (EP ratio) from US$ 21,000 to US$ 40,000 GDP per capita

ISIC code	21000	22000	23000	24000	25000	26000	27000	28000	29000	30000	31000	32000	33000	34000	35000	36000	37000	38000	39000	40000
15	0.467	0.459	0.451	0.443	0.435	0.427	0.418	0.410	0.401	0.393	0.385	0.377	0.369	0.361	0.353	0.345	0.338	0.330	0.323	0.316
16	0.007	0.007	0.006	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002
17	0.140	0.129	0.119	0.110	0.102	0.094	0.087	0.080	0.074	0.068	0.063	0.059	0.054	0.050	0.046	0.043	0.040	0.037	0.034	0.032
18	0.323	0.297	0.273	0.249	0.227	0.206	0.187	0.170	0.153	0.138	0.125	0.112	0.101	0.091	0.082	0.074	0.066	0.059	0.053	0.048
20	0.057	0.056	0.054	0.053	0.052	0.051	0.049	0.048	0.047	0.046	0.045	0.044	0.044	0.043	0.042	0.041	0.040	0.039	0.039	0.038
21	0.069	0.067	0.064	0.062	0.060	0.058	0.055	0.053	0.051	0.049	0.047	0.045	0.043	0.041	0.040	0.038	0.036	0.035	0.033	0.032
22	0.099	0.099	0.098	0.098	0.097	0.096	0.095	0.094	0.093	0.092	0.091	0.089	0.088	0.087	0.086	0.084	0.083	0.082	0.080	0.079
23	0.015	0.015	0.014	0.014	0.013	0.012	0.012	0.011	0.011	0.010	0.010	0.009	0.009	0.009	0.008	0.008	0.007	0.007	0.007	0.006
24	0.161	0.157	0.153	0.150	0.146	0.142	0.139	0.135	0.131	0.128	0.125	0.121	0.118	0.115	0.112	0.109	0.106	0.103	0.100	0.097
25	0.180	0.180	0.181	0.181	0.181	0.180	0.180	0.179	0.178	0.177	0.176	0.175	0.174	0.173	0.171	0.170	0.168	0.167	0.165	0.164
26	0.139	0.135	0.131	0.126	0.122	0.118	0.114	0.110	0.106	0.103	0.099	0.096	0.092	0.089	0.086	0.083	0.080	0.077	0.074	0.072
27	0.086	0.081	0.076	0.072	0.067	0.063	0.060	0.056	0.052	0.049	0.046	0.043	0.041	0.038	0.036	0.033	0.031	0.029	0.028	0.026
28	0.216	0.215	0.214	0.212	0.210	0.208	0.206	0.203	0.200	0.198	0.195	0.192	0.189	0.185	0.182	0.179	0.176	0.173	0.169	0.166
29	0.212	0.210	0.206	0.202	0.198	0.193	0.188	0.182	0.177	0.171	0.165	0.159	0.153	0.148	0.142	0.136	0.131	0.125	0.120	0.115
31	0.235	0.227	0.218	0.209	0.200	0.190	0.181	0.171	0.162	0.153	0.145	0.136	0.128	0.120	0.113	0.106	0.099	0.092	0.086	0.081
33	0.055	0.055	0.056	0.056	0.056	0.056	0.055	0.055	0.054	0.053	0.053	0.052	0.051	0.050	0.049	0.047	0.046	0.045	0.044	0.043
34	0.227	0.221	0.214	0.207	0.200	0.193	0.186	0.179	0.171	0.164	0.157	0.150	0.143	0.137	0.130	0.124	0.118	0.112	0.107	0.102
36	0.160	0.158	0.155	0.152	0.148	0.144	0.140	0.136	0.132	0.128	0.124	0.120	0.116	0.112	0.108	0.104	0.100	0.096	0.092	0.089
early	1.408	1.354	1.301	1.250	1.200	1.153	1.107	1.064	1.022	0.983	0.945	0.909	0.875	0.843	0.813	0.784	0.756	0.730	0.705	0.681
middle	0.425	0.418	0.410	0.402	0.393	0.384	0.376	0.367	0.358	0.349	0.340	0.331	0.323	0.314	0.306	0.298	0.290	0.282	0.274	0.266
late	1.014	0.994	0.972	0.949	0.924	0.899	0.873	0.846	0.820	0.793	0.767	0.742	0.716	0.692	0.668	0.644	0.622	0.599	0.578	0.558

Note: EP ratio here is calculated by level of employment divided by population times 100. The numbers in the boxes are the highest employment levels that industries are estimated to reach during the course of a large country's development from US$ 1,000 to US$ 40,000 GDP per capita.
Source: Created by the authors.

Appendix D:

Changes in labour intensity (employment per value added) from US$ 1,000 to US$ 20,000 GDP per capita

sector	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000	18000	19000	20000
15	0.0672	0.0267	0.0162	0.0115	0.0089	0.0073	0.0061	0.0053	0.0047	0.0042	0.0038	0.0034	0.0032	0.0029	0.0027	0.0025	0.0024	0.0023	0.0021	0.0020
16	0.0381	0.0130	0.0072	0.0048	0.0035	0.0027	0.0022	0.0018	0.0016	0.0013	0.0012	0.0010	0.0009	0.0008	0.0008	0.0007	0.0006	0.0006	0.0005	0.0005
17	0.1682	0.0725	0.0407	0.0263	0.0186	0.0140	0.0110	0.0089	0.0074	0.0063	0.0055	0.0048	0.0043	0.0038	0.0035	0.0032	0.0029	0.0027	0.0025	0.0023
18	0.0979	0.0198	0.0137	0.0124	0.0122	0.0124	0.0125	0.0126	0.0127	0.0126	0.0125	0.0122	0.0119	0.0116	0.0112	0.0107	0.0102	0.0098	0.0093	0.0088
20	0.0408	0.0303	0.0226	0.0178	0.0147	0.0126	0.0111	0.0099	0.0090	0.0084	0.0078	0.0074	0.0070	0.0067	0.0064	0.0062	0.0061	0.0059	0.0058	0.0057
21	0.0592	0.0213	0.0129	0.0093	0.0072	0.0059	0.0049	0.0042	0.0037	0.0032	0.0028	0.0025	0.0023	0.0021	0.0019	0.0017	0.0015	0.0014	0.0013	0.0012
22	0.1206	0.0262	0.0136	0.0093	0.0073	0.0061	0.0053	0.0047	0.0043	0.0040	0.0037	0.0035	0.0033	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026	0.0025
23	0.0231	0.0080	0.0045	0.0030	0.0023	0.0018	0.0014	0.0012	0.0010	0.0009	0.0008	0.0007	0.0006	0.0006	0.0005	0.0005	0.0004	0.0004	0.0004	0.0003
24	0.0842	0.0247	0.0130	0.0084	0.0061	0.0046	0.0037	0.0030	0.0025	0.0022	0.0019	0.0016	0.0014	0.0013	0.0011	0.0010	0.0009	0.0008	0.0008	0.0007
25	0.0499	0.0222	0.0145	0.0109	0.0087	0.0073	0.0063	0.0055	0.0049	0.0044	0.0040	0.0037	0.0034	0.0031	0.0029	0.0027	0.0026	0.0024	0.0023	0.0021
26	0.1381	0.0327	0.0173	0.0118	0.0090	0.0073	0.0062	0.0053	0.0047	0.0042	0.0037	0.0034	0.0031	0.0029	0.0026	0.0024	0.0023	0.0021	0.0020	0.0018
27	0.0521	0.0306	0.0190	0.0127	0.0090	0.0066	0.0051	0.0040	0.0032	0.0026	0.0022	0.0018	0.0016	0.0013	0.0012	0.0010	0.0009	0.0008	0.0007	0.0006
28	0.0685	0.0399	0.0249	0.0171	0.0127	0.0099	0.0080	0.0067	0.0057	0.0050	0.0045	0.0040	0.0037	0.0034	0.0032	0.0030	0.0028	0.0027	0.0025	0.0024
29	0.0969	0.0304	0.0186	0.0136	0.0108	0.0090	0.0076	0.0066	0.0057	0.0050	0.0045	0.0040	0.0035	0.0032	0.0028	0.0026	0.0023	0.0021	0.0019	0.0017
31	0.2455	0.0338	0.0166	0.0114	0.0088	0.0072	0.0061	0.0052	0.0045	0.0039	0.0034	0.0030	0.0026	0.0023	0.0020	0.0018	0.0016	0.0014	0.0012	0.0011
33	0.0235	0.0105	0.0077	0.0065	0.0057	0.0053	0.0050	0.0047	0.0045	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036	0.0035	0.0034	0.0033	0.0033
34	0.0698	0.0361	0.0226	0.0156	0.0115	0.0088	0.0070	0.0057	0.0047	0.0040	0.0034	0.0029	0.0025	0.0022	0.0020	0.0018	0.0016	0.0014	0.0013	0.0012
36	0.0483	0.0140	0.0102	0.0092	0.0089	0.0088	0.0087	0.0087	0.0086	0.0085	0.0083	0.0081	0.0079	0.0077	0.0075	0.0072	0.0069	0.0067	0.0064	0.0061

Changes in labour intensity (employment per value added) from US$ 21,000 to US$ 40,000 GDP per capita

sector	21000	22000	23000	24000	25000	26000	27000	28000	29000	30000	31000	32000	33000	34000	35000	36000	37000	38000	39000	40000
15	0.0019	0.0018	0.0017	0.0017	0.0016	0.0015	0.0015	0.0014	0.0014	0.0013	0.0013	0.0012	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010
16	0.0005	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
17	0.0022	0.0020	0.0019	0.0018	0.0017	0.0016	0.0016	0.0015	0.0014	0.0014	0.0013	0.0013	0.0012	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
18	0.0083	0.0078	0.0073	0.0069	0.0064	0.0060	0.0056	0.0053	0.0049	0.0046	0.0042	0.0039	0.0037	0.0034	0.0031	0.0029	0.0027	0.0025	0.0023	0.0021
20	0.0056	0.0055	0.0054	0.0054	0.0054	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0054	0.0054	0.0054	0.0055	0.0055
21	0.0011	0.0010	0.0009	0.0009	0.0008	0.0008	0.0007	0.0007	0.0006	0.0006	0.0005	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003
22	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0020	0.0019	0.0019	0.0018	0.0018	0.0018	0.0017	0.0017	0.0017	0.0016	0.0016	0.0016	0.0015
23	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
24	0.0007	0.0006	0.0006	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002
25	0.0020	0.0019	0.0018	0.0017	0.0017	0.0016	0.0015	0.0015	0.0014	0.0013	0.0013	0.0012	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	0.0010	0.0009
26	0.0017	0.0016	0.0015	0.0014	0.0014	0.0013	0.0012	0.0011	0.0011	0.0010	0.0010	0.0009	0.0009	0.0008	0.0008	0.0008	0.0007	0.0007	0.0007	0.0006
27	0.0006	0.0005	0.0005	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001
28	0.0023	0.0022	0.0022	0.0021	0.0021	0.0020	0.0020	0.0019	0.0019	0.0019	0.0019	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0017
29	0.0016	0.0014	0.0013	0.0012	0.0011	0.0010	0.0009	0.0009	0.0008	0.0007	0.0007	0.0006	0.0006	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0003
31	0.0010	0.0009	0.0008	0.0007	0.0006	0.0005	0.0005	0.0004	0.0004	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
33	0.0032	0.0031	0.0031	0.0030	0.0029	0.0029	0.0028	0.0028	0.0027	0.0027	0.0026	0.0026	0.0025	0.0025	0.0024	0.0024	0.0023	0.0023	0.0023	0.0022
34	0.0011	0.0010	0.0009	0.0008	0.0008	0.0007	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003
36	0.0058	0.0056	0.0053	0.0051	0.0048	0.0046	0.0043	0.0041	0.0039	0.0037	0.0035	0.0033	0.0031	0.0030	0.0028	0.0026	0.0025	0.0024	0.0022	0.0021

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