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Do Global Value Chains Enhance Economic Upgrading? A Long View.

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A Long View.

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Abstract

Exporting through global value chains (GVC) has recently been highlighted as a panacea for weak industrialisation trends in the South. We study the long-run effects of GVC participation for a large set of countries between 1970 and 2008. We find strong evidence for the positive effects on productivity growth in the formal manufacturing sector. This effect is stronger when the gap with the global productivity frontier is larger. However, we find no evidence for an effect on employment generation. If anything, GVC participation might be negatively correlated with job creation. The mixed blessing of GVC participation is in line with the hypothesis put forward by Baldwin (2014) and Rodrik (2018).

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I. Introduction

Economic development relies on productivity growth driven by a reallocation of labour from less to more productive activities. Traditionally, a key role is attributed to the manufacturing sector, which is argued to provide abundant opportunities for capital intensification, scale and technological change. Many studies have shown that poor countries that caught up do so by starting a long process of industrialisation. Conversely, countries lagging in manufacturing growth, or even suffering from deindustrialisation, have not been able to increase incomes over a sustained period (de Vries et al. 2015; Haraguchi et al., 2017; McMillan et al, 2014; Rodrik, 2016; Szirmai and Verspagen, 2015).

Exporting through global value chain (GVC) participation has recently been highlighted as a possible panacea for weak industrialisation trends (e.g. Taglioni and Winkler, 2016; World Bank, 2017). Due to improved information and communication technologies, poor countries can nowadays access global markets by carrying out only particular stages in the production process (Baldwin, 2014, 2016). Industrialisation through exporting is thus seen as more 'easy' than ever, requiring few capabilities of firms and depending more on a country's macro-economic stability and easy physical access to global markets. It is argued that participating in GVCs can stimulate productivity growth through a myriad of channels. These include benefits from specialisation in core tasks, access to imported inputs, knowledge spillovers from multinationals and pro-competitive effects of global competition (Criscuolo and Timmis, 2017). A large literature has investigated FDI spillovers and arrives at a broad consensus in favour of positive productivity spillovers to industries that supply multinationals through backward linkages (Javorcik, 2004), with little evidence for other channels though (Iršova, and Havránek, 2013). Collier and Venables (2007) further argue that trade agreements that allow for specialization in GVCs increase export competitiveness. They find that less developed countries especially benefitted from preferential trade preferences with soft rules of origin, allowing for more fine-grained GVC specialization. More generally, Rodrik (2013) finds in a cross-country regression that lagging countries catch up with the world productivity leader in manufacturing, *independent* of country characteristics.

Yet economic development requires that unconditional productivity convergence goes hand in hand with sustained employment growth in the modern sector of the economy. From this perspective, fast productivity growth in manufacturing might be a mixed blessing. Rodrik (2013) advances the hypothesis that firms that participate in GVCs might be successful at absorbing advanced technologies but less so in employing labour. Similarly, Baldwin (2014) suggests that GVCs might facilitate entry into global manufacturing goods markets initially boosting productivity and employment, but at the same time making industrialisation less meaningful as capability building is not guaranteed and long-run development might be stunted. Rodrik (2018) further argues that the technologies associated with GVC production provide diminishing possibilities of substitution of unskilled labour for other factors of production. Producing for global markets demands increasing levels of precision and adherence to quality standards, which requires more automation and less manual work. This makes it harder for developing countries to put their abundant unskilled labour to use. Furthermore, he stresses that skill-biased technologies, such as robotisation, reduce relative demand for unskilled labour and might ultimately reverse patterns of comparative advantage in manufacturing, leading to reshoring of off-shored stages to advanced countries in the longer run. As a result, GVC participation of developing countries might benefit a small group of highly productive firms that provide limited opportunities for employment (see also Rodrik, 2014). We will refer to this as the 'mixed-blessing hypothesis' on GVC participation.

There is evidence that supports this hypothesis. Sen (2017) finds that overall trade integration had a positive impact on manufacturing employment in developing countries via the expansion of the scale of production, but a negative impact via the productivity effect as less labour is needed per unit of output. Hungary, Portugal, Slovenia and South Africa, for example, even experienced an overall decline in employment, because the productivity effect fully offset the positive scale effect. Moreover, positive employment effects appear to peter out once domestic wages for unskilled workers start to rise, as follows from surplus-labour models in the vein of Arthur Lewis (Lewis, 1954; Sen, 2017). Sen (2017) provided a broad analysis focusing on overall manufacturing production. Other cross-country studies have zoomed in on trade specifically related to GVCs. Kummritz (2016) and Constantinescu et al. (2017) document positive labour productivity effects in mainly developed countries using yearly variation between 1995 and 2007. Lopez-Gonzalez (2016) uses aggregate data for total manufacturing and broad sectors to study value added and employment effects in short periods of one to five years since 1995. Using data on 54, mostly middle- and high-income, countries from the OECD TiVA database, he finds positive effects from importing intermediates on both dimensions, in particular in services. More qualitative studies on GVCs are in general critical about the opportunities for upgrading through GVC participation in the long run (Gereffi, 1994; Kaplinsky, 2000; Barrientos et al., 2016). They highlight governance structures with asymmetric power relationships between lead firms in advanced countries and suppliers from developing regions, such that firms are often locked in low value activities (Humphrey and Schmitz, 2002). Escaping from such captive governance structures may only be possible under the right domestic conditions, such as well-functioning domestic innovation systems offering ample opportunity to absorb and assimilate new technologies (Pietrobelli and Rabellotti, 2011). Such demanding preconditions for success were present in South Korea and Taiwan in the past, but may not be in place in the average developing country today. The aim of this paper is to put the mixed-blessing hypothesis of GVC participation to the test. To this end we will use a new set of data on GVC participation, and investigate its impact on employment and productivity growth for a wide set of countries, including low-income, and over a long period, from 1970 onwards.

How to measure GVC participation? The hallmark of GVC participation is specialisation in particular tasks such that the exporting country may only add part of the value of the exported good. In an already classic case study, Dedrick et al. (2010) found that the Chinese contribution to its gross exports of electronics, such as Apple's iPod, was only minor. It mainly performed assembly, testing and packaging activities on imported high-tech components while relying on software, supply chain orchestration and branding from foreign companies. Koopman et al. (2012) found that in 2002, the domestic value added in Chinese exports of computer electronics was only 19.3 percent. More generally, the share of domestic value added in exports has declined almost everywhere. For a set of more than 80 countries, Pahl and Timmer (2018) found that the average share of domestic value added in gross exports of manufactured goods decreased by about 14 percentage points since 1970 reaching 63 percent in 2008.[1] Using gross export statistics can thus be highly misleading and new initiatives have been started to measure trade in value added (see e.g. OECD Tiva project at oe.cd/tiva.). We will therefore study new measures of value added and employment related to exports that are commensurate with GVC production. In particular, we will

[1] See also Hummels et al. (2001); Johnson and Noguera (2017), for more evidence on international production fragmentation.

measure *all* manufacturing value added and employment (number of workers) in a country that is related to exports. Traditional studies focus only on the industry or firms that actually export. Yet with production fragmentation other domestic firms might indirectly contribute by delivering inputs to the exporting firms. One might even argue that the establishing of backward linkages into the domestic sectors is a hallmark of success in benefitting from trade. This idea is far from new, going back at least to Hirschmann (1958) (see also Chenery et al., 1986), but until now it has not been measured for a large set of countries over a long period. We will study the period from 1970 to 2008 and analyse trends in up to 58 countries, drawing on disaggregated data from UNIDO's Indstat2 (2016) and complemented by additional sources. Combined with national input-output tables from Pahl and Timmer (2018), we can trace all manufacturing value added and employment related to exports of manufacturing goods.

Through simple means testing, we document that countries with high GVC participation have on average higher growth rates of labour productivity, but not of employment. In further econometric analyses, we find robust evidence for a strong association of GVC participation and labour productivity growth. This result is robust to different specifications, and also holds for a subset of developing countries only. Moreover, this effect even becomes larger the further a country is from the productivity frontier. This is found in 10-year periods, and we obtain a qualitatively similar result in 5-year periods. We conclude that GVC participation has a strong positive productivity effect, especially for countries that are further away from the productivity frontier. In contrast, we do not find evidence for positive effects on employment growth. If anything, we find a negative association between GVC participation and employment growth if we control for unobserved heterogeneity at the country level. Hence, the results suggest that on average higher GVC participation not necessarily leads to higher employment generation in manufacturing, confirming the mixed-blessing hypothesis.

We would like to stress a number of caveats at this point. First, we focus on the *formal* manufacturing sector and do not study informal employment. GVC participation might lead to employment generation outside the formal sector, for example through outsourcing by formal manufacturing firms to households and small firms with irregular and informal workers. This might not be desirable as working conditions and pay are usually (much) worse than in regular jobs. One might even argue that the success of the formal sector in exporting depends on the exploitation of informal workers (Gereffi, 2014). Given lack of reliable data on irregular employment, we have no way of testing this. Instead, we focus on formal firms as it is formal job creation that is ultimately needed for modern industrialization. Another caveat is that we interpret labour productivity growth as a useful indicator of economic upgrading. One might argue that (real) wage development is more relevant, as used by Bernhardt and Milberg (2013) and Bernhardt and Pollak (2016). Correlation between the two is positive in the medium to long-run, but not necessarily in the short-run, in particular in countries with labour markets characterised by surplus labour in the vein of Lewis (1954). More generally, we like to emphasize that our cross-country study should be seen as a complement to case studies that do more justice to the large heterogeneity across sectors and countries, and the important idiosyncrasies in countries' institutional settings.

The rest of the paper is organized as follows. In section II, we discuss the methodology and section III describes the data sources and construction, which is extended in the appendix. We discuss the results in section IV and section V concludes.

II. Methodology

II.1. The Concept of Value Added and Employment in Exports

With the emergence of GVCs, the productivity and employment effects of exporting become less visible. As is well known by now, the value of gross exports is not a valid indicator of output anymore. When production relies on imported intermediates (e.g., assembly in export-processing zones), the proper measure is domestic value added in exports (Chenery et al., 1986; Hummels et al., 2001; Koopman et al., 2012). We illustrate this in figure 1.

<<Figure 1 here>>

Domestic value added in exports (and employment in exports) is a composite of domestic activities by several firms in multiple industries. Directly exporting firms in industry A generate value added by producing goods exported to foreign consumers and producers. The exported value however is also composed of value added that is generated by other domestic firms. This includes indirect contributions of firms within the exporting industry, but also contributions from firms in other industries within formal manufacturing (represented by industry B), from informal manufacturing and from non-manufacturing sectors. Those indirect contributions can be sizeable and depend on the strength of backward linkages to domestic firms. In our data, the share of these indirect manufacturing contributions reaches more than 39 percent in the upper decile of our sample.[2] This variation matters cross-sectionally and inter-temporally. In South Korea, for example, the share of indirect formal manufacturing employment contributions to products exported by 'automotives' varies between 35 and 54 percent between 1970 and 2008.

To measure domestic employment and value added in exports we are using the value chains as units of analysis as opposed to generic industries. We define domestic value chains by the exporting industry (industry A in figure 1). The domestic value chain includes all domestic direct and indirect contributions to these exports, but excludes the foreign content (imported intermediates). We consider the formal manufacturing part of the chain, that is, contributions of 14 manufacturing industries for which we have data.[3]

The next section shows the calculation of manufacturing employment and value added in exports. By dividing manufacturing value added in exports by employment in exports, we obtain manufacturing labour productivity in exports.

II.2. The Measurement of Value Added and Employment in Exports

The implementation is based on using information from input-output tables. We follow Koopman et al. (2012) and Los et al. (2016) and define domestic value-added content in exports (VAXD) as:

$$VAXD = \mathbf{v}(\mathbf{I} - \mathbf{A_{dom}})^{(-1)}\ \mathbf{e} \quad (1)$$

where $\mathbf{v}$ is a row vector of value added to gross output ratios, $\mathbf{I}$ is an identity matrix, $\mathbf{A_{dom}}$ is a matrix of domestic input coefficients and $\mathbf{e}$ a column vector of exports. Multiplying the Leontief inverse $(\mathbf{I} - \mathbf{A_{dom}})^{(-1)}$ with the export vector $\mathbf{e}$ identifies how much output is generated in any

[2] The direct effect is value added and employment generated by exporting firms only. In input-output terms, we define it as the vector of value-added to gross output ratios times the export vector.
[3] Studies using firm-level data cannot account for these indirect contributions. Typically, importing and exporting firms themselves are considered but not their production linkages to other domestic firms (see Del Prete et al., 2017; Foster-McGregor et al., 2014; Okafur et al., 2017).

sector of the economy to produce the export vector (that is, in all directly and indirectly exporting firms). Pre-multiplying with **v** identifies how much value added is generated in these sectors when producing the needed output and therefore captures all directly and indirectly generated value added in exports. If instead pre-multiplied by a row vector of employment inputs to gross output ratios, this captures how much employment is needed to produce the exports. We refer to this as employment in exports. We have data on persons employed and value added in formal manufacturing industries. Manufacturing labour productivity in exports is defined as value added in exports divided by employment in exports. We calculate these measures for each exporting manufacturing industry separately.

Our measure of GVC participation (G) is the imported input content in exports, which is equal to one minus VAX-D (see Los et al., 2016). We express it as a share of gross exports (X), such that G is bound between zero and one.

$$G = (1 - VAXD)/X \tag{2}$$

A ratio close to one indicates that an exporting industry is relying heavily on imported intermediates and GVC participation is thus high, and vice versa.

III. Data Sources

To implement our methodology, we built a new dataset by combining two data sources. We need series of formal manufacturing employment and value added, as well as national input-output tables. For the latter we rely on Pahl and Timmer (2018), which constructed national input-output tables for 91 countries between 1970 and 2008. The industry detail is 14 manufacturing industries and 5 broad non-manufacturing sectors. For series of formal manufacturing employment and value added, we use UNIDO’s Indstat2 (2016). This database provides data for a large set of developing countries over a long period and is therefore suited for our long-run analysis. The online appendix provides a detailed description of the data construction and a summary table on the construction for each country. However, we would like to stress two points of relevance for interpreting our results here.

Firstly, the UNIDO data is collected from national industrial surveys and censuses, which are based on samples of manufacturing establishments. These surveys typically exclude small-scale and informal establishments. Depending on the survey, it might cover firms with at least five, or ten, *formally* employed workers. In many developing countries, the informal workforce makes up a large share of manufacturing employment, which is thus not covered in these surveys. We therefore stress that our results apply to the productivity and employment effects in formal manufacturing production.

Secondly, the UNIDO data makes no distinction between export-related production and production for domestic demand. This is a general caveat in estimating the employment and value-added content of exports with input-output tables. Koopman et al. (2012) show, for example, that firms in export-processing zones tend to use more foreign intermediates than ordinary exporters in China, and generate less domestic value added. Further improvements in data for a large cross-section of countries on both fronts would need to be awaited.

When using UNIDO's Indstat2 (2016), we need to apply harmonisation strategies. The data exhibit a large amount of gaps and changes of classifications, which make time-series comparisons erroneous and the data not readily usable. Value added is available at three different price concepts (in basic prices, in purchaser's prices and in an unknown price concept), and employment is available for two different measures (as persons engaged and as employees). Our construction is therefore guided to maximize intertemporal (over time), internal (between variables), and international (cross-country) consistency. To assure intertemporal consistency, which is most important in the long-run productivity comparisons of this paper, we apply linking procedures. After careful harmonization and aggregation, we start with an initial cross-section of both variables and link a series of growth rates to the respective cross-section. Hence, we obtain the initial level from the raw data, but we are able to repair breaks from changes in revisions or classifications of activities by using the trends in the different series. When constructing these growth rates, we fill gaps (for example, due to lack of overlap) by additional data sources and assumptions, which we describe in the appendix.

Internal consistency between value added and employment is generally high as both variables come from the same sources, which are industrial censuses and surveys. Within one sampled year, the recorded employment and value added entries cover the same establishments within industry classifications across the recorded variables. The initial values to which we link the series therefore come from the same year in both variables, yielding highest internal consistency. International consistency is most difficult to achieve, but it is also least critical in our analysis. We aggregate all variables to the same internationally comparable ISIC Rev.3.1 combinations, such that we cover in principle the same activities. Actual coverage of the industrial censuses may of course still differ (e.g., through different threshold levels of the minimum establishment size). In the econometric analysis, the dependent variable is in growth rates, and this thus matters only if, for example, productivity growth in larger firms is different from smaller firms (which are not covered in all countries in the industrial surveys). It is also not possible to use the same classification of variables across all countries because some only report in basic prices and others only in market prices. We can control for a large part of such cross-country differences by including dummies. For example, country dummies account for level differences that arise from different price concepts, and capture systematic differences in growth rates related to establishment size.

Combined with our data set of input-output tables, this leaves us with a dataset for in total 58 countries of which 38 are developing countries, as classified by the World Bank in 1990. Table A5 in the appendix provides an overview of countries, indicating the covered years and underlying sources. In the next section, we will discuss our results.

IV. Empirical Results

IV.1. Exploration

We investigate the relationship between GVC participation and growth of employment and labour productivity in long-run periods at the level of individual value chains. We identify value chains by the country-industry that exports, so in total there are 754 GVCs (58 countries with 13 industries).[4] Our data set covers an unbalanced panel over the period 1970 to 2008. To focus on

[4] We exclude ISIC Rev.3 industry 23, 'Coke, refined petroleum and nuclear fuel'. It appears to be an important outlier. Apart from statistical concerns, there are also other reasons to exclude it. Firstly, there is little information in the participation index in this value chain. Value chains with high GVC participation simply need to import oil or other resources because they are not available domestically and this will not change. Secondly, importing raw oil is unlikely to have similar productivity dynamics as when importing intermediates in other manufacturing value chains. The economic relationship that we intend to study may thus not hold in this value chain. We did not find evidence for other outliers in the data.

long-term developments, we use three 10-year periods going backward from 2008, and one 8-year period 1970 to 1978. For each country-industry, we thus observe up to four periods.

To explore the relationship, we rank our observations by level of GVC participation at the beginning of each period pooled across country-industries and time periods. We define the top quartile of these observations as the group with 'high GVC participation', and the bottom quartile as the group with 'low GVC participation'. Figures 2 and 3 show kernel density plots of growth of labour productivity and employment in exports over the subsequent 10-year periods across GVCs split by the two groups.[5] Figure 2(a) shows the distributions of growth rates of labour productivity in exports for all countries, and 2(b) for developing countries. Figure 3 repeats these graphs for employment growth. In table 1, we present one-sided t-tests for differences in means between the two groups.

The group with 'high GVC participation' appears to have higher growth rates in terms of labour productivity growth, but not in terms of employment growth. For productivity, the distribution of observations with high GVC participation is further to the right. The mean is 0.067 for observations with low GVC participation, and 0.075 for observations with high GVC participation in the full set of countries. In the subset of developing countries, it is 0.057 and 0.085 respectively. These differences in means are statistically significant, as shown in t-tests in table 1. Especially for developing countries, this difference is highly statistically significant and large. It suggests that GVC participation is positively related to productivity growth.

For employment, however, there is much weaker evidence for a relationship. Whether plotting all countries or only developing countries, the two distributions are close to one another. If anything, observations for value chains with high GVC participation are more to the left. Table 1 shows the means of the two distributions, which are 0.057 for low and 0.042 for high participation in the set of all countries. Within the subset of developing countries, value chains with low GVC participation also experience faster growth of employment: 0.079 (low) against 0.063 (high). The difference is only marginally statistically significant however.

Taken together, these results suggest that higher GVC participation might contribute positively to labour productivity growth, but potentially even negatively to employment growth.

[5] Our data is in nominal values, but in the regression analysis, we account for price effects following Rodrik (2013), as we will describe below.

<< Table 1 here >>

<< Figure 2 here >>

<< Figure 3 here >>

IV.2. Econometric Model

To investigate the issue in full, we will estimate the following model:

$$\widehat{lp}_{ict} = \beta_0 + \beta_1 G_{ict} + \beta_2 lp_{ict} + \beta_3 (lp_{ict} \times G_{ict}) + C_c + T_{it} + \varepsilon_{ict}, \tag{3}$$

where *i* is exporting industry, *c* is country, *t* is time period and ε is the error term. In the baseline model, each time period is 10 years and $\widehat{lp}$ is accordingly growth of labour productivity in exports over these 10 years. All independent variables are measured at the start of each time period. The main variable of interest is GVC participation, measured by our participation index and abbreviated by *G*. Following Rodrik (2013), we add time period-industry dummies T_{it} to account for price developments.[6] We also add country dummies, C_c, to control for country-fixed effects. These may include potential cross-country differences in the measurement of value added and employment as described in section III. They also pick up effects due to country-size differences: it is well known that larger countries tend to have lower GVC participation because more intermediates are domestically available (e.g., Baldwin and Lopez-Gonzalez, 2015; Timmer et al., 2013).

We also add the nominal labour productivity level (lp) at the beginning of each period as an explanatory variable. As all our regressions include time period-industry dummies, *lp* is measured relative to the global productivity frontier (which varies only by industry and time period). As shown in Rodrik (2013), patterns of unconditional convergence are strong in manufacturing. Lagging countries can benefit from the availability of information and codified knowledge, which helps them to learn from earlier innovations and thus catch up. Our specification identifies whether there is any additional effect of participating in GVCs beyond an unconditional trend of convergence. Countries that engage in GVCs might additionally benefit, for example, from direct production assistance and use of sophisticated inputs embodying technology. We also add an interaction term (*lp* x *G*) to study whether the effect of GVC participation depends on the

[6] Value added is in nominal dollars and we assume that the inflation term is only product (and not country) specific by the law of one price for internationally traded products.

distance to the productivity frontier. We would expect that the productivity effects operate especially in value chains where the productivity level is further from the productivity frontier, because this might offer more scope for learning.

We use cluster-robust standard errors to control for heteroscedasticity. Errors are clustered at the cross-sectional identifier, that is, the country-industry dimension. All our variables are in log-terms. We run regressions for long 10-year periods as well as for shorter medium-run 5-year periods, following the same regression set up.

Our model for explaining employment growth follows a similar set-up. The full model is given by:

$$\widehat{emp}_{ict} = \beta_0 + \beta_1 G_{ict} + \beta_2 lp_{ict} + \beta_3 (lp_{ict} \times G_{ict}) + \beta_4 Reg_{ct} + \beta_5 Hum_{ct} + T_{it} + \varepsilon_{ict}, \quad (4)$$

where $\widehat{emp}$ is growth of employment in exports. Again, all independent variables are measured at the beginning of each time period. We add time period-industry dummies to control for fluctuations in world demand. For example, world demand for ‘automotives’ might develop differently from demand for ‘food and beverages’ and thus affect employment growth in these value chains. We also add additional control variables at the country-level. We firstly add regulatory institutions (*Reg*). There is a large literature arguing that stricter labour market regulations have detrimental effects on employment generation (Botero et al., 2004). Labour market regulations create adjustment costs to which firms may respond by substituting capital for labour (Heckman and Pages, 2004). Furthermore, labour market regulations may increase the bargaining power of workers, which might reduce investments and thus limit the scale of the sector if investors fear that workers will extract a larger share of the profits ex-post (Besley and Buress, 2004). If true, we can expect a negative association with employment growth in exports. We measure labour market institutions by a component of the Index of Economic Freedom (Fraser Institute, 2015). As the detailed index of labour market regulations is not available for a large set of countries before 1980, we use a more aggregate component for all periods. This component broadly captures ‘regulation’ and includes not only labour market institutions, but also measures on the business and credit market environment. It is available every 5-years and we therefore linearly interpolate between these years to obtain measures at the beginning of each studied period.[7]

We also add an indicator for the level of human capital (*Hum*). A highly skilled workforce may imply a comparative advantage in skill-intensive activities (Wood and Berge, 1997). For developing countries, this might imply specialisation in manufacturing activities as opposed to primary production within the manufacturing value chains and thus might have a positive effect on manufacturing employment growth. However, it could also imply a shift towards capital-intensive production if skilled labour and capital are complements in the production process (Acemoglu and Pischke, 1998). We obtain human capital stock at the country level from PWT9.0 (Feenstra et al., 2015). This index is a combination based on the average years of schooling from Barro and Lee (2013) and an assumed rate of return to education from Psacharopoulos (1994).

We also add initial labour productivity level. We might expect that value chains closer to the productivity frontier have slower employment growth, because these value chains are more likely to be substituting away from labour to capital, following the lead of more developed countries that typically specialise in more capital-intensive activities as wages rise. On the other hand, high relative labour productivity might also signal low unit labour costs and allow countries to capture a larger share of world demand, increase the scale of production and generate employment growth. We will also investigate whether the effect of GVC participation depends on the distance to the productivity frontier by inclusion of an interaction term between participation and labour productivity. One might expect that only countries far from the productivity frontier benefit from participation as they specialise in labour-intensive production stages when engaging GVCs, while the developed countries offshore labour-intensive stages and attract capital-intensive ones. Lastly, we also present all specifications with country dummies to control for the country averages in the participation index and measurement differences. Summary statistics of our four main variables are given in Table 2.

<< Table 2 here >>

[7] We have also obtained the measure of labour market rigidities by Campos and Nugent (2018), which is available for 5-year intervals. Our results on GVC participation and on the other variables do not change. Using this variable, we find that labour market rigidities are negatively correlated to employment growth. However, these data are not available for Cyprus and Hungary (only recent years) of our covered countries.

IV.3. Econometric Results

We begin by discussing the results on labour productivity growth in exports. Table 3 shows the regression results for our long-run (10-year) periods. Without any controls (except the time period-industry dummies), we find a strong positive and significant relationship between GVC participation and labour productivity growth. A one percent increase in the GVC participation index is associated with a 0.009 percentage point higher growth rate. This implies a 0.7 percentage-point increase in the growth rate if a value chain increases its participation from the 25^{th} percentile to the 75^{th} percentile in our sample. In column (2), we add dummies to account for country-fixed effects. The coefficient almost doubles and is still statistically distinguishable from zero. A one percent increase in GVC participation is associated with a 0.016 percentage-points increase in the growth rate, implying a 1.3 percentage-point increase from the 25^{th} to the 75^{th} percentile of GVC participation.

In columns (3) and (4), we add initial labour productivity level in exports and the interaction with GVC participation to the model. Consistent with Rodrik's (2013) finding on convergence, the effect of initial labour productivity level is negative and statistically different from zero. The coefficient of GVC participation is positive, while the coefficient on the interaction is negative. This suggests that the effect of GVC participation is stronger for countries which are further from the productivity frontier. To show this, we graph the marginal effects of the changes in the participation index by different levels of labour productivity for the result of column (3) in figure 4. It shows that the effect of GVC participation is positive and significantly different from zero for all value chains with labour productivity (ln) lower than or equal to 9.5. This includes most of the developing countries in our data set (the mean in our sample is 9.35 with a standard deviation of 1.1, see table 2). For the least productive countries in our sample, the coefficient increases up to 0.035 implying a rise of labour productivity growth of 2.8 percentage points when increasing participation from the 25^{th} to the 75^{th} percentile in our sample, holding everything else constant. The estimated effect is not significantly different from zero for observations with labour productivity larger than 9.5, and turns significantly negative for countries with initial labour productivity (ln) of 11.5, which corresponds approximately to the top 1% of our distribution. These results strongly suggest an association between GVC participation and labour productivity growth in long-run periods. Moreover, this effect is stronger in value chains further from the productivity frontier.

To test the robustness of these results, we repeat the estimation on a data set with 37 developing countries only. Overall, the qualitative finding is the same with even somewhat larger coefficients (see table A1) and we conclude that our main finding is not driven by the inclusion of data for developed countries. We are also in the position to investigate these effects in shorter periods. Table A2 in the appendix repeats our regressions for data at 5-year periods. Overall, we confirm our long-run results also in the short-run periods. This provides convincing evidence for a positive effect of GVC participation on labour productivity growth in exports.

<< Table 3 here >>

<< Figure 4 here >>

We next investigate the relation between GVC participation and employment growth. Results are given in table 4 (all specifications include time period-industry dummies). Our baseline regression indicates that employment growth in exports appears not to be associated with GVC participation. It shows a negative correlation with GVC participation (col 1), turning insignificant when adding country dummies (col 2). This is in strong contrast with our findings on LP growth and confirms our previous finding based on the distributions in figure 3. In column (3), we add initial level of labour productivity and find that it is positive and significantly related to employment growth. This indicates that more productive value chains are able to extend the scale of production, such that employment is increasing. In column (4) we additionally add our set of country-level control variables (and drop the country dummies as the country level variables show relatively little variation over time). The association between GVC participation and employment growth turns negative but remains statistically not significant. The effect of initial labour productivity level is lost. Of our control variables, only human capital is significantly (negatively) associated with employment growth. This negative association might be because of a complementarity between high-skilled workers and capital. Availability of skills might yield a shift to more capital-intensive methods of production and thus reduce employment.

In columns (5) and (6), we explore whether the negative association between GVC participation and employment growth (col 1) depends on the distance to the productivity frontier by including an interaction term. The sign of the coefficient of GVC participation is positive, and the sign of the interaction is negative. Figure 5 shows the marginal effects based on column (5). We do not find a significant positive effect for any level of labour productivity observed in our dataset. Instead, we find that it is significantly negative for value chains with relatively high labour productivity in exports, for labour productivity (ln) larger than about 9.5. In conclusion, these results show that there is no positive association between GVC participation and employment growth in exports, not even for the least productive value chains. If anything, GVC participation is associated with slower employment growth for relatively productive value chains.

To investigate robustness of this result, we repeat the regressions four our subset of 37 developing countries. Results are given in table A3 in the appendix and are qualitatively the same: we do not find a statistically significant association between GVC participation and employment growth. For this set of countries we do find an additional role for regulatory institutions. The sign is positive and distinguishable from zero, suggesting that less regulation is associated with faster employment growth. Also when restricting the sample to developing countries, we find a consistent positive effect of initial labour productivity. In Appendix table A4, we show the results for 5-year periods and they are the similar.

Our result differs considerably from Lopez-Gonzalez (2016) who finds positive effects from GVC participation on employment in exports. Using data on 54, mostly middle and high-income, he studies employment in exports at the level of one aggregated manufacturing sector, 11 services sectors, agriculture and mining. Hence, while our approach zooms into formal manufacturing employment in manufactured exports, his result might reflect more on the employment possibilities outside manufacturing and in particular in services exports which are more important for richer countries. Overall, our results clearly show that on average higher GVC participation does not contribute positively to employment growth in manufacturing. Moreover, countries closer to the productivity frontier even seem to experience negative effects on employment growth.

<< Table 4 here >>

<< Figure 5 here >>

V. Concluding remarks

It is sometimes argued that GVCs provide a quick way to industrialize without the need for building up a sizeable domestic manufacturing base first. Countries are supposed to benefit from specialisation, realising long-run productivity growth and employment generation. In this study, we have investigated whether GVC participation is indeed a possible panacea for weak industrialisation trends in the South. The key contribution of our study is to provide long-run evidence on the impact of GVC participation on economic upgrading using data since 1970 on a large set of developing countries. We find robust evidence for a positive productivity effect from GVC integration. This is found to be true in analyses of 10-year periods and of shorter 5-year periods. Moreover, we find that relatively less productive countries can benefit more from GVC participation in terms of productivity growth. This speaks against concerns that GVC participation will leave developing countries locked in unproductive activities (see Dalle et al., 2013). Through GVC participation, countries become more productive in performing the same activities or might move into higher value-adding activities. Our identification does not distinguish between these scenarios, and this is an interesting avenue for further research by, for example, collecting (cross-country) data on business functions that allow for characterization of activities such as R&D, fabrication or marketing (as in Sturgeon and Gereffi, 2009; de Vries and Reijnders, 2017; Timmer et al. 2018).

However, our findings on employment generation in the formal manufacturing sector provide a more pessimistic outlook. Even after conditioning the relationship between GVC participation and employment growth in exports on other factors, we do not find any sign of a positive relation. If anything, the average association appears to be negative, in particular for countries closer to the productivity frontier. The results suggest that GVC participation is on an average not a driver of job growth in modern activities in the economy: it is a mixed blessing at best.

That said, our results do not rule out that some countries have successfully relied on GVC production as a stepping stone for both productivity and employment creation. China and Thailand, for example, have both successfully developed through GVC participation (on Thailand, see Wad, 2009). Gereffi and Sturgeon (2013) argue that such success depends on new and GVC-specific industrial policies. The authors emphasise the role of global suppliers serving multiple lead firms and suggest that countries must attract such global suppliers to generate employment and to allow local firms to have access to world-class inputs through the sourcing structure of these global suppliers. Rodrik (2018) advocates close cooperation between public and private entities to identify and evaluate the bottlenecks to generating linkages between the highly productive firms and the rest of the economy. Case-study approaches are best suited to suggest and refine these determinants for why a particular country deviates positively or negatively from the average. Critical in the assessment is whether these conditions for success are in reach for developing countries that are typically small and cannot built from a base supported by buoyant domestic demand. We conclude that economic upgrading through GVC participation is possible, but far from automatic.

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Table 1. Difference in means: average annual growth rates in 10-year periods

	Low GVC participation Mean	High GVC participation Mean	t-value	p-value
All countries				
Growth of labour productivity in exports	0.067 (N=522)	0.075 (N=522)	2.04	p<0.05
Growth of employment in exports	0.057 (N=522)	0.042 (N=522)	2.28	p<0.05
Developing countries only				
Growth of labour productivity in exports	0.057 (N=288)	0.085 (N=288)	5.34	p<0.01
Growth of employment in exports	0.079 (N=288)	0.063 (N=288)	1.67	p<0.05

Note: 'High GVC participation' are all observations in the top quartile of the respective distribution of the GVC participation index. 'Low GVC participation' are all observations in the bottom quartile of the distribution. There are 57 countries of which 37 are developing ones: Argentina, Bangladesh, Brazil, Bulgaria, Chile, China, Columbia, Cyprus, Czech Republic, Ecuador, Egypt, Estonia, Greece, Hungary, India, Jordan, Kenya, Latvia, Lithuania, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Rumania, Russia, Saudi Arabia, Senegal, Slovakia, Slovenia, South Africa, South Korea, Sri Lanka, Thailand, Turkey, Uruguay.

Source: Authors' calculation on described data set.

Table 2. Summary statistics: 10-year periods

Variable	Obs.	Mean	SD	Min	Max
Growth of employment	2,088	0,05	0,11	-0,67	0,94
Growth of labour productivity	2,088	0,07	0,06	-0,17	0,37
Labour productivity level (ln)	2,088	9,35	1,11	5,66	12,72
GVC participation (ln)	2,088	-1,69	0,65	-3,88	-0,20
Human Capital	2,088	2,41	0,53	1,19	3,52
Regulatory institutions	2,088	6,09	1,12	2,15	8,44

Source: Authors' calculation based on described data set.

Table 3. Explaining labour productivity (LP) growth in exports

Dependent variable: Growth of formal manufacturing labour productivity in exports				
VARIABLES	(1)	(2)	(3)	(4)
GVC participation (ln)	0.00908***	0.0160***	0.0763***	0.0521***
	(0.00173)	(0.00359)	(0.0131)	(0.0133)
Labour productivity (ln)			-0.0263***	-0.0663***
			(0.00257)	(0.00346)
Interaction: GVC Participation x labour productivity			-0.00739***	-0.00533***
			(0.00138)	(0.00145)
Constant	0.136***	0.179***	0.370***	0.701***
	(0.00767)	(0.0184)	(0.0249)	(0.0305)
Observations	2,088	2,088	2,088	2,088
Countries	57	57	57	57
Adjusted R-squared	0.341	0.535	0.399	0.668
Time period-industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	No	Yes	No	Yes

Note: Robust standard errors to heteroscedasticity in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All independent variables are measured at the beginning of each period.

Source: Authors' calculation based on described data sets.

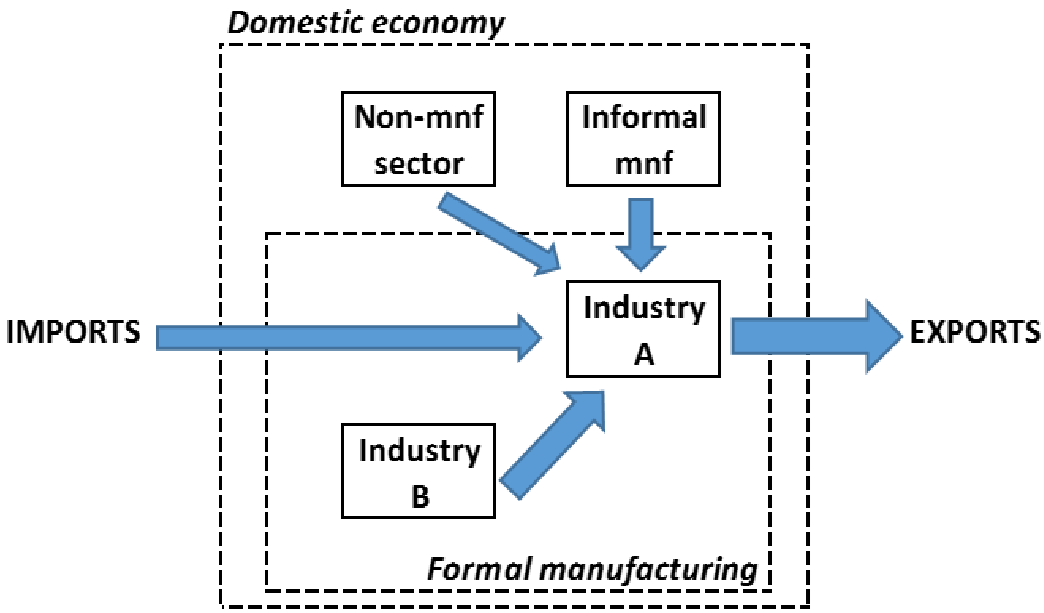
Table 4. Explaining Employment growth in exports

Dependent variable: Growth of formal manufacturing employment in exports						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
GVC participation (ln)	-0.00839**	-0.00305	0.00208	-0.00550	0.0653**	0.0623**
	(0.00380)	(0.00759)	(0.00792)	(0.00375)	(0.0278)	(0.0317)
Labour productivity (ln)			0.0274***	-0.000196	-0.0124**	0.0159
			(0.00805)	(0.00288)	(0.00522)	(0.00990)
Human capital				-0.0547***	-0.0573***	
				(0.00620)	(0.00646)	
Regulatory institutions				0.000502	2.24e-05	
				(0.00186)	(0.00189)	
Interaction: GVC participation x labour productivity					-0.0077***	-0.00685**
					(0.00281)	(0.00339)
Constant	0.0212	0.0116	-0.203***	0.145***	0.269***	-0.108
	(0.0142)	(0.0289)	(0.0653)	(0.0247)	(0.0571)	(0.0815)
Observations	2,088	2,088	2,088	2,088	2,088	2,088
Countries	57	57	57	57	57	57
Adjusted R-squared	0.079	0.218	0.226	0.140	0.142	0.227
Time period-industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	No	Yes	Yes	No	No	Yes

Note: Robust standard errors to heteroscedasticity in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All independent variables are measured at the beginning of each period.

Source: Authors' calculation based on described data sets.

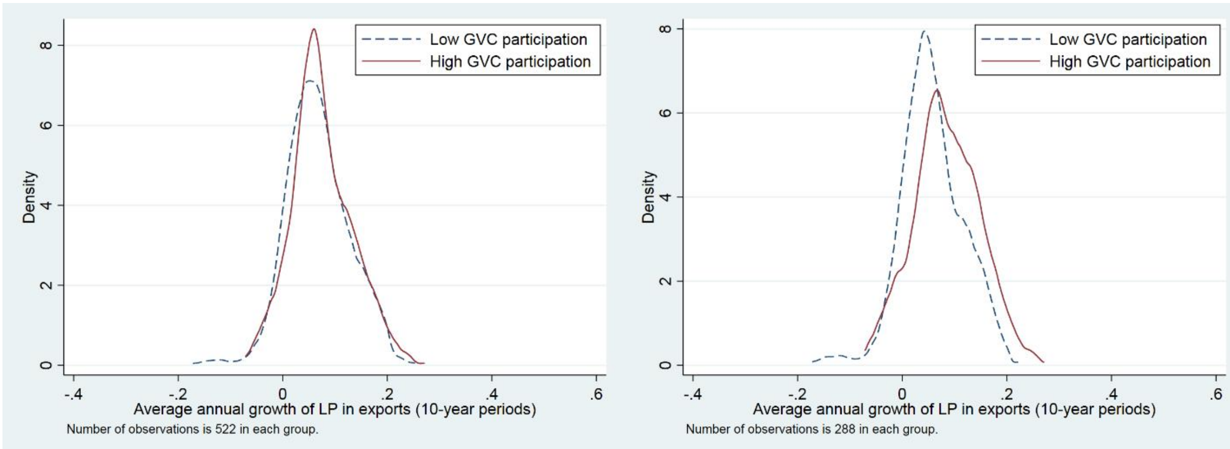
Figure 1. Domestic value chains in export production



Source: Authors' illustration.

Figure 2. Labour productivity in exports growth: Kernel density plots

2(a) All countries 2(b) Developing countries

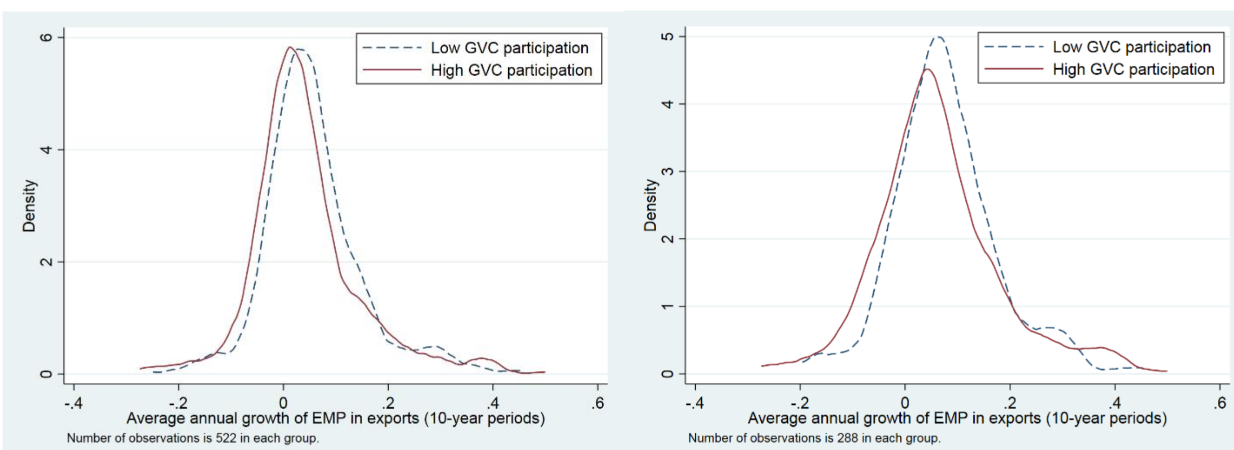


Note: 'High GVC participation' are all observations in the top quartile of the respective distribution of the GVC participation index. 'Low GVC participation' are all observations in the bottom quartile of the distribution. In all graphs, the tails are not displayed, and the data is cut as shown in the graphs. LP is manufacturing labour productivity in exports; growth rates are in long periods (10 years). See Table 1 for country coverage.

Source: Authors' calculation on described data set.

Figure 3. Employment in exports growth: Kernel density plots

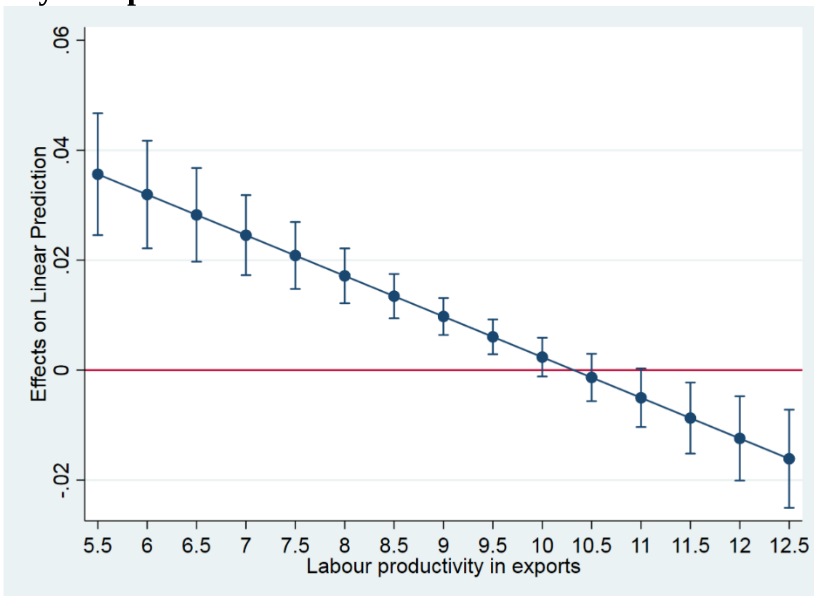
3(a) All countries 3(b) Developing countries



Note: See Figure 2. EMP is manufacturing employment in exports; growth rates are in long periods (10 years).

Source: Authors' calculation on described data set.

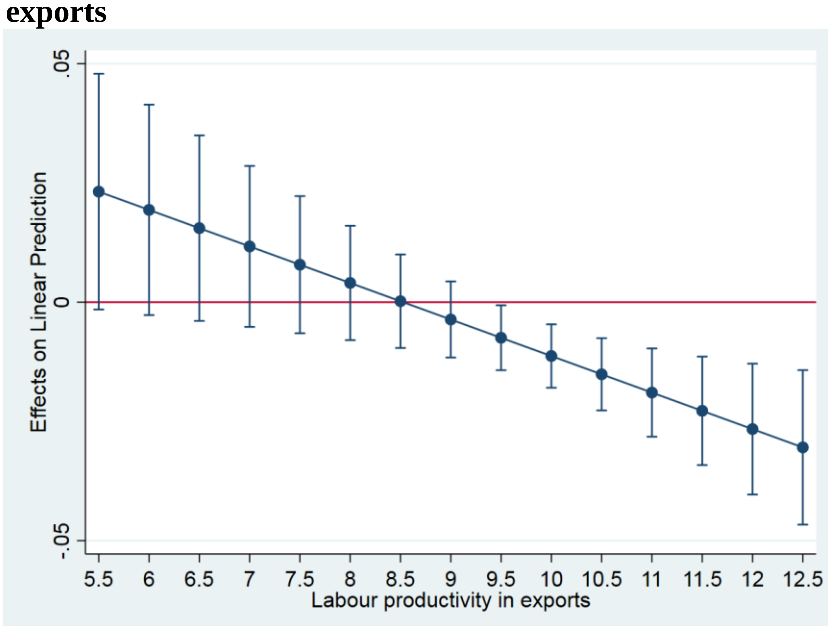
Figure 4. Marginal effects of GVC participation on labour productivity growth, by levels of labour productivity in exports



Note: Marginal effects are obtained from regression of table 3, column 3. Confidence interval for 95%.

Source: Authors' calculation.

Figure 5. Marginal effects of GVC participation on employment growth, by level of labour productivity in exports



Note: Marginal effects are obtained from regression of table 4, column 5. Confidence interval for 95%.

Source: Authors' calculation.

Appendix 1. Additional tables

Table A1. Explaining labour productivity growth in exports: developing countries

Dependent variable: Growth of formal manufacturing labour productivity in exports		
VARIABLES	(1)	(2)
GVC participation (ln)	0.0130***	0.0182***
	(0.00265)	(0.00498)
Constant	0.125***	0.163***
	(0.0114)	(0.0239)
Observations	1,152	1,152
Countries	37	37
Adjusted R-squared	0.233	0.470
Time period-industry Dummies	Yes	Yes
Country Dummies	No	Yes

Note: Robust standard errors to heteroscedasticity in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All independent variables are measured at the beginning of each period.

Source: Authors' calculation based on described data sets.

Table A2. Explaining labour productivity growth in exports: 5-year periods

Dependent variable: Growth of formal manufacturing labour productivity in exports				
VARIABLES	(1)	(2)	(3)	(4)
GVC participation (ln)	0.0137***	0.0297***	0.0758**	0.0784**
	(0.00243)	(0.00645)	(0.0332)	(0.0377)
Labour productivity (ln)			-0.0259***	-0.0935***
			(0.00602)	(0.00727)
Interaction: GVC participation x labour productivity			-0.00680*	-0.00760*
			(0.00369)	(0.00446)
Constant	0.157***	0.366***	0.388***	0.867***
	(0.00910)	(0.0293)	(0.0551)	(0.0589)
Observations	3,877	3,877	3,877	3,877
Countries	58	58	58	58
Adjusted R-squared	0.287	0.373	0.317	0.497
Time period-industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	No	Yes	No	Yes

Note: Robust standard errors to heteroscedasticity in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All independent variables are measured at the beginning of each time period.

Source: Authors' calculation based on described data sets.

Table A3. Explaining employment growth in exports: developing countries

Dependent variable: Growth of formal manufacturing employment in exports				
VARIABLES	(1)	(2)	(3)	(4)
GVC participation (ln)	-0.00548	-0.00459	0.00441	0.00112
	(0.00625)	(0.0105)	(0.00741)	(0.0111)
Labour productivity (ln)			0.0200***	0.0278**
			(0.00424)	(0.0113)
Human capital			-0.0552***	
			(0.00957)	
Regulatory institutions			0.00580*	
			(0.00350)	
Constant	0.0596**	0.00674	-0.0165	-0.218**
	(0.0269)	(0.0435)	(0.0550)	(0.0965)
Observations	1,152	1,152	1,152	1,152
Countries	37	37	37	37
Adjusted R-squared	0.103	0.176	0.146	0.183
Time period-industry Dummies	Yes	Yes	Yes	Yes
Country Dummies	No	Yes	No	Yes

Note: Robust standard errors to heteroscedasticity in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All independent variables are measured at the beginning of each period.

Source: Authors’ calculation based on described data sets.

Table A4. Explaining employment growth in exports: 5-year periods

Dependent variable: Growth of formal manufacturing employment in exports						
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
GVC participation (ln)	-0.0149***	-0.0141	-0.0106	-0.0155***	0.0335	0.0339
	(0.00428)	(0.00871)	(0.00863)	(0.00441)	(0.0348)	(0.0405)
Labour productivity (ln)			0.0140*	-0.0107***	-0.0189***	0.00559
			(0.00815)	(0.00324)	(0.00650)	(0.0114)
Human capital				-0.0473***	-0.0490***	
				(0.00624)	(0.00654)	
Regulatory institutions				0.00819***	0.00781***	
				(0.00210)	(0.00212)	
Interaction: GVC participation x labour productivity					-0.00524	-0.00491
					(0.00362)	(0.00441)
Constant	0.0131	0.121**	0.0534	0.158***	0.243***	0.126
	(0.0191)	(0.0500)	(0.0636)	(0.0306)	(0.0680)	(0.0908)
Observations	3,877	3,877	3,877	3,864	3,864	3,877
Countries	58	58	58	57	57	58
Adjusted R-squared	0.076	0.150	0.151	0.108	0.108	0.151
Time period-industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	No	Yes	Yes	No	No	Yes

Note: Robust standard errors to heteroscedasticity in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All independent variables are measured at the beginning of each period.
Source: Authors’ calculation based on described data sets.

Appendix for online publication only

Appendix 2. Data construction

In this section, we describe the data construction of the series of formal manufacturing employment and value added. Our dataset covers an unbalanced sample of 58 countries of which 40 are non-high-income countries.

The construction of the series of employment and value added relies mainly on the UNIDO Industrial Statistics database (UNIDO Indstat2, 2016). In some cases, these data are complemented by other sources to bridge small gaps in the data.

As described in the main text, the construction is guided to maximize intertemporal (over time), internal (between variables), and international (cross-country) consistency by applying linking procedures. We proceed as follows.

In the first step, we clean the data. We set observations to missing which we identify as erroneous entries. Firstly, we set all negative entries of value added and employment to missing. Secondly, we treat zeros and missing observations. In the raw data, zeros might appear when data is missing, that is, when the industry is not sampled in the respective year. It can, however, also indicate that the actual value is zero.[8] We therefore set zeros to missing that (i) are entered in-between recorded values. Hence, if an industry has a positive value in year 1, a zero in year 2, but a positive value in year 3, we assume that the zero in-between is a missing value. We set observations to missing if (ii) the industry records zeros at the beginning or end of the time series, but emerges from 0% to more than 5% of total manufacturing, and vice versa. Hence, we allow for the possibility that industries emerge or vanish, but restrict it to a change of 5% in total manufacturing. We assume that larger changes from or to 0 indicate that the zero indicates missing data. We do not set observations to missing if only zeros are recorded in one industry, and thus allow for the possibility that some industries do not exist at all. We also set observations to missing if (iii) a positive value is recorded in the other variable. For example, if employment data is recorded, but value added is reported as zero, we treat the zero as a missing value.

[8] A motivating example for this treatment is Senegal. Between 1986 and 1989, no industry records any value added and employment except for recycling and food manufacturing. After this period, all remaining industries start recording again. It is very unlikely that all industries disappear in the same year and return in the same year.

Having obtained the cleaned value added and employment data, we aggregate into the 14 ISIC Rev.3 categories: 15t16, 17t18, 19, 20, 21t22, 23, 24, 25, 26, 27t28, 29, 30t33, 34t35, 36t37. We additionally construct aggregate categories for 17t19 and 29t33, because almost all countries report the categories 18t19 and 29t30 together in years before the 1990s, such that we cannot aggregate into our classification. This provides aggregated series of 14 industries plus the two higher aggregates of value added and employment in three and two different classifications, respectively. Value added is reported in basic prices, in market prices and in unreported classification; employment as persons engaged and employees. To bridge gaps within these five series, we linearly interpolate the series. If the two more aggregated categories are available but not the disaggregated ones, we use the closest available split to obtain the disaggregated categories. Per country we obtain up to five series for the two variables, aggregated to the 14 manufacturing industries.

We use these aggregated data to obtain initial cross-sections for both variables. To assure international consistency, we take the latest available value added cross-section in basic prices and employment cross-section as employees. If these classifications are not available, we prefer value added in basic prices over market prices over unreported classification, and employment as employees over persons engaged. Both cross-sections come from the same year to assure internal consistency.

We extrapolate these cross-sections backward and forward by growth-rate series, which we construct as follows. Firstly, starting from the aggregated data, we calculate the growth rates within each of the variable-classification series, that is, of up to five series per country. Secondly, we combine these series into one single series of growth rates for each of the two variables. We thus assume that the growth rates are consistent across different classifications. When combining these growth rates into one single series, we prefer growth rates in basic prices over market prices over unreported classification. For employment, we prefer the series in employees over the series in persons engaged.[9] These constructed growth rates account for almost all derived data points in our data.

Next, we complement these series with additional sources and assumptions to bridge small gaps, for example, if there is no overlap between series in different classifications. Firstly, we add

[9] This procedure assures that we always start the extrapolation with growth rates of the same classification as the initial cross-section.

data from the OECD (OECD, 2017). This database provides total (formal and informal) manufacturing employment for up to 17 manufacturing industries. We use this data source to backdate and extrapolate, and to bridge gaps in our series of formal manufacturing employment and value added. By using this data source, we assume that the growth rates of total manufacturing are consistent with the growth rate of formal manufacturing. For France and South Korea, we also add data from KLEMS (Jäger, 2017; ASIA KLEMS, 2017), and proxy the growth rates following the same assumption. We further bridge the remaining small gaps of mostly single years, but of up to four years, by assuming a common trend of labour productivity growth across manufacturing industries. This is only done if there is no overlap between two classifications of value added, which could not be repaired by the additional data sources. It occurs in 14 countries. Table A2 provides an overview of the data sources and time period coverage for each of the individual countries.

Legend for Table A5.

	Meaning
1	Growth rates are based on raw data
a	Growth rates are based on raw data, but use of higher aggregates 17t19 and/or 29t33 for respective industries
i	Growth rates for one or more industries are obtained from linear interpolation between raw data points
o	Growth rates for one or more industries are obtained from OECD (2017)
k	Growth rates for one or more industries are obtained from KLEMS
m	Growth rates of VA are based on common manufacturing trend of value added per worker
E	Employment classified as employees
PE	Employment classified as persons engaged
B	Value added classified in basic prices
M	Value added classified in market prices
NR	Value added classification is not reported

Note that the classification is not indicated in table A5 if the cross-section for extrapolation is after 2008. All of those countries report employment as employees, except Uruguay (reporting persons engaged). All countries report value added in basic prices, except Cyprus, India, Jordan, Kuwait, Mexico and Peru (in market prices), and Japan, Russia and Uruguay (in unreported classification).

Table A5. Overview of sources by country

		70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
ARG	EMP															1a	1a	1a	1a	1a	1a	1a	ia	ia	1	1	1	1	1	1	1	1	1	**E**	o	o	o	o	o	o
	VA															1a	1a	1a	1a	1a	1a	m	m	m	1	1	1	1	1	1	1	1	1	**M**	o	o	o	o	o	o
AUS	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**																		
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**B**																		
AUT	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	1	1	1	1	1i	1i	1i	1i	1i	1	1i	1i	1i	1i	1	1i	1i	1i
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	m	1	1	1	1	1	1i	o	1	1	1	1	1i	1i	1i	1i	1	1i	1i	1i
AZE	EMP																																1	1	1	1	1	1	1	1
	VA																																1	1	1	1	1	1	1	1
BEL	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1iao	iao	iao	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BGD	EMP							1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	1	i	i	1	i	i	i	i	i	i	i	1i	i	i
	VA							1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	m	m	m	1m	i	i	1	i	i	i	i	i	i	i	1i	i	i
BGR	EMP																										ia	1i	1	1	1	1	1	1	1	1	1	1	1	1
	VA																										iao	1a	1	1	1	1	1	1	1	1	1	1	o	1
BRA	EMP																										1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	iao	1
	VA																										1ao	1	1	1	1	1	1	1	1	1	1	1	1	1
CAN	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**M**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CHL	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**M**	1i	1ao	1ao	1ao	1ao	1iao	1iao	1iao	1iao	1iao	1iao	1iao	1iao	1ao
CHN	EMP											1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	**E**	1
	VA											1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	o	1	1	1	1	**M**	o
COL	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	o	1	1	1	1	1	1	1	1	1
CYP	EMP			1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1				
	VA			1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1				
CZE	EMP																										1	1	1	1	1	1i	1	1	1	1	1	1	1i	1
	VA																										1	1	1	1	o	1	1	1	1	1	1	1	1i	1
DEU	EMP																										1	1	o	1	1	1	1	1	1	1	1	1	1	1
	VA																										o	o	o	1	1	1	1	1	1	1	1	1	1	1
DNK	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	i	1	**E**	1i	1i	1i	1i	1i	1i	1i	1i	1i
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	1	1	1	1	**B**	1i	1i	1i	1i	1i	1i	1i	1i	1i
ECU	EMP	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1i	1	1	1	1	**E**
	VA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1i	1	1	1i	1	1	1	1	**M**
EGY	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**	ia	ia	ia	ia	ia	ia	ia	1	1	i	i	i	1	i	1	1i	1	i	i
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1a	1a	1a	1a	1a	1a	**B**	1a	1a	1a	1a	1a	1a	1a	1	1	i	i	i	1i	i	1i	1i	1	ia	ia
ESP	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EST	EMP																								1	1	1	1	1	1	1	1i	1i	1	1	1	1	1	1i	1
	VA																								1	1	1	1i	1	1	o	1	1	1	1	1	1	1	1i	1
FIN	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**E**	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	ia	ia	ia	ia	1	1	1	1	1	1i	1	1	1	1	1	1	**B**	1
FRA	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1i	1i	1i	1i	1i	1i	1	1	1	1i	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	m	1a	1a	1a	1a	1a	1a	1a	1a	1a	m	1k	1k	1k	1ik	1k	1k	1	1	1	1i	1	1	1	1	1	1	1	1	1
GRC	EMP																								1	1	1	1	1	1	i	i	i	i	1	1	1	1	1	1
	VA																								1	1	1	1	1	1	i	i	i	i	1	1	1	1	1	1
HUN	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	1i	1i	1i	1i	1	1	1i	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1a	1ia	1a	1ao	o	1	1	1i	1	1	1	1	1	1	1	1

(continued on next page)

Table A5. Overview of sources by country

		70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
IND	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	o	1	1	1	1	1	1	1	1	1	1	1
IRL	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1ia	1ia	1ia	**E**	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1a	1ia	1ia
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1i	1i	1i	1i	**B**	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i	1i
ISR	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1ia	1ia	1ia	1ia	1ia	1ia	**E**	1ia	1ia	1ia	1ia	1ia	1ia	ia	ia	ia	ia	ia
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**M**	o	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a
JOR	EMP											1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	1	1i	1i	1i	i	1i	1	1	1	1	1	1	1	1
	VA											1ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1i	1i	1i	1	1	1i	1i	1	1	1	1	1	1
JPN	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	ia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KEN	EMP			1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	**PE**	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia
	VA			1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1ia	1ia	1ia	1a	1a	**B**	1	1	1	1	1	1	1	1	1	1
KOR	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**M**	k	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KWT	EMP	1a	1a	1a	1a	1a	1a	1a	ia	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1
LKA	EMP										1a	1a	**E**	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	ia	1	1	1
	VA										1a	1a	**B**	ia	1a	ia	ia	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	ia	1	1	1
LTU	EMP																										1i	1i	1	1	1	1	1	1	1	1	1	1	1	1
	VA																										o	o	o	o	o	1	1	1	1	1	1	1	1	1i
LVA	EMP																								1i	1i	1i	**E**	1i	1i	1	1	1	1	1	1	1	1	1	1
	VA																								1	1i	1	**B**	1io	1io	1io	1io	1io	1io	1io	1io	1io	1io	1io	1io
MAR	EMP							1a	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	ia	ia	ia	ia	ia	ia	ia	ia	1	1	1	1	1	1	1	1	1
	VA							1a	1ia	1ia	1ia	1ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	1	1i	1i	1	1	1i	1i	1	1
MEX	EMP															1a	1a	1a	1a	1a	1	1i	1i	1i	1i	i	i	i	i	i	i	i	i	i	1	i	i	i	i	1i
	VA															1a	1a	1a	1a	1a	1	1i	1i	1i	1i	1	1	1	1	1	1	1	1	1	1i	1i	1i	1i	1i	1i
MYS	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	**E**	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	**B**	o	1	1	1	1	1	1	1	1
NLD	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1i	1i	1	1i	1	1i	1i	1i	1i	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	1	1	1	1	1	1	1	1	1	1	1	1i	1	1i
NOR	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1i	1i	1i	1i	1i	1	1i	1i	1i	1i	1	1	1	1i	1i
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	m	1	1	1i	1i	1i	1i	1i	1i	1i	1i	1	1	1	1i	1i
NZL	EMP	1a	1a	1a	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**																							
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**M**																							
PER	EMP													1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	1a	1	1	i	i	i	i	1	1	**PE**					
	VA													1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	m	1	1	i	i	i	i	1i	1i	**NR**					
PHL	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	i	1	i	1	i	1	1	i	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	i	1	i	1	i	1	1	i	1
POL	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1	1i	1i	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	o	1	1	1	1i	1i	i	1i	1	1	1	1	1	1i
PRT	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	ia	ia	ia	ia	ia	1	1	1	1	1	1	1	1	1i	1i	1i	1i	1i
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1ia	1a	1a	1a	1a	1a	1a	1a	1a	o	1	1	1	1	1i	1	1	1	1i	1i	1i	1i	1i
ROU	EMP																										1	1	1	1	1	1	1	1	1	1	**E**	1	1	1
	VA																										1o	1o	1o	1o	1o	1o	1o	o	1ao	1	**B**	1ao	1ao	1iao
RUS	EMP																											1	1	1	1	1	1	1	1	1	1	1	1	1
	VA																											1	1	1	1	i	1	1	1	1	1	1	1	1
SAU	EMP																										ia	ia	ia	ia	ia	ia	1ia	1ia	1ia	1ia	1ia	**E**	1	1
	VA																										o	o	o	o	o	o	o	1iao	1iao	1iao	1iao	**NR**	o	o

(continued on next page)

Table A5 (continued). Overview of sources by country

		70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
SEN	EMP																			ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	1	1	1	1	**E**						
	VA																			1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	1ia	**M**						
SGP	EMP	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	ia	1	1	1	1	**E**	1	1	1	1	1	1	1	1	1i	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	**B**	o	1	1	1	1	1	1	1	1i	1	1	1	1
SVK	EMP																								1	1	1	1	1	**E**	1	1i	1	1	1i	1i	1i	1i	1i	i
	VA																								1	m	1	1	1	**B**	1	1i	1	1	1i	1i	1i	1i	1i	1i
SVN	EMP																							1a	1a	1a	1i	1i	1i	1i	1i	1	1	1	1i	1	1	1	1	**E**
	VA																							1a	1a	m	1o	1o	1o	1o	1o	1i	1i	1i	1i	1	1	1i	1i	**B**
SWE	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1	1	1	1i	1	1	1	1	1	1	1
THA	EMP	1a	1a	ia	ia	1a	1a	1a	1a	ia	1ia	ia	ia	1a	ia	1a	ia	1a	ia	1a	1a	1ia	1a	ia	1a	1a	ia	1	i	**E**	i	1	i	1	i	i	i	1	i	I
	VA	1ia	ia	ia	ia	1a	1a	1a	1a	ia	1ia	ia	ia	1a	ia	1a	ia	1a	ia	1a	1a	1ia	1a	ia	1a	1a	ia	1	i	**M**	o	o	i	1	i	i	i	1	i	I
TUR	EMP	1a	1a	ia	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	m	1	1	1	1	1	1	1	1	1	o	1	1	1	1	1	1	1
URY	EMP	ia	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	ia	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1i	1i	1i	1i	i	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1	1	1	1	1i	1i	1i	1i	i	ia	1
USA	EMP	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**	ia	1	1	1	1	1	1	i	1	1	1	1	1
	VA	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**B**	o	o	1	1	1	1	1	1	1	1	1	1	1
ZAF	EMP										1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**E**	1a	ia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	VA										1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	**B**	m	ia	1i	i	i	1i	i	1i	1o	1o	1o	1o	1o	1o	1o	1o	1o	1o

Note: 1 indicates that at least one industry's growth rate is based on raw data; a indicates that industries 17t18 and 19, and/or 29 and 30t33 are based on an aggregate split of the raw data; i indicates that at least one industry's growth is based on linear interpolation; o indicates that at least one industry's growth is based on data from OECD; k indicates that at least one industry's growth is based on KLEMS data; m indicates that at least one industry's value added growth is based on aggregate trend of value added per worker.