

# Trade, Global Outsourcing and (de)industrialisation, 1995-2019

## Volume II: Production, Demand, and the Dynamics of Industrial Change

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H. Escaith \*

**Abstract:** This is the second volume of our data-driven analysis of the evolution of productive structure of economies between 1995 and 2019. It complements a first part delineating the main stylised facts characterising structural changes in the geographical distribution of World industrial production and the implications for employment. With a special emphasis on deindustrialisation, the present volume looks inside the production functions themselves. It investigates whether the decline of manufacturing shares in developed and some developing economies results from a statistical reclassification of activities due to domestic outsourcing, offshore relocation due to international outsourcing, or increasing demand constraints on the domestic and the export markets. Data on the use and origin of intermediate inputs provide information on the evolution of business models for each industry and their insertion in global value chains. It reveals the extent of domestic and international outsourcing and provides information on the evolution of business models across countries. While outsourcing motivated the investigation, the empirical analysis progressively relegates it to a secondary or ambiguous role. In its quest for deindustrialisation drivers, the study analyses the role of the demand constraints. The empirical results conclude by distinguishing normal and pathologic deindustrialisation in both developed and developing countries. Five broad lessons emerge from the analysis: (1) Heterogeneity of deindustrialisation, as the phenomenon is multidimensional; (2) Role of effective-demand constraints, as industrial expansion depends as much on absorption capacity as on supply potential, (3) Dual impact of outsourcing, when domestic or international outsourcing often signals functional specialisation and efficiency gains (a “Porterian” type of outsourcing), but may denote, at a contrary, a weakness (a “Post-Porterian” strategy); (4) Importance of global value chain (GVC) integration in developing successful business strategies; and (5) Importance of the domestic value chain, as successful GVC-based industrialisation requires also developing a strong domestic supply chain, particularly between high and medium technology industries.

**Key words:** industrialisation, global manufacturing, employment, input-output analysis, tertiarization and servification, regional integration

**JEL codes:** O14, L60, F14, C67, F16, J16, O47

\*/ University of Liège. Former WTO Chief Statistician and former Director of Statistics and Economic Forecasting at UN-ECLAC. ORCID iD: <https://orcid.org/0000-0001-6936-3377>

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# Volume II: Production, Demand, and the Dynamics of Industrial Change

## 1. Introduction

This two-volumes background paper presents the results of a data-driven exercise that aims at identifying industrialisation and deindustrialisation patterns in the World economy during the 1995–2019 period. The main question that structured the analysis was “Did globalisation accelerate deindustrialisation or was it only the natural outcome of the long-term structural development process?” (A spoiler: Taken together, our results suggest that deindustrialisation cannot be primarily interpreted as a supply-side reallocation driven by outsourcing, but rather as the outcome of heterogeneous supply–demand regimes interacting with existing domestic and international production structures).

Despite its empirical ubiquity, deindustrialisation remains analytically elusive, as similar outcomes often co-exist with very different production structures and trade exposures. Deindustrialisation is probably multidimensional and heterogeneous across countries and periods. Thus, it should not be discussed from a single-cause point of view (employment, outsourcing, globalisation, technology, etc.).

The first volume was devoted to the macroeconomic and employment perspectives. It relied on comparative statistical analysis to identify stylised facts characterising (de)industrialisation; among others, the existence of tipping points in the structural transition from an industry-intensive economy to a service-oriented one. It explicitly searched for specific patterns in production and employment related to the “*hyper-globalisation*” sub-period (1995–2007) and the “*new normal*” years that followed the global financial crisis of 2008–2009, a period also labelled “*slowbalisation*”.

With a special emphasis on deindustrialisation, this second volume investigates whether the decline of manufacturing shares in developed and some developing economies results from (i) a statistical reclassification of activities due to domestic outsourcing; (ii) offshore relocation of activities due to international outsourcing; or (iii) from intensifying demand constraints on the domestic and the export markets.

Specifically, three complementary mechanisms guide our analysis.

- **Domestic outsourcing** — the subcontracting of activities to specialised service providers — may reduce measured manufacturing employment without reducing national value-added.
- **International outsourcing** — the off-shoring of tasks — can indisputably shift value-added and employment abroad.
- **Effective demand** — the capacity of domestic and foreign markets to absorb industrial output — can limit industrialisation even when supply conditions are favourable.

While outsourcing motivated the initial investigation, the empirical analysis will progressively investigate other dimensions, without relegating it to a secondary role. Other drivers of (de)industrialisation appear progressively elsewhere, either from changes in the input–output structure or in the relative strength of effective demand. To explore these channels, we combine a production function decomposition — consistent with input–output accounting — with two demand indicators ( $\Omega, \zeta$ : the share of total demand for a product met by domestic production and share of domestic output that is exported). These can be computed for each {country-sector-year} triplet, using Inter Country Input-Output (ICIO) data, distinguishing intermediate and final demand (domestic and foreign).

Access to the OECD's ICIOI tables provides a detailed picture of both the supply and demand aspects of a global multi-agent/multi-sector model. This allows to combine both macro-economic and sectoral micro-economic perspectives into a statistically consistent perspective.

Besides this introduction, the paper presents the conceptual building blocks guiding the investigation, in particular specifying a prototype of production function in an open economy. The empirical sections describe the data before offering a first look at trends affecting industrialisation between 1995 and 2019. Then, a series of exploratory data analysis produce a classification of top and bottom performers according to their industrial characteristics before identifying cases of potential deindustrialisation. Conclusions summarise the main findings of volumes I & II.

For reference, we present here the tables of contents of the two volumes that constitute the background paper.

*Table 1 Table of contents of Volume I and II*

General Introduction and Volume I	Volume II and General Conclusions
1. General Introduction to Volumes I & II 2. Literature Review 3. Motivation, Premises and Methodological Orientation <b>Volume I</b> 1. Structural Changes in Global Manufacturing 2. Manufacturing and Development 3. Employment, Industrialisation and Outsourcing 4. Income-Related Turning Points in Industrial Employment 5. Preliminary Conclusions References Annexes	1. Introduction 2. Conceptual Background: Outsourcing and Deindustrialisation 3. Accounting Framework: Production Function in an Open Economy 4. Empirical Framework and Data 5. Results: Long-Term and Sub-Period Trends 6. Prototyping Performer vs. Non-Performer 7. Identifying Countries at Risk of Deindustrialisation 8. Summary and Conclusions Bibliography (Vol. I & II) Annexes

## 2. Conceptual Background: Outsourcing and Deindustrialisation

Outsourcing production to developing countries has often been identified as one of the causes of deindustrialisation in developed economies (Wood, 1994). An optimistic interpretation professes that deindustrialisation may only be a statistical artefact caused by a reclassification of industrial employees' job to business services. Domestic outsourcing often takes the form of sub-contracting non-core tasks to firms specialised in providing specific inputs to the industry. These inputs can be manufactured parts and components or business services. In the latter case, jobs that were previously classified as manufacturing move to services. The shift is merely qualitative, as the value-added stays at home. The case of international outsourcing is different. The outsourced inputs are now made abroad, then imported back to produce an output. The proximate effect is a drop in both gross value-added and employment per unit of output in the home economy. A way of differentiating both approaches is to make a clear distinction between domestic and international outsourcing.

### 1) From Vertical to Horizontal Integration

Until the 1980s, most firms were vertically integrated, producing intermediate goods and services in-house. A Model T car in the 1920s was almost entirely produced in Henry Ford's factory in Red River. Today, many suppliers in different countries will have contributed to making the car. Global competition, new approaches to business management and advanced digital technologies subsequently encouraged a shift toward *horizontal* networks of specialised producers, each focusing on its core competencies. Some of these suppliers are other manufacturing producers, other are business or logistic services providers, some were producing at home, others were foreign based.

The outsourcing of manufacturing tasks is often justified by the “Smile Curve” introduced by Acer founder Stan Shih in the early 1990s. The curve is “U-shaped” and show that for a typical final good, manufacturing is at the bottom of the value-added curve, with high-profitability at the end. Indeed, some manufacturers (producing heavy machinery or aircraft engines, for example) make a large part of their business selling after-sales services to their clients. At the extreme, some factory-less companies stopped entirely to fabricate products and concentrate on R&D, branding and marketing. Obviously, the “outsourced” employees may be severely affected in the process, first by losing their job, then by having to look for another one in the often lesser-paid services sector. All in all, the traditional manufacturing vs. services boundary is blurred, while manufactured products are less and less “Made in any single country” and increasingly “Made in the World”.

## 2) Domestic Outsourcing and Statistical Tertiarisation

Outsourcing is often seen as a specific driver of deindustrialisation, as many activities that were once part of manufacturing are now provided by companies in the service sector (Majzlíková, 2024). Domestic outsourcing often takes the form of sub-contracting non-core tasks to firms specialised in providing specific inputs to the industry (in this essay, we will indifferently use “manufacturing” and “industry” –implicitly excluding “construction”). These inputs can be parts and components, or business services. D’Angelo, Di Berardino and Pernagallo (2025) distinguish “insourcing” —outsourcing within the same manufacturing sub-system of the same country— and “intersectoral outsourcing”, the outsourcing of tasks and inputs outside the sub-sector but within the domestic economy. Tertiarisation of industrial tasks occurs when domestic outsourcing transfers ancillary tasks to independent service firms.

International competition with low-cost producers has forced corporations in industrial countries to compete on higher-quality branded products, usually more intensive in tertiary inputs, from R&D to marketing and after-sales services. Employment and value-added move from “manufacturing” to “business services”, while keeping them within national borders. The “*servicification*” of manufacturing is particularly strong in the case of global value chains, where some of these services are closely embedded with the production and delivery of products when production is geographically fragmented (Box 1).

This process generated a statistical deindustrialisation —sometimes called *apparent* deindustrialisation— even if physical production and value-added remained in the country. It has been documented in OECD countries (Montresor and Vittucci-Marzetti 2011). D’angelo et al. (2025) calculate that in 2020, 45% of total employment integrated into manufacturing subsystems in Germany were services jobs. The highest percentage was found for high-tech industries (51.6%). Of these 51.6%, 22.3 percentage points (ppt) were jobs in distributive services and another 13.5ppt in the knowledge intensive business services. The latter were recording the fastest increase across all manufacturing sectors (18% in average), reflecting the ongoing integration of manufacturing into a knowledge-based economy.

### Box 1. Embodied and imbedded services in Global Value Chains

Quoting Low (2013), “services figure in almost every activity in an economy. This is particularly true of what are often referred to as producer services — transport, communications finance, distribution and business services. This pervasiveness makes services key determinants of competitiveness and the productivity of capital and labour.”

When it comes to global value chains, the services that participate to the value creation come in two different varieties: embodied or imbedded.

Embodied services are those that are part of the production process itself and are intrinsic ingredients of the final output delivered at the factory gate. These include services that participated directly as inputs in the manufacturing process, such as R&D or quality control. Other are services that support the life of the producing firm, such as in-house legal and accounting services, security and safety, catering of the employees, etc. Often considered as part of the overhead costs, they add to the total cost of producing the output.

Imbedded services are proper to the functioning of global supply chains. They are often identified as the services that “glue” the different actors of the value chain. We find here the logistic, transport and communication services needed to coordinate production and delivery among geographically separated entities and in a just-in-time manner. Increasingly, the imbedded *servicification* of manufacturing is extending to the demand-side. In addition to after-sale services, it is now common to find services such as leasing, service-contracting, and other marketing strategies that aim at increasing the sales and retention of customers. The contribution of these services tends to increase with more complex and sophisticated production in large GVCs. These services can be individually identified, at the difference of embodied services that are complementary to material and factorial inputs in producing the output.

But, as Low (2013) mentions, the distinction cuts across key service sectors and is not always operative. Similar kinds of services such as back-office functions or information technology systems might be embodied or embedded. Moreover, they can be produced in-house or sub-contracted. Arms-length contracted services could be domestically or internationally outsourced.

From the perspective of this essay, all in-house embodied services are part of the sectoral value-added. Arms-length embodied services are accounted for by the input-output data. The situation is more complex for arms-length embedded services. Some may be contracted by the producing unit, and will be accounted for in its production function, others may be paid for by the “ordering party” in a Principal/Client relationship.

### 3) International Outsourcing and Real Relocation

International outsourcing fragments production across countries. The outsourced inputs are now made abroad. International outsourcing, specially through offshoring,<sup>1</sup> enabled to share advanced industrialised know-how with developing countries. Sophisticated industrial products could now be produced and exported by low-wage/labour-abundant countries. This mutation in the nature of comparative advantages — Grossman and Rossi-Hansberg (2006) advanced the term “paradigm shift” — had a series of consequences on the way business managers and economists understood the role and logic of international trade.

Globalisation and the “flattening of Earth” — understood as a drop in monetary and non-monetary trade and transport costs — is both a threat and an opportunity for the manufacturing firm. An opportunity, because it can outsource tasks to more efficient suppliers, taking full “advantage of comparative advantages” (see Box 2).

As Ahn and Choi (2016) mention, the increase of the share of imported intermediate inputs is associated to an increase in firms’ productivity. They identify several channels for such an effect: learning from the superior foreign technology embodied in the inputs, quality-ladder effects from higher quality imports, or variety effects from an enlarged set of available inputs. Yet the same mechanism can compress profits and weaken local industrial ecosystems if domestic suppliers disappear.

Lábaj and Majzlík (2022) conclude that international outsourcing and offshoring was the main driver of deindustrialisation in the G7 developed economies over the 2000-2014 period. The distinction between *domestic* and *international* outsourcing is therefore central: the first alters measurement, the second alters reality. Ruzic (2025) examines how inputs external to the firm displace labour from production. He states that external inputs are closer substitutes for labour than for capital. When labour becomes more expensive relative to the cost of outsourcing, firms substitute towards both capital and external inputs, making the capital-labour ratio more responsive to labour prices than to capital prices.

The effect is expected to be stronger when importing inputs from low-cost labour abundant countries. But the ultimate impact may eventually be an increase in efficiency in the home economy, with a positive impact on exports and employment (Mankiw and Swagel, 2006).

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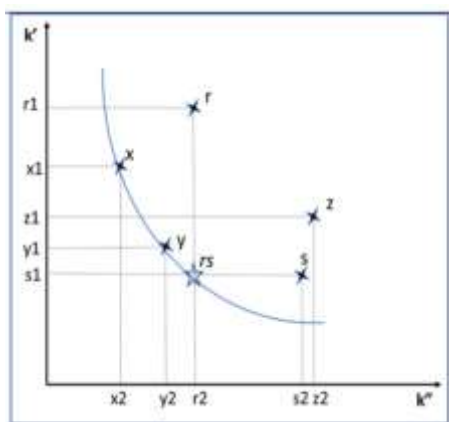
<sup>1</sup> International outsourcing can take two forms. The first one is through arms-length contractual arrangements of the lead-firm with local producers of the foreign country; the second is offshoring, through direct investment of the lead-firm in the foreign country.

## Box 2. Efficiency gains and globalisation

When production in high-cost countries loses competitiveness, outsourcing “inefficient” tasks is often a way to keep the firm afloat by sharing production with firms that are more competitive for these tasks. Figure 1 shows how firms *r* and *s*, that are individually away from the efficiency curve when considering the entire production process, can move to the production frontier by sharing production, focusing on their respective core functions (capital intensive tasks for *r* and labour-intensive ones for *s*).

This efficiency-improving strategy works for both domestic and international outsourcing alike. In its “make-or-buy” strategic review, a firm may, for example, improve its logistics by outsourcing its distributive activities to specialised domestic services providers or decide to stop producing itself some parts and components. It may procure them nationally or internationally, usually via long-term contractual arrangements or, for large multinational enterprises, through outward foreign direct investment and offshoring.

Figure 1 Production sharing and efficiency gains



Note:  $k'$ : labour intensive tasks;  $k''$ : capital intensive tasks. Firms “ $x$ ” ( $x_1, x_2$ ) and “ $y$ ” ( $y_1, y_2$ ) are on the efficiency frontier. By sharing production along their comparative advantages, “ $r$ ” and “ $s$ ” can move to the frontier at point “ $rs$ ” ( $r_2, s_1$ ). No such option is available to inefficient firm “ $z$ ” in the present configuration.

Our own estimations do not point to a significant role of international outsourcing in displacing local suppliers and causing deindustrialisation, at least when considering developed economies as a group (see Box 3 below).

### 3. Accounting Framework: Production Function in an Open Economy

Inter-Country Input-Output (ICIO) data provide a detailed picture of both the supply and demand aspects of a global multi-agent/multi-sector model. The information is sufficiently detailed to allow moving from a standard macro-economic perspective of growth accounting to an aggregated micro-economic approach.

#### 1) Basic Formulation

Manufacturing output  $Q$  is produced with capital  $K$ , labour  $L$ , energy  $E$ , and intermediate goods  $M$ .

$$Q = Af(K, L, E, M) \quad [1]$$

where  $A$  denotes technology and organisational efficiency and  $f(\dots)$  is the production function.

The subset of efficient {KLEM} combinations is conditional to  $A$ , the level of technology available to the firm.  $A$  is a function of past and present time: it denotes the state of art at time  $t$ , but also the past investment in R&D and human capital in the country where the firm operates.

For any given desired level of output, the subset of the efficient {KLEM} combinations in physical terms can be written as:

$$\overline{(K, L, E, M)}_{A,Q} = \left\{ \overline{(K, L, E, M)} \in (K, L, E, M) \mid (f, A, Q) \right\} \quad [2]$$

At the difference of commonly used aggregated growth models,  $K$  is not the stock of productive capital but denotes “capital services”, the flow of productive benefits derived from an asset ( $k$ ) over a period of time.

Moving from the space of efficient production capabilities to the sub-space of financially profitable ones requires affecting a market price to each component of the production function.

$$\hat{Q} = \left\{ f(\widehat{K}_1, \dots, \widehat{K}_K, \widehat{L}_1, \dots, \widehat{L}_L, \widehat{M}_1, \dots, \widehat{M}_J) \mid \overline{(K, L, E, M)}_{A,Q} \right\} \quad [4]$$

Where:  $\widehat{K}_k = p_k K_k; k = 1, \dots, K$ ;  $\widehat{L}_l = p_l L_l; l = 1, \dots, L$  and  $\widehat{M}_j = p_j M_j; j = 1, \dots, J$

$\widehat{K}_k$  covers not only the cost of capital consumption but also the net profit, distributed as a dividend to shareholders or accumulated as a reserve for further investment by the firm. In national accounting practice,  $K$  and  $L$  remunerations are included in the sectoral value-added.

Denoting by  $p_q^c$  the domestic market price of output  $Q$  in country “c”,  $\hat{Q}$  must verify that the unit cost is at or below the prevailing domestic market price in order for production to be economically sustainable.<sup>2</sup>

$$\frac{\hat{Q}}{\overline{Q}} \leq p_q^c \quad [5]$$

In an open market economy, the domestic price of tradeable products is equal to the prevailing international price ( $p_q^w$ ) plus the cost of importing a similar product.

$$p_q^c = p_q^w + (1 + \theta_q^c) \quad [6]$$

With  $\theta_q^c \geq 0$ , the ad-valorem trade cost (tariffs and transportation, plus other monetary transaction costs) of the internationally tradeable product  $q$  in country  $c$ .<sup>3</sup>

Consequently, observed productivity gains may partly stem from relative-price shifts or from intermediate imports substitution. They may reflect behavioural strategies or simply changes in the broader industrial ecosystem context.

Incidentally, this accounting framework is close to the cost of production-based theory of value in the neo-Ricardian model proposed by Shiozawa (2012). The productive capacity of any country is determined by the quantity of labour set of feasible production techniques. It is intuitive in his model that trade costs multiply the possibility of feasible productive techniques. The higher the trade costs, the easier it is for a production technique to remain competitive in its home market. When trade costs decrease, the set of competitive production techniques — at a given domestic wage rate — shrinks. As a consequence, the sub-space of financially profitable technologies is determined by the relationship between technology, wage rate and trade costs.

More recently, the sub-set of feasible production techniques has been restrained by the instauration of administrative norms aiming at pursuing social or environmental goals. In the short run, the introduction of such norms mechanically narrows the set of admissible production techniques.

More generally, our decomposition is not to be interpreted as a behavioural production function. It is a simpler accounting framework compatible with the information provided by input-out tables, which offers a structured descriptive map of how output growth is accommodated. More precisely, this supply-side framework provides

<sup>2</sup> If this wasn't the case, the gross value-added would be negative. In practice, subsidies on production may compensate for the losses. Input-Output accounting includes the net taxes on production, including subsidies.

<sup>3</sup> Non-monetary trade costs include delays, at the border and behind the border administrative tasks, and the perceived risks of dealing with overseas suppliers.

the basis for decomposing observed manufacturing output into contributions from domestic and foreign intermediates and from factorial value-added (Box 3). This decomposition is the basis for Producer Based Accounts (PBA) measuring the input–out insertion of an industry at home and abroad.

### Box 3. Outsourcing and imported deindustrialisation?

What is the role of international outsourcing in the (supposed) deindustrialisation process over the 1995–2019 period? Table 2 classifies the purchase of inputs used by the country’s manufacturing sector in four types, according to their source: domestic (purchased locally), imported from developed countries, imported from developing countries (except China), imported from China (PRC).

*Table 2 Share of selected domestic and imported inputs used by the manufacturing sector, in percent of total output, 1995–2019.*

Inputs <sup>a/</sup>	Year	Sourced from:	
		DVD <sup>b/</sup>	DVG <sup>c/</sup>
Manufactured in DOM	1995	22.1%	20.6%
	2019	18.5%	20.3%
Manufactured in DVD	1995	8.6%	6.2%
	2019	10.1%	4.0%
Manufactured in DVG	1995	1.1%	2.4%
	2019	1.6%	3.1%
Manufactured in PRC	1995	0.1%	0.3%
	2019	1.3%	2.8%
Business Services from DOM	1995	14.6%	13.4%
	2019	15.2%	14.6%
Business Services from DVD	1995	3.4%	2.4%
	2019	5.8%	2.0%
Business Services from DVG	1995	0.5%	0.9%
	2019	0.9%	1.2%
Business Services from PRC	1995	0.0%	0.1%
	2019	0.2%	0.4%
Value added <sup>d/</sup>	1995	32.0%	33.4%
	2019	29.4%	31.1%

Note: In column, the average values observed for all manufacturing sectors in developed and developing countries sectors (simple average of country’s values). a/ DOM stands for “sourced from domestic providers” in the “home country”, DVD/DVG/PRC stand for “imported from developed/developing economies/China”, respectively. b/ Developed economies. c/ Developing economies, including China; d/ From the producing sector itself in the Home country.

*Developed countries* (DVD) reduced by 3.6 ppt their reliance on processing domestic manufactured inputs to increase their imports from other developed economies by 1.5 percentage points (ppt) and from developing economies by 1.7ppt, most of it due to imports from China. If the reliance on domestic business services to procure inputs for the production increased (0.6ppt), it was less than the increase of 2.4ppt observed in the import of such services from other developed economies. This said, the share of domestic providers remains much higher compared to foreign ones. Despite some marginal increase, the contribution of business services imported from developing economies remains negligible.

*Developing countries* (DVG, including China) followed a different trajectory. The purchase of local manufactured inputs remained stable at about 20% in average of the countries. Imports of these inputs from developed countries declined 2.2ppt while purchases from other developing countries increased somewhat (0.7ppt). But the main changes came from the share of intermediate inputs imported from China, which jumped 2.6ppt. The weight of domestic business services increased also (1.2ppt) while the reliance on service providers from developed economies was slightly reduced (–0.4ppt) at the benefit of China (0.3) and other developing countries (0.2). As for developed countries, the bulk of business services used for producing a manufacturing output is sourced from local providers.

These changes reflect an increased reliance in developed economies on outsourcing, either domestically with an increase in the reliance of business services, or internationally. A race to the bottom cannot explain this trend, because we observed an increase in North–North trade in intermediate inputs while purchases from low-cost labour abundant countries (except China) remained low. Most importantly, the data indicate that outsourcing “explains” only slightly more than 2ppt of the decrease in the share of sector’s own value-added per unit of output.

## 2) Demand-Side Constraints and Effective Demand

Global demand is often seen as the new constraint facing low-income developing economies when trying to follow the export-led path to industrialisation, or by developed countries' firms trying to diversify out of a saturated domestic market. This constraint is usually referred to as the "fallacy of composition". These limitations result from the confrontation of fast-growing global industrial output, especially after China's integration into the WTO (Mayer, 2003) with slow-growing global demand due to the low income-elasticity of demand for such products in middle- and upper income countries.

This section defines two indicators aiming at measuring the strength of effective demand for domestic industrial products on both the home and the foreign markets.

### i. Aggregate and effective demands

Let's define Aggregate domestic demand ( $Add_{mh}$ ) for manufactured product as the total demand for industrial goods "m" in an economy "h". We don't consider exports for the time being.

$$Add_{mh} = IC_{mh} + FD_{mh} \quad [7]$$

Where:

$IC_{mh}$  and  $FD_{mh}$  are the value of intermediate and final goods required by the Home country  $h$  agents (firms, households and public administrations). These products can be locally produced or imported. [7] can be directly extracted from the IO table.

We define Effective domestic demand ( $EdF_{mh}$ ) as the domestic demand for domestically produced final goods and services. Effective domestic demand is equal to Aggregate demand minus imports of "m" goods for intermediate and final uses ( $IM_{mh}$ ).

$$EdF_{mh} = Add_{mh} - IM_{mh} \quad [8]$$

*Total effective demand should include exports:*  $EdF_{m,h}$  represents only the domestic part of the demand addressed to the home manufacturing sector. To obtain the total effective demand ( $EF_{mh}$ ) for domestically produced "m" products, we must add the foreign demand addressed to the Home producers ( $EX_{mh}$ ).

$$EF_{mh} = EdF_{mh} + EX_{mh} = Q_{mh} \quad [9]$$

### ii. Indicators of Demand Strength and Orientation

From a demand-driven perspective,  $EF_{mh}$  is "effective" because it translates into actual purchases of locally produced products "m", influencing domestic production levels and employment.

Let's note,

$$\Omega = EF_{mh}/Add_{mh} \quad [10]$$

With  $\Omega$ , the share of total demand for home product "m" met by domestic production.

$Add_{mh}$  is a function of the domestic income. The dynamic of demand for products "m" is usually expressed in terms of income elasticity of demand. It measures how much the quantity demanded of a good or service changes in response to a change in consumer income. As long as domestic and imported products are substitutes,  $\Omega$  is also analysed in terms of relative price elasticity.

In a closed economy or when exports and imports of "m" balance exactly,  $\Omega = 1$ ; and  $\Omega < 1$  when country "h" is a net importer or  $\Omega > 1$  when it is a net exporter.

The purpose of  $\Omega$  in our analysis is to capture the strength of the domestic demand, governed by income and price elasticities. But exports may be as effective as domestic demand for driving output and be a marker of comparative advantages.

A natural complement is therefore to measure the evolution of  $\zeta$ , the share of output that is exported.

$$\zeta = EX_{mh} / EF_{mh} \quad [11]$$

$\Omega$  and  $\zeta$  can be computed for each {country-sector-year} industrial triplet using ICIO data: Intermediate and final demand (domestic and foreign) for domestic output; imports and exports by product and origin.

- Dynamic equilibration

As it is explicit in the title of the pioneering Leontief (1941) paper, input-output models are a representation of an equilibrium between supply and demand at a given point in time. In the Leontief model, any change in the demand for outputs for one given industry will fully be passed on backwardly to other industries, leading to proportional changes in their demand for each intermediate and primary input.<sup>4</sup>

In our case, the demand for both final and intermediate goods that is addressed to the domestic sector “*m*” is the sum of the domestic and foreign demand for home products “*mh*”

$$Q_{mh} = EF_{mh} = \Omega \text{Add}_{mh} \quad [12]$$

$\text{Add}_{mh}$  is directly (final demand) or indirectly (intermediate goods) a function of the domestic income (GDP).

The dynamic of final demand for products “*m*” is usually expressed in terms of income elasticity of demand. It measures how much the quantity demanded of a good or service changes in response to a change in consumer income. Demand for intermediate products is endogenous in this model and determined by the (fixed) technical coefficients of the production function [4]. Intuitively, (as in Rowthorn and Ramaswamy, 1999), there is a relationship between the inverted-U pattern in manufacturing’s share of GDP that we identified in Vol. I and the household’ preferences: as income rises, the income elasticity of demand for manufactured goods declines (an Engel-type mechanism), leading to a saturation of demand and a subsequent shift of both production and consumption toward services.

In an open economy, exports, on the supply side, and imports, on the demand one, complete the equation. As long as domestic and imported products are substitutes, imports are usually analysed in terms of price elasticity.<sup>5</sup>

Thus, when it comes to manufacturing in mature or maturing economies, the static equilibrium [12] hides a systemic contradiction from a dynamic perspective.

- $dQ_{mh}/dt$  seen from the supply side as in [4] benefits from rapid technological progress.
- $d\text{Add}_{mh}/dt$  at the contrary, is constrained by Engel’s law that predicts an income-elasticity close or lower than 1 when domestic demand is saturated.

In a mature economy, sustaining industrial production above a constrained (saturated) domestic demand in order to avoid deindustrialisation implies increasing  $\zeta$ , the share of output that is exported. But  $\zeta$  itself is constrained by the “fallacy of composition”: not all mature or maturing economies can export their way out of deindustrialisation, especially when the global market is also conquered by large low-cost emerging economies. The

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<sup>4</sup> This is only a reasonable assumption when supply is price-inelastic (Oosterhaven, 2025); for example, when the economy is below full capacity utilisation.

<sup>5</sup> When products are traded internationally and are differentiated by country of origin, the Armington elasticity are used to estimate the substitution between comparable products of different countries.

issue is more complex for smaller low-to middle income countries. Even if the income elasticity of demand for manufactured products remains high, the domestic producers may not be competitive for a series of structural reasons, ranging from small size of both market and firms, inadequate infrastructure, adverse business environment and overvalued exchange rate.

With the passing of time, the economic and business environment changes, coerced by the availability of new technology and modifications in income, consumer preferences, business models and prices. Since the late 1980, this environment has been deeply affected by the growing interdependence of the world's economies, cultures, and populations, brought about by cross-border trade in goods and services, technology, and flows of investment, people, and information.

The subset of feasible technologies  $A_q$  is expected to be wider for large firms, as heterogenous firms do not respond equally to trade (Melitz, 2003). Irrespective of firm size, enterprises located in advanced economies are also expected to have access to a wider range of technologies. Industrial firms in developing countries may have more difficulties to adapt to the structural shift in global manufacturing activity linked to globalisation. Not only lower prices reduce profit margins and future investments, but domestic consumers' preference may shift towards imported products, considered as being of better quality or expressing a higher social status.

$dQ_{mh}/dt$ ,  $\Omega$  and  $\zeta$  must be considered jointly when asserting deindustrialisation: a country can experience apparent deindustrialisation according to  $dQ_{mh}/dt$  because domestic effective demand ( $\Omega$ ) weakens, even if its export orientation ( $\zeta$ ) rises.

#### 4. Empirical Framework and Data

The analysis uses OECD's Inter-Country Input-Output (ICIO) tables for 1995–2019, expressed in current USD. Complementary deflators derived from UNIDO and national sources support robustness checks. Economies are grouped by development level and their industries are disaggregated by technology intensity (high, medium, low tech). See Annex for the list and classification of industries and countries.

##### 1) The Measurement Framework

In the simple case of a two-country, two-product (manufactured goods and services) model, the table is structured as in Table 3.

Table 3 Simplified structure of an inter-country input-output table

Origin <sup>a</sup>		Home		Foreign		Final demand		Output
		Industry	Services	Industry	Services	Home	Foreign	
Home	Industry	$Z_{hm,hm}$	$Z_{hm,hs}$	$Z_{hm,fm}$	$Z_{hm,fs}$	$FD_{hm,h}$	$FD_{hm,f}$	$Q_{hm}$
	Services	$Z_{hs,hm}$	$Z_{hs,hs}$	$Z_{hs,fm}$	$Z_{hs,fs}$	$FD_{hs,h}$	$FD_{hs,f}$	$Q_{hs}$
Foreign	Industry	$Z_{fm,hm}$	$Z_{fm,hs}$	$Z_{fm,fm}$	$Z_{fm,fs}$	$FD_{fm,h}$	$FD_{fm,f}$	$Q_{fm}$
	Services	$Z_{fs,hm}$	$Z_{fs,hs}$	$Z_{fs,fm}$	$Z_{fs,fs}$	$FD_{fs,h}$	$FD_{fs,f}$	$Q_{fs}$
	Value added <sup>b</sup>	$Y_{hm}$	$Y_{hs}$	$Y_{fm}$	$Y_{fs}$			
	Output <sup>c</sup>	$Q_{hm}$	$Q_{hs}$	$Q_{fm}$	$Q_{fs}$			
	Labour	$L_{hm}$	$L_{hs}$	$L_{fm}$	$L_{fs}$			

Note: a/ Production is in column, uses are in line; for simplicity, other sectors (agriculture, mining) are omitted; b/ net taxes on production (taxes less subsidies) are included in value-added. c/: In I-O models, "Output" is usually noted "X", which may confuse macroeconomists. We use "Q" instead.

Our starting point is equation [4], comparing the structure of the production function at two different points of time. We have to adapt the theoretical equation in order to match data availability. In particular, we cannot separate the remuneration of Labour and Capital factorial services from the value-added data.

Using standard Input-Output notations, the accounting decomposition of value of the manufacturing production into the cost its intermediate and factorial inputs at time “t” is:

$$Q_{hm}^t \equiv Z_{hm,hm}^t + Z_{hs,hm}^t + Z_{ho,hm}^t + Z_{f,hm}^t + VA_{hm}^t \quad [14]$$

With, in current values:

- $Q_{hm}^t$  : manufacturing output (hm: Home manufacturing sector)
- $Z_{hm,hm}^t$  : manufactured inputs from other Home manufacturing suppliers
- $Z_{hs,hm}^t$  : business services input, from Home suppliers
- $Z_{ho,hm}^t$  : other inputs from Home suppliers (primary goods, other services)
- $Z_{f,hm}^t$  : all foreign intermediate inputs
- $VA_{hm}^t$  : factorial inputs (Value-Added)

## 2) Growth Decomposition

Changes in manufacturing production between years “t” and “t+1” can be expressed as:

$$\eta = (Q_{hm}^{t+1} - Q_{hm}^t) / Q_{hm}^t = \sigma + \theta + \mu + \varphi + \nu \quad [15]$$

With the following variations, normalised by the value of output in time “t”:

- $\sigma = (Z_{hm,hm}^{t+1} - Z_{hm,hm}^t) / Q_{hm}^t$  relative contribution of intra-sectorial use of home inputs
- $\theta = (Z_{hs,hm}^{t+1} - Z_{hs,hm}^t) / Q_{hm}^t$  relative contribution of the use of home business services inputs
- $\mu = (Z_{ho,hm}^{t+1} - Z_{ho,hm}^t) / Q_{hm}^t$  relative contribution of intra-sectorial use of home other inputs
- $\varphi = (Z_{f,hm}^{t+1} - Z_{f,hm}^t) / Q_{hm}^t$  relative contribution of all imported inputs
- $\nu = (VA_{hm}^{t+1} - VA_{hm}^t) / Q_{hm}^t$  relative contribution of Value Added

We can further disaggregate  $Z_{f,hm}^t$  into its three components ( $f_m$ ,  $f_s$  and  $f_o$ ) to calculate the substitution between home and foreign products, business services or other inputs.

## 3) Interpretation and Caveats

This analysis relies on input-output data measured at current prices, which introduces important interpretative limitations. Performance is proxied by output in nominal terms, potentially conflating real productivity gains with price-driven effects such as exchange rate fluctuations or shifts in commodity price.

While input composition reflects actual market transactions and thus captures meaningful substitution patterns, it is sensitive to price movements. For instance, a decline in the share of foreign inputs may reflect not a reduction in quantity, but a drop in import prices. Consequently, observed associations between input structure and performance may partly reflect price dynamics rather than underlying technological changes.

These caveats do not invalidate the analysis but underscore the need for cautious interpretation. The results should be viewed as exploratory correlations within the constraints of current-price data, rather than definitive causal inferences. Actually, the supply-demand analysis based on input-output data does not advance a structural model of (de)industrialisation. Instead, we combine accounting decompositions and classification tools to map observed trajectories, before confronting them with effective demand constraints.

# 5. Results: Long-Term and Sub-Period Trends

## 1) Global Patterns, 1995–2019

In this section, we compare for developed and developing countries, the results obtained for our growth decomposition exercise (Table 4).

Five stylised facts summarise the worldwide evolution of manufacturing:

- 1) *Developing economies expanded low-tech industries more rapidly.* As expected from Heckscher-Ohlin's theory of comparative advantages in international trade, developing countries increased their Low-Technology industrial production much more (4.3%) than developed countries (1.4%). Yet several ones achieved unexpectedly — at least according to this theory — strong growth in high-tech segments (mostly through integration into global value chains, as we shall see later).
- 2) *Developed economies preserved output levels, especially in high-tech industries.* Nevertheless, the results indicate that developing countries as a group are catching-up with developed ones. This provides some support to the hypothesis of (unconditional?) convergence in manufacturing industry.
- 3) *Value-added remained the largest single contributor to output growth,* followed by home-manufacturing inputs. The data do not provide a definite answer to the analytical question of possible substitution of some in-house embodied services inputs, previously classified as manufacturing and progressively outsourced to the business sector. It could be the case in North America, as the use of domestic business services rose twice as much as the use of domestic manufacturing inputs. But it is not so explicit in the case of EU15.
- 4) *Regional divergence increased.* Asia surged ahead but Latin America lagged. Thus, the evidence challenges the notion of unconditional convergence in manufacturing development. Europe splits between a lagging core (EU15) and a higher-growth/catching-up regional periphery (EU13). More than divergence, this process shows convergence within the EU region.
- 5) *The 1995-2007 years of hyper-globalisation was also a time of high growth for most countries,* while the “new-normal” period that followed the global financial crisis of 2008-2009 was also one of slow-growth and increased heterogeneity (see next section).

Table 4 Contribution of the various components of the production function to industrial output, 1995–2019 nominal variations by technology content and level of development.

1995_2019	DVD	DVG	DVG/DVD	DVD	DVG	DVG/DVD	DVD	DVG	DVG/DVD
	High-Technology			Medium-Technology			Low-Technology		
<b>Var Output(mean)</b>	<b>2.75</b>	<b>5.79</b>	<b>2.1</b>	<b>1.99</b>	<b>4.82</b>	<b>2.4</b>	<b>1.39</b>	<b>4.28</b>	<b>3.1</b>
<b>FromH_Manuf(mean)</b>	0.46	1.59	3.4	0.32	1.13	3.5	0.18	0.83	4.7
– fromH_High(mean)	0.26	0.98	3.8	0.06	0.22	3.6	0.02	0.07	4.0
– fromH_Med(mean)	0.10	0.39	4.1	0.18	0.62	3.5	0.04	0.10	2.5
– fromH_Low(mean)	0.11	0.22	2.0	0.08	0.29	3.7	0.12	0.67	5.5
<b>FromH_BSect(mean)</b>	0.35	0.72	2.1	0.27	0.62	2.3	0.21	0.51	2.4
<b>FromH_OtherSect(mean)</b>	0.11	0.40	3.6	0.19	0.67	3.6	0.18	1.03	5.7
<b>FromF_Manuf(mean)</b>	0.68	0.93	1.4	0.33	0.55	1.7	0.14	0.35	2.6
– fromF_High(mean)	0.49	0.58	1.2	0.11	0.18	1.6	0.03	0.04	1.7
– fromF_Med(mean)	0.12	0.22	1.8	0.16	0.22	1.4	0.04	0.04	1.1
– fromF_Low(mean)	0.07	0.12	1.7	0.06	0.15	2.4	0.07	0.27	3.6
<b>FromF_NonManufSect(mean)</b>	0.33	0.27	0.8	0.23	0.27	1.2	0.27	0.31	1.2
<b>VarValue-Added (mean)</b>	0.82	1.89	2.3	0.66	1.58	2.4	0.41	1.25	3.0

Note: Simple average of countries' cumulative nominal variations over the 1995–2019 period, divided by the respective output value in 1995. DVD stands for developed countries, DVG stands for developing countries, including China; H stands for Home inputs, F for foreign ones (imported).

Source: Author, based on OECD data.

The results confirm that (de)industrialisation is not a uniform process but reflects differing combinations of outsourcing intensity and demand conditions.

## 2) The Post-Crisis Slowdown

Comparing 1995–2005 and 2010–2019 reveals a clear deceleration in the post-GFC period. A simple disaggregation by development status (not shown here) would show that developed countries experienced a marked fall in the contribution of value-added ( $\rho$ ), not compensated by more inputs being outsourced to domestic business

services (tertiarization of manufacturing production), while foreign-input shares ( $\varphi$ ) remained high. This is consistent with symptoms of deindustrialisation. The EU results show also the large impact of increased regional integration after 1995, with higher reliance on imported inputs. The trend was particularly strong for EU13 countries that joined the EU in 2004 or later. The impact fades away after the 2008-2009 crisis, more so in the EU15 but also in the EU13.

As for developing economies, they maintained their growth mainly through a reliance on domestic intermediates ( $\sigma$ , in equation 15) rather than services ( $\theta$ ). This pattern suggests that post-crisis recovery in developing countries relied more on existing industrial capacity than on new technological upgrading along the “smile-curve”. This said, this is only tentative as our data do not measure the share of services that are produced within the industry itself.

Yet, the developed vs. developing dichotomy is a rather crude one. Not all developing countries have benefitted equally from this trend. If China registers double digit increase in its domestic production, other regions, such Latin America, have been less dynamic. Sub-Saharan Africa, a region that was expected to suffer from premature deindustrialisation according to Rodrick (2016), seems to have avoided this trap to display a modest resilience (a case of “thin industrialisation”). We observe in particular a rapid growth of the Value-Added, a proxy for employees’ remuneration.

Here again, there is a large heterogeneity within each sub-region. This heterogeneity calls for more multifaceted characterisation of individual countries performance. This is the objective of the following section.

## 6. Prototyping Performer vs. Non-Performer

In the following section, we investigate the characteristics that may distinguish top and bottom performers and eventually explain successes and failures. We follow a general-to-specific exploratory approaches starting with a simple split of Top and Bottom performers before looking at more complex clustering methods. After factoring-in the demand dimension, the section concludes by looking at the way industries transitioned during the 1995–2019 period.

### 1) Differentiating Top vs. Bottom Performers

We proceed in two steps. In the first one, we split countries into groups of Top or Bottom achievers over the 1995–2019 period. Then we use discriminant analysis to identify what are the most salient characteristics of their respective production function. In a second step, we enlarge the data analysis to include some additional contextual indicators and look at how these data help categorising sectors in specific clusters that may have followed different growth patterns, some more successful than others.

#### i. Classification based on the sole production function

Countries are ranked by cumulative manufacturing-output real growth over the 1995–2019 period (see Table 10 and Table 11 in Annex). The results are presented in Table 5.

There are several ways of looking at these data:

- (i) comparing Top and Bottom performers for each industry within the same development classification is a first option. This will be covered in the next section where expand the analysis to other variables;
- (ii) comparing the Top performers in developing countries (Top-DVG, the rising stars) with the slow-growing mature bottom performers (Bottom-DVD) that are typical of legacy industrialisation.

Our main findings from the (ii) North-South perspective are:

- *High-Tech industries*: High reliance of Top-DVGs on same-country outsourcing, especially for high-tech inputs and lower reliance on imported High-Tech inputs. In contrast, the Bottom-DVD industries are relying much more extensively on outsourcing non-industrial tasks to the business services sector. There is no difference in the contribution of sectoral value-added, even if developed countries' factories outsourced more inputs outside of their own industrial sector.
- *Medium-Tech industries*: A similar pattern is observed. Top-DVGs outsource a much larger proportion of their inputs to same-sector domestic industries than the Bottom-DVDs in mature economies. The latter, in contrast, rely twice as much on domestic business services inputs and on imported inputs from foreign High-Tech and Medium-Tech. The contribution of value-added is also similar in both developed and developing country industries, despite their differences in the use of material inputs.
- *Low-Tech industries*: value-added generated by Top-DVG industries contributes a much lower percentage to total output growth than their Bottom-DVD counterparts. One cannot conclude that those low-tech industries in high labour-cost countries adopted labour-saving technologies (a quantity effect) or that wages increased much faster in successful developing countries (a nominal effect). There is a much higher reliance of developed countries industries on imported commodities, even if many top-performers in developing countries are not located in natural resources rich economies.
- **Endogenous cross-sectoral dynamism**: fast-growing industries in developing countries were consistently able to source intermediate inputs at home. This indicates that industrial growth in top-performing countries was most probably relatively equilibrated across sectors and self-reinforcing thanks to a strong agglomeration effect. This is an important result as it points to the role of external effects, when separate industries benefit from belonging to a dense domestic industrial network (economies of agglomeration).

Table 5 Top and Bottom performers growth decomposition, 1995-2019

	V <sub>atVA</sub>	H_High	H_Med	H_Low	H_Business Sect	H_Other Sects <sup>a</sup>	F_High	F_Med	F_Low	F_Other sectors <sup>b</sup>
<b>High Technology industries</b>										
DVD:										
-Bottom	32.5%	5.5%	2.4%	3.6%	22.6%	6.6%	10.8%	4.0%	2.6%	9.3%
-Top	30.1%	11.0%	4.0%	4.2%	10.5%	2.3%	18.7%	4.3%	2.5%	12.6%
-Average <sup>c</sup>	31.7%	8.7%	3.4%	3.7%	16.5%	5.3%	13.7%	3.6%	2.4%	11.1%
DVG:										
-Bottom	29.0%	10.3%	4.7%	3.4%	17.6%	7.7%	14.6%	3.7%	1.7%	7.3%
-Top	32.6%	14.9%	9.4%	4.4%	12.4%	7.4%	8.7%	4.3%	2.1%	3.7%
-Average <sup>c</sup>	35.1%	12.7%	5.8%	4.2%	14.1%	6.5%	10.8%	3.0%	1.9%	5.7%
<b>Medium Technology industries</b>										
DVD:										
-Bottom	30.0%	6.9%	1.4%	0.4%	21.0%	9.9%	7.0%	11.3%	2.3%	9.8%
-Top	34.4%	3.2%	10.4%	3.6%	12.2%	7.9%	5.4%	8.6%	2.9%	11.4%
-Average <sup>c</sup>	29.8%	4.0%	6.9%	2.8%	15.9%	12.7%	5.4%	8.8%	2.5%	11.0%
DVG:										
-Bottom	28.8%	5.0%	13.8%	4.0%	12.9%	16.9%	5.2%	5.6%	1.7%	6.1%
-Top	30.3%	4.4%	13.5%	7.1%	11.6%	15.9%	3.7%	4.2%	4.3%	5.0%
-Average <sup>c</sup>	33.8%	4.8%	12.1%	5.3%	12.8%	13.7%	4.0%	4.7%	2.7%	6.1%
<b>Low Technology industries</b>										
DVD:										
-Bottom	18.1%	1.0%	2.7%	0.2%	25.3%	10.5%	2.0%	5.3%	-0.2%	35.0%
-Top	29.5%	1.9%	3.4%	10.9%	14.5%	12.6%	2.5%	2.8%	5.9%	16.0%
-Average <sup>c</sup>	25.6%	1.2%	3.3%	6.1%	18.7%	12.4%	1.9%	3.5%	4.1%	23.2%
DVG:										
-Bottom	28.8%	5.0%	13.8%	4.0%	12.9%	16.9%	5.2%	5.6%	1.7%	6.1%
-Top	30.3%	4.4%	13.5%	7.1%	11.6%	15.9%	3.7%	4.2%	4.3%	5.0%
-Average <sup>c</sup>	33.8%	4.8%	12.1%	5.3%	12.8%	13.7%	4.0%	4.7%	2.7%	6.1%

Note: Bottom and Top performers: real growth of output for first and third quartiles at constant 2015 prices. Production function decomposition in current USD.

a/ Agriculture, mining and other services; b/ Agriculture, mining and all services; c/ Average over the whole sample. DVD stands for developed countries, DVG stands for developing countries, including China

Source: Author, based on OECD and UNIDO data.

## ii. Identifying the main discriminant factors

The top quartile (“Top performers”) and bottom quartile (“Bottom performers”) are compared using the decomposition shares ( $\sigma$ ,  $\theta$ ,  $\mu$ ,  $\varphi$ ,  $\rho$ ) and demand indicators ( $\Omega$ ,  $\zeta$ ).<sup>6</sup> In order to identify the most salient characteristics that separate both groups, we apply a linear discriminant analysis (LDA) to each industrial subgroup defined by similar {technology, development status}. LDA produces two discriminant functions (LD1 and LD2) that map on a two-dimension graph the industries data according to their characteristics (Top, Bottom and Inliers).

The LDA results reveal distinctive discriminant characteristics for each type of industry and each group of countries. An important qualifying indicator is the capacity of LDA to reclassify properly the top and bottom performers based on LD1 and LD2 discriminant functions. The classification remains tentative, as the LDA does not perfectly reclassify back all cases. The “confusion matrix” shows the capacity of the LDA to correctly reclassify all cases. The better the reclassification, the higher the homogeneity of industries.

We present here the factors that were the most discriminant, positively or negatively. These are usually determining LD1, while LD2 captures orthogonal variations likely tied to sectoral composition and input sourcing strategies. The higher the absolute value of the coefficient in the orthogonal discriminant functions LD1 or LD2, the more important its discriminatory power.

Table 6 Discriminant functions identifying Top and Bottom performers, 1995-2019

Development status:	DVD		DVG		DVD		DVG	
Industries:	High Technology industries				Medium Technology industries			
Discriminant factors:	LD1	LD2	LD1	LD2	LD1	LD2	LD1	LD2
VarVA	-6.0	2.9	14.8	8.6	0.5	5.9	13.7	2.0
fromH_High	-2.1	1.0	18.1	11.2	-13.5	2.6	27.1	-7.0
fromH_Med	3.4	-6.2	36.1	20.6	-0.2	6.4	12.5	10.6
fromH_Low	-3.1	23.5	6.5	5.3	21.4	-12.7	44.8	14.8
fromH_BSect	-19.4	6.5	-3.6	18.5	-8.0	-4.9	17.3	8.6
fromH_OtherSect	-7.3	-9.6	10.2	15.8	-0.8	-2.0	16.2	11.0
fromF_High	0.4	3.5	-1.5	16.6	-5.4	16.7	-43.7	29.6
fromF_Med	3.0	20.8	15.6	33.3	-2.7	1.3	28.8	11.0
fromF_Low	-29.7	-10.6	60.4	20.5	15.6	9.8	54.6	7.5
Explained Variance	93%	7%	80%	20%	79%	21%	74%	26%
	Low Technology industries							
Discriminant factors:	LD1	LD2	LD1	LD2				
VarVA	3.3	-2.4	4.7	-0.8				
fromH_High	-4.2	22.5	-33.1	-82.5				
fromH_Med	21.2	-11.9	42.7	17.6				
fromH_Low	2.9	7.4	8.0	6.4				
fromH_BSect	-8.8	-2.5	7.1	10.1				
fromH_OtherSect	6.1	-1.3	15.7	1.8				
fromF_High	23.1	60.8	-17.4	73.3				
fromF_Med	-2.0	-2.9	25.3	55.8				
fromF_Low	4.8	-13.4	30.2	-0.9				
Explained Variance	80%	20%	68%	32%				

Note: DVD and DVG: developed and developing countries (including China), respectively. Bottom and Top performers based on first and third quartile value of industries’ real growth of output at constant 2015 prices. Discriminant factors based on the production function decomposition at current prices.

<sup>6</sup> We dropped from the analysis the variation in imported inputs from non-industrial sectors to avoid the degenerative case of perfect collinearity.

Table 6 presents the discriminant functions for each industry group, distinguishing developed and developing economies. In a two-dimensional representation, LD1 would lie on the horizontal axis and LD2 on the vertical axis. Top performers are generally associated with positive coefficients on both axes, although the imperfect reclassification by the LDA implies that not all of them would fall in the North-East quadrant. In most cases LD1 explains the bulk of the variance, ranging from 93% to 68%.

Both groups of countries remain heterogeneous. Among developed economies, most bottom performers are mature high-income economies with legacy industrial structures, while top performers are mainly found in EU13 and other European and Central Asian transition economies. Among developing economies, bottom performers are largely natural-resource-rich countries in Africa and Latin America, whereas top performers are concentrated in labour-abundant East and South Asia.

**High-technology industries.** In developed economies, the bottom-performer group is heterogeneous: only 55% of cases correctly reclassified by the LDA, compared with 70% for top performers. The main discriminating factors suggest that faster-growing industries rely less on imported low-tech inputs and domestic business services. The negative coefficient associated with outsourcing to home business services is counter-intuitive as it is usually considered as a marker of efficient “à la Porter” management. To verify whether this reflects the coexistence of different development regimes, ex-transition economies were removed from the sample. The negative correlation remained across all industry groups. In high-tech legacy industries, the average share of home business-services inputs declines from 0.23 for bottom performers to 0.10 for top performers. One possible interpretation is that outsourcing to business services reflects cost-cutting strategies in weaker firms, while stronger firms tend to internalise key capabilities. However, this interpretation remains speculative, as firm-level strategies cannot be observed in aggregated input-output data.

In developing economies, the results are more homogeneous: 89% of bottom performers and 75% of top performers are correctly reclassified. Successful industries tend to rely more on imported low-tech inputs and on domestic suppliers of medium-tech inputs.

**Medium-technology industries.** In developed economies the classification is weak, particularly for top performers, of which only 40% are correctly reclassified (64% for bottom performers). The results tentatively indicate that successful industries increased their reliance on home-based and imported low-tech inputs, while greater use of domestic high-tech inputs or business services is associated with negative coefficients. Given the limited discriminatory power, these findings should be interpreted cautiously.

The diagnostic is also tentative for developing economies, where only about half of the cases are correctly reclassified. In this group, successful industries tend to rely more on domestically produced and imported inputs from low-tech sectors. Imports of foreign high-tech inputs carry a strong negative coefficient, while the use of domestically produced high-tech inputs is associated with better outcomes, suggesting complementarities between domestic high- and medium-technology activities.

**Low-technology industries.** In developed economies the model correctly classifies about half of the cases (50% of top performers and 55% of bottom performers). Top performers tend to rely more on imported high-tech inputs and on domestic medium-tech inputs. The LD2 component suggests that the contribution of domestic high-tech inputs is particularly important in transition economies, where low-tech industries upgraded their production technologies after integration into the global economy.

In developing economies, the predictive power is similarly limited (around half of the cases correctly classified). The results suggest that successful low-tech industries rely more on domestic and imported medium-tech inputs, while greater use of imported low-tech inputs also contributes positively. By contrast, increasing the use of high-technology inputs—whether domestic or imported—carries a negative weight.

Across all technological sub-groups in both developed and developing economies, sectoral value-added never appear to be a strongly discriminant factor, with the possible exception of high-tech industries in developing countries. Thus, it appears that successful industries were those that were able to successively insert themselves into domestic and foreign supply chains by increasing their reliance on procuring inputs to other home or foreign firms. *Servicification* of production through outsourcing manufacturing and business services to specialised firms was not a factor of success.

The customary division of countries by development or by regional status did not lead to clear-cut results. Classifying performers based only on growth during the 1995-2019 period ignores other characteristics that may have been important. According to the convergence hypothesis, it was probably easier for laggard industries that started with a relatively low industrial basis in 1995 to register higher growth than for countries that had already a well-established industrial sector at that time. The next section will examine more in details this effect and the role of other contextual variables.

## 2) Beyond Standard Classifications: Extended Production Profiles

In this section, we go beyond this standard classification based on supply and demand variables, to investigate if there exists some underlying country grouping based also on additional macroeconomic and sectorial variables. We also include variables describing the initial situation in terms of productivity. As mentioned by Majzlíková (2024), manufacturing industries exhibit strong unconditional convergence in labour productivity. We can therefore expect that industries starting further away from the labour productivity frontier in 1995 experienced faster productivity growth.

In addition to the variables used in the previous section, the analysis includes also a selection of contextual variables:<sup>7</sup> share of sectoral Value-Added in Output in time “t1” ; variation over time of the share of sectoral value-added in country’s GDP; GDP per employed worker at T1 (whole economy); industrial Value-Added per employee in T1; variation of the aggregated manufacturing deflator relative to GDP deflator; variation of the share of aggregated manufacturing value-added in total GDP at constant prices; variation of the aggregated manufacturing deflator relative to the GDP deflator; change in the share of nominal manufacturing value-added in GDP at current price.

To identify industrialisation patterns, we used a particular variant of cluster analysis, the Fuzzy K-Means clustering, to accept the fact that there is probably no clear-cut partition in our data. In order to have some more granular results without blurring too much the analysis, we fix the number of clusters to 5.

The resulting clusters over the 1995-2019 period are presented in Annex Table 12. The associated production function prototypes are shown in Table 7. Several countries are consistently classified together across all three technological categories. This is particularly evident among 19 legacy industrial economies, which are systematically grouped into clusters High\_4, Medium\_2, and Low\_3. These shared assignments suggest a stable structural pattern across sectors, typical of mature industrial countries.

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<sup>7</sup> Values are estimates based on data at current prices, unless specified. I thank L. Artige for suggesting several of these indicators.

Table 7 Production function decomposition by technological cluster, 1995–2019 variations (current prices)

Clusters <sup>c</sup>	CAGR (%)		Contribution to the growth of output, in percentage points <sup>a</sup>									
	Output	V-A	Domestic origin <sup>b</sup>						Imported <sup>b</sup>			
			V-A	High	Med	Low	BServ.	Others	High	Med	Low	Others
High_2	12.45	3.47	27.8	18.8	5.7	3.8	9.9	4.3	15.3	5.2	2.8	6.4
High_3	6.91	2.55	36.9	6.9	6.7	4.0	14.5	10.6	8.1	2.7	1.7	7.8
High_1	2.08	0.69	33.1	11.6	5.7	3.8	15.3	6.6	11.9	3.4	2.1	6.6
High_5	1.74	0.65	37.4	9.6	4.8	3.6	14.9	3.6	13.1	3.5	1.9	7.6
High_4	1.24	0.41	33.0	13.2	3.2	3.2	16.7	3.7	11.4	2.0	2.2	11.5
Med_3	8.59	2.88	33.6	4.1	12.4	6.0	12.1	11.5	4.1	5.3	3.8	7.0
Med_1	2.48	0.99	40.0	4.4	9.2	4.4	13.1	11.2	4.0	5.4	2.2	6.1
Med_5	2.46	0.75	30.3	4.3	7.7	5.1	14.8	19.6	3.9	4.6	2.7	7.0
Med_4	2.33	0.74	32.0	4.8	12.9	4.4	12.9	9.7	5.4	7.5	2.4	8.0
Med_2	0.81	0.18	22.6	2.8	11.2	2.7	17.6	15.1	5.0	7.9	2.1	13.1
Low_4	7.09	1.94	27.3	2.0	2.8	16.4	11.1	26.3	1.2	0.7	5.2	7.0
Low_5	4.16	1.33	32.0	0.7	1.8	12.8	12.1	14.6	1.6	2.8	9.8	12.0
Low_1	2.78	1.05	37.8	0.9	1.6	12.2	12.8	18.6	1.0	1.1	4.5	9.5
Low_2	1.15	0.33	28.4	1.4	2.6	12.1	17.1	20.0	1.9	2.0	3.9	10.5
Low_3	0.72	0.16	22.6	1.0	3.4	6.0	18.3	13.1	0.9	1.8	5.3	27.6

Note: a/ based on the “prototype” identified for each cluster; b/ V-A: same-sector value added, High/Med/Low: inputs purchased from High-Tech/Medium-Tech/Low-Tech industries; c/ Clusters of each technological industry are ranked by decreasing variation of production over the 1995–2019 period.

The growth in value-added is systematically lower than output growth. A simple polynomial regression on Annex Table 7 results shows that the increase in value-added slows down the faster is the output growth.<sup>8</sup> The slow-down is particularly pronounced for Low-tech industries.

*-High-Tech clusters* exhibit the widest range of outcomes. Some developing and transition economies achieved rapid growth through increased sectoral value-added and integration into global supply chains. In contrast, high-income legacy industrialisers tended to experience stagnation, often accompanied by a shift toward service-intensive production functions. This shift had to be anticipated in post-industrial societies and may not be a sign of pathologic deindustrialisation.

*-Medium-Tech clusters* show intermediate performances. Growth was generally more modest, with some countries relying on self-generated value-added and others on domestic outsourcing. The role of relative prices appears to be significant, though not uniformly decisive.

*-Low-Tech clusters* are characterised by greater reliance on non-industrial inputs — a pattern consistent with commodity-intensive industries — and more limited growth. While some countries managed to expand output through domestic linkages, others faced structural constraints that limited industrial progress, including adverse price dynamics and possible signs of premature deindustrialisation in the case of developing countries.

Overall, the results confirm that industrial performance cannot be explained solely by technological classification or input composition. Contextual variables — such as initial income levels, relative price movements, infrastructure, macroeconomic and business climate, external integration — play a critical role in shaping outcomes. These contextual variables are often categorised under the concept of “globalisation readiness”. Their appraisal stands outside of our research perimeter. ADB et al. (2025) provides in its chapter 2 an interesting in-depth review of the multi-dimensional determinants of preparedness and competitiveness from a global economy perspective, with a special emphasis on Africa and Latin America, two regions where we found risks of premature deindustrialisation.

<sup>8</sup> The equation is  $VA\_gr = -0.12 + 0.4181Q\_gr - 0.0103Q\_gr^2$  (R2: 0.98); VA\_gr and Q\_gr being the average annual growth of value-added and output, respectively.

The next section will look at the ultimate driver of production in any market-oriented economy: the strength of effective demand.

### 3) How effective are domestic and foreign demands in driving (de)industrialisation?

After recognising that industrial performance cannot be explained solely by the supply side, this section introduces effective demand as our final — and possibly determining — filter.

Following Engel's Law — see Matsuyama (2018) for a formal treatment in open economies and its impacts on Home Market<sup>9</sup> — we expect demand elasticity for manufactured products to be higher than unity in low- and middle-income countries, becoming lower than one in higher-income economies. In the latter case, industrial products face a saturated market, while in the former one, there is still an unmet demand. Considering the weight of domestic market in driving output, even in open countries (Escaith, 2025), the relative evolution of domestic demand and industrial production is an important marker of possible industrialisation pathologies.

On this basis, we derive from [10] a synthetic indicator ( $Zeta = 1/\Omega$ ;  $\Omega > 0$ ), which measures the coverage ratio of domestic demand by domestic output. In mature economies, we expect production to remain more or less in-line with a stable or slowly declining demand. In low-to-middle income countries, demand for industrial products is expected to raise with income level and drive domestic production. Thus, Zeta variations during the period of analysis ( $\Delta Zeta$ ) help building a diagnostic for distinguishing between:

- *Mature deindustrialisation*: Low output and demand growth in high-income contexts, with stable or declining Zeta ( $\Delta Zeta \approx 0$ ).
- *Premature deindustrialisation*: Weak output response despite demand growth in middle- and low-income developing countries ( $\Delta Zeta < 0$ ).

Following the same fuzzy-clustering approach than above, we define five clusters by technological intensity for three periods (1995–2007; 2010–2019 and 1995–2019) for each sub-sample of developed and developing countries. The variables used as the average nominal growth rate over each period for output, domestic demand, imports, exports, and  $\Delta Zeta$ . To control for the influence of the catching-up effect on industrial growth, we also include the level of output in 1995. Results are presented in Annex Table 13 to Table 15.

Then, we visualise each cluster relative to its domestic and foreign demand drivers in a scatter graph (Figure 2). The ubication on the plot reveals for each cluster how the average annual growth of industrial output results from changes in sales on the domestic and on foreign markets. The growth rates of both markets are not weighted averages, so their sum does not equal the resulting output growth.

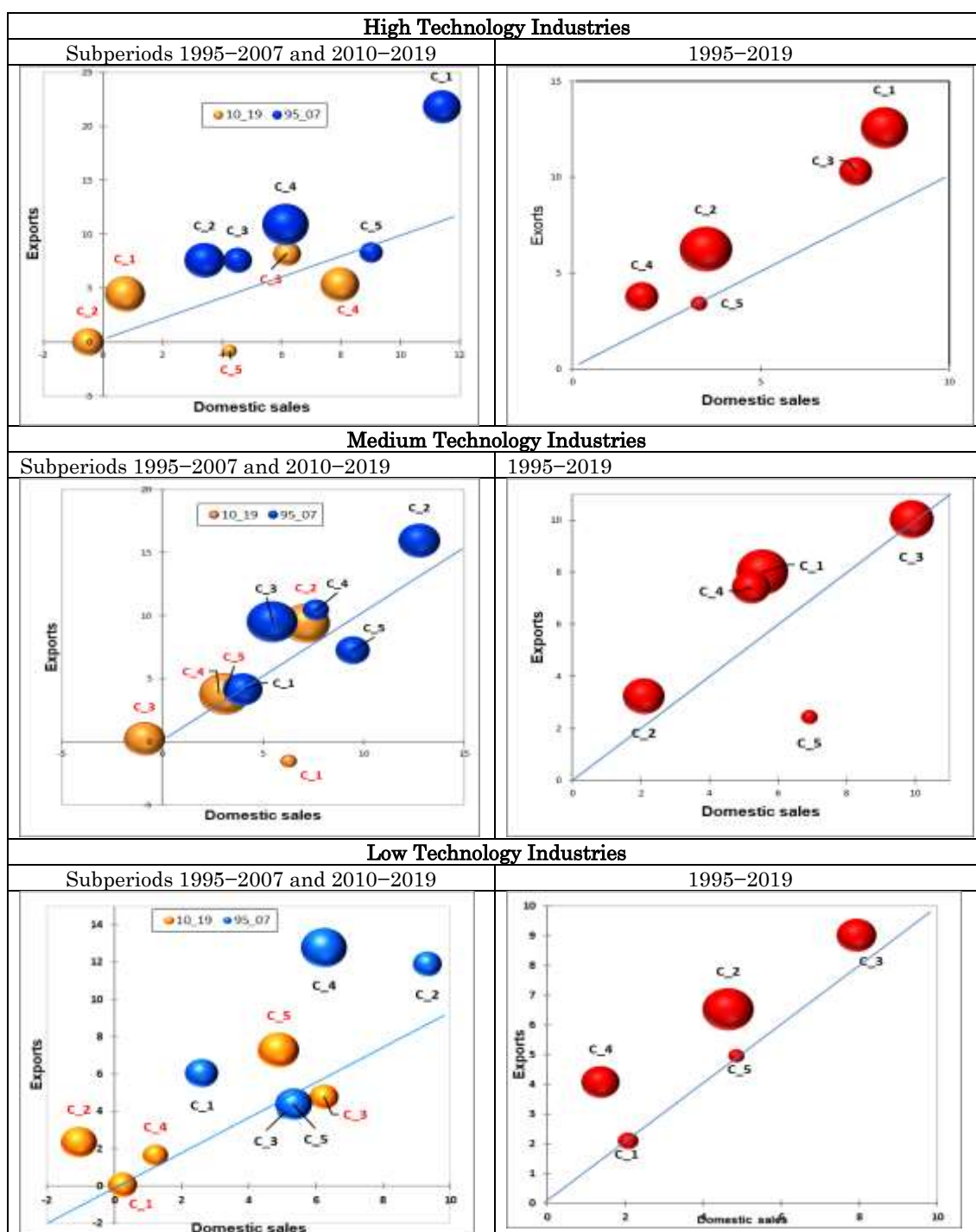
The size of the bubble measures the variation in the Zeta indicator over the period. A small size indicates that domestic production was losing ground with domestic demand, as evidenced by a growing penetration of imports not compensated by an expansion of domestic output on foreign market.

Overall, the 1995-2007 hyper-globalisation period reflects a "rising tide lifts all boats" dynamic, where domestic and external demand jointly supported industrial expansion. The alignment between output and demand suggests a relatively healthy industrial structure, even in clusters with moderate growth. The New-Normal period of "slowbalisation", after the 2008-2009 global crisis, exposed underlying fragilities. Output growth slowed markedly, leading to mediocre outcomes in all industries.

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<sup>9</sup> The author shows that "globalization magnifies, instead of weakening, the power of the domestic demand composition differences in dictating the patterns of structural change" (p.21).

Figure 2 Foreign and domestic demand drivers, 1995–2019 and subperiods



Note: size of the bubble: Variation in the coverage ratio of domestic demand by domestic output. The diagonal line indicates the limit of identical growth rates for both demand components.

The composition of clusters varies with time; their numbering is algorithm dependent and randomly attributed across periods and industries. Thus, for example, the country composition of C\_1 in one graph may be totally unrelated to another cluster, also called C\_1, in another graph.

Source: Annex Table 13 to Table 15.

The downturn did not affect all countries uniformly. Some were particularly hit by the weaker international environment in 2010–2019. It is particularly the case of C\_1 and C\_2 clusters in high-tech industries, C\_1 and C\_3 in medium-tech, and C\_2, C\_1 and possibly C\_4 in low-tech. Countries of legacy industrialisation dominate these slow or negative outcomes.

- In *High-Tech*, C\_2 output contracting an average -0.5% is the largest cluster (28 countries, many being developed or middle-high developing economies). Negative outcome is due to domestic demand contraction in a context of stagnating exports. Sluggish domestic demand penalised also the high-tech cluster C\_1 (mostly Western European economies).
- In *Medium-Tech*, the slowest-moving cluster C\_3 is also the largest (25 countries). This cluster hosts most high-income developed economies, with the worrying presence of developing countries in Latin America, Africa (Tunisia and South Africa) or Turkey. This mediocre performance took place in a context of reduced domestic demand. As imports did not significantly displace domestic products, Zeta did not change much over this sub-period. The case of C\_1 countries is atypical: exports declined in a context of robust domestic demand. This small and heterogenous group of countries is mainly constituted of developing countries, plus two ex-transition economies (Kazakhstan and Russia).
- In the case of *Low-Tech* industries, we observe in Figure 2 a group of three clusters (C\_1, C\_2 and C\_4) stagnating on the south-west corner of the graph. C\_1 is the largest group, almost entirely constituted by European countries, plus Argentina and Taiwan. A 1% annual decline in domestic sales drove C\_2 production growth into negative territory (-0.3%). This cluster C\_2 is mainly composed of developed economies, with a few developing countries (Brazil, Turkey and South Africa among the largest). While domestic sales were slightly stronger in the borderline case of C\_4 (a meagre 1.2%, in line with output growth), these countries faced a surge of imports, while their exports remained weak. As a result, the variation in the Zeta indicator is negative, making this cluster a possible candidate for pathological deindustrialisation. The presence of India in this group and its attraction for the C\_2 cluster<sup>10</sup> are preoccupying, considering the importance of these industries as provider of low-skill jobs in rural areas.

The results suggest structural divergence over the entire 1995-2019 period (right-hand side panel of Figure 2). Exports were generally more dynamic than domestic sales, with only one exception for cluster C\_5 in the case of medium-tech industries. For this heterogenous small group of countries, domestic demand was growing at twice the speed of exports in a context of high growth of imports leading to a negative  $\Delta Zeta$ . But in general, top performers in the three groups of industries build their performance on the strong growth of their domestic market. This was particularly the case in high-tech industries C\_1 and C\_3. As we saw in the previous section, the domestic market includes both final and intermediate inputs, the demand for the latter group being positively correlated by the growth of the other classes of industries.

#### 4) Analysing Transitions from 1995-2007 to 2010-2019

We will discuss how the country clusters, identified in Annex Table 13 to Table 15, evolved between and after the 2008-2009 global crisis.

##### i. Clusters transitions

In Figure 3, the width of the ribbons linking two clusters refers to the number of countries transiting from one cluster in one period to another one in the other period. In the discussion, we turn our attention to the clusters at risk of deindustrialisation.

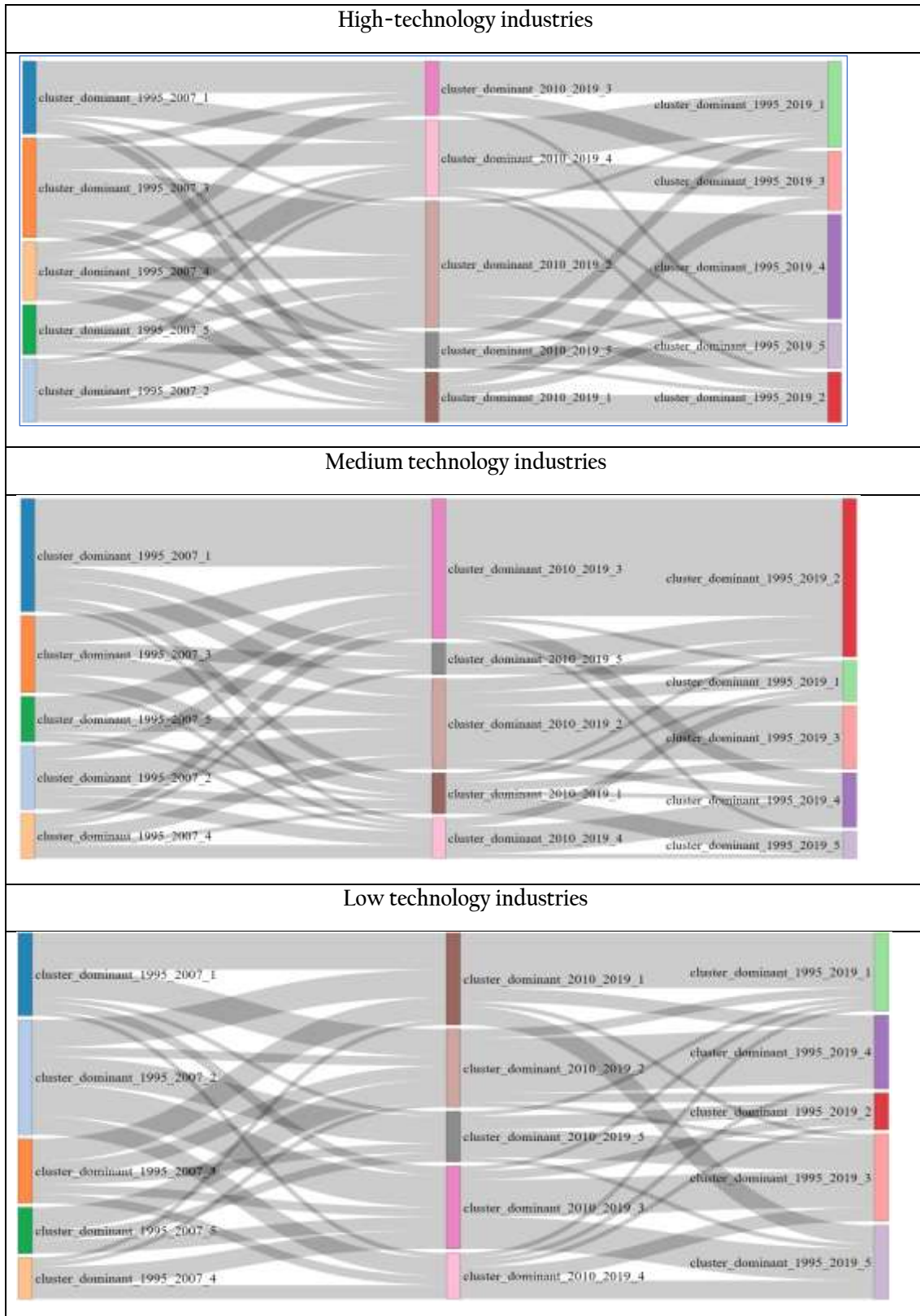
*Even if the high-tide of 1995-2007 lifted all boats, the difference between high and slow performers was already perceptible, at least in the case of high and medium technology industries.* The graph for high-tech industries indicates that the late-period [2010-2019] cluster C\_2, showing potential symptoms of deindustrialisation in 2010-2019, was composed mainly by members from early-period [1995-2007] clusters C\_3 and C\_2. Both clusters were already lagging behind the

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<sup>10</sup> More formally, India's silhouette for cluster C\_4, an indicator that measures how similar a data point is to its own cluster, is only 0.32. India's alternative closest neighbourhood would be low-performing cluster C\_2.

others during this early period. Most of these countries classify in overall [1995–2019] clusters C\_4 and C\_5, characterised by lower growth of high-tech production.

Figure 3 Demand driven transition graph, 1995–2019 and subperiods.



Note: Based on fuzzy K-Means dominant membership. Cluster composition is in Annex Table 13 to Table 15  
Source: Author.

Similarly, in the group of medium-technology industries, many countries transited towards a large cluster of slow-growth countries. Overall, the [1995-2019] slow-growth cluster C\_2 (average annual output growth of 2.4% CGAR) is by far the largest group (35 countries, 46% of the total) after having attracted most of late-period C\_3 members and many C\_5 and C\_2 countries.

*The evolution of low-tech industries was more diverse.* The transitions of clusters from early 1995-2007 to late 2010-2019, and then to the wider 1995-2019 are fluid, with no clearly dominant pattern. C\_3 is a large high-growth cluster, with output growing a solid 8.2%, based on both domestic sales (8%) and exports (9%), equilibrating a strong demand for imports. This cluster absorbed countries from the late clusters C\_5, C\_3 and, but in a smaller proportion, C\_4. These late clusters were themselves produced by attracting countries from diverse early clusters. C\_2, also a high-performer, shares several of the C\_3 characteristics, albeit with more moderate growth. It draws also from several late clusters.

## ii. Comparing with regression results drawn from Volume I

In Volume I, we classified each observation of the triplet {country; industry; year} according to its position vis-à-vis the expected manufacturing share conditional on income: under-performers and over-performers (below/above the 0.95 confidence interval) and inliers. The “transition matrices” presented in Table 8 highlight only the transitions towards an “underperformer” status between 1995 and 2019. It should be noted that several countries move repeatedly across categories through time over the whole period, particularly among smaller or more open economies exposed to external shocks. Therefore, downgrades to underperforming in 2019 should therefore be interpreted with caution. This is specially the case for smaller economies that may have transited more rapidly towards a service-based economy than larger ones.

Table 8 Transition table towards under-performers, 1995-2019

Developed countries			Developing countries		
y1995	y2019	Countries	y1995	y2019	Countries
<b>Low technology industries</b>			<b>Low technology industries</b>		
within	under	AUS, SWE	under	under	KHM
over	under	CYP*, FIN, MLT, NZL, UKR	within	under	CMR, COL, IDN, PHL
<b>Medium technology industries</b>			<b>Medium technology industries</b>		
under	under	ISL	over	under	CHL, CRI, IND, SEN, TUN*
within	under	BRN, FIN*, GRC*	<b>High technology industries</b>		
over	under	AUS*, MLT, ROU, RUS	within	under	ARG*, CHL*, COL*, IDN, SEN
<b>High technology industries</b>			over	under	IND, PHL, ZAF*
under	under	FIN *	<b>High technology industries</b>		
within	under	SWE*	within	under	CHL*, CIV, CRI*, IDN, ISR, PHL*
over	under	AUS*, CAN*, HRV*, MLT*, NOR*, UKR	over	under	ZAF*

Note: under/within/over: Observed manufacturing share below/within/over the 0.95 confidence interval for the expected value, based on GAM regressions, Table 3 in volume I.

\*/ Countries belonging also to the slowest growing 2010-2019 cluster in Annex Table 13 to Table 15: Low-Tech, cluster C\_2; Medium-Tech, cluster C\_3; High-Tech, cluster C\_2

Let's add a brief comment on High-Tech industries, probably the most revealing cases in terms of developing countries industrial upgrading. Among developed economies, most countries remain stable inliers. Transitions into under-performance are recent and concentrated after 2010, suggesting that they may reflect post-crisis adjustment rather than long-run divergence from expected industrial patterns. On the negative side, South Africa exhibits a consistent downward trajectory, moving from over-performance in the late 1990s to persistent under-performance after 2010. Similar patterns — albeit less pronounced — are observed for Côte d'Ivoire and the Philippines. Several apparent cases of under-performances in 2019 (e.g. Israel, Costa Rica, Chile) follow long periods as inliers and are likely to reflect short-term fluctuations rather than structural shifts.

Most countries that were flagged as underperforming outliers by the GAM exercise for High-Tech industries in 2019 are also classified as belonging to the slowest growing 2010–2019 by the demand-driven clustering exercise in Annex Table 13. This is much less noticeable in the case of Medium-Tech and exceptional for Low-Tech industries (only two countries, Cyprus and Tunisia). A tentative inference is that high-technology industries follow more homogeneous high or low development path across countries than medium- and low-technology industries, where development drivers and growth trajectories are more diverse.

## 7. Identifying Countries at Risk of Deindustrialisation

To conclude our investigation, we shift towards a more detailed case-by-case analysis and identify countries that exhibited signs of possible deindustrialisation over the 1995–2019 period. As before, our diagnostic relies on two complementary indicators:

- *Real growth of domestic output*, assessed over the period.
- *Zeta*, a market-based ratio that captures the alignment between domestic industrial output and domestic demand.

These two indicators are complementary and do not overlap. A decline in Zeta ( $\Delta \text{Zeta} < 0$ ) is interpreted unambiguously: domestic output has failed to keep pace with expanding domestic demand. Even if imports substitute home products on the domestic market, Zeta may still increase. It is the case when export growth offsets declining domestic sales. In such cases, the issue is not competitiveness per se, but a structural mismatch between domestic production and domestic consumption.

Table 9 lists the cases where, for a given industry, the Zeta indicator declined ( $\Delta \text{Zeta} < 0$ , at current market prices) and output growth at constant 2015 prices was below the first quartile of the country's development reference group. We have the same number of flagged cases (22) for both developed and developing sub-samples, but it is a coincidence.<sup>11</sup>

Table 9 Countries at risk of deindustrialisation, 1995–2019

Developed countries			Developing countries		
ISO3	Industry	Region	ISO3	Industry	Region
AUS *	Man_High	EAP	ARG *	Man_High	LAC
CAN *	Man_High	NAM	ARG	Man_Med	LAC
CHE *	Man_Low	ECA	BRA	Man_High	LAC
CHE	Man_Med	ECA	BRA	Man_Low	LAC
CYP	Man_Low	EU13	BRA	Man_Med	LAC
CYP *	Man_Med	EU13	CHL	Man_Med	LAC
DEU	Man_Low	EU15	CRI *	Man_High	LAC
DNK *	Man_Low	EU15	CRI *	Man_Low	LAC
DNK *	Man_Med	EU15	HKG	Man_High	EAP
ESP	Man_High	EU15	HKG	Man_Low	EAP
ESP	Man_Med	EU15	HKG *	Man_Med	EAP
FRA	Man_Low	EU15	MEX *	Man_Low	LAC
GBR	Man_Med	EU15	MEX *	Man_Med	LAC
GRC	Man_Low	EU15	NGA	Man_Low	SSA
HRV	Man_High	EU13	PER *	Man_High	LAC
HUN	Man_Low	EU13	PER	Man_Low	LAC
ITA *	Man_High	EU15	PER	Man_Med	LAC
JPN	Man_Low	EAP	THA	Man_Med	EAP
MLT	Man_High	EU13	TUN *	Man_Low	MNA
NOR	Man_High	ECA	ZAF	Man_High	SSA
NZL *	Man_High	EAP	ZAF	Man_Low	SSA
PRT *	Man_Low	EU15	ZAF	Man_Med	SSA

Note: Based on concomitant negative evolutions of indicator Zeta and negative or low real growth of output over the 1995–2019 period.

<sup>11</sup> The sample of countries is not balanced, with 41 developed and 35 developing countries; moreover, the number of  $\Delta \text{Zeta}$  being negative is not pre-established.

\*/: Already flagged as an industry at risk in the early 1995–2007 sub-period.

In the case of developed economies, most risky occurrences happen in the case of Low-Tech (41%) and High-Tech (36%). High-Tech industries in developing countries are relatively less represented than the other two types of industries (27% against 36%). It probably denotes the fact that high-tech industries in these countries are relatively new and still in expansion.

The deindustrialisation signal is particularly disturbing when it affects more than one sector in the same country and when it was already present during the high-growth subperiod 1995–2007. In the group of developed economies, this is the case of Denmark for low-tech and medium tech industries. Switzerland is also flagged for the same types of industries, albeit only its low-tech industries were already problematic in the early phase of globalisation. This country is widely regarded as a successful case of industrial resilience, but embraced structural change, pivoting toward high-value, innovation-driven manufacturing. This may explain the dire performance of its low and medium technologies subsectors. Two sectors are also identified as at risk in Spain, albeit the issue appeared only after the global financial 2008–2009 crisis, which severely affected this country.

In the case of developing countries, several cases are showing preliminary signs of deindustrialisation, according to our indicators. All three subsectors are flagged in Brazil, Hong Kong, Peru and South Africa. In Costa Rica and in Mexico, the two problematic subsectors were already in dire straits during the early “golden age” of high global growth. The case of the Mexican medium-tech industry is particularly interesting as the issue resides less in its modest industrial growth than in a mismatch between export-oriented output and domestic demand. It may be an example of GVC-based enclave industrialisation that could not succeed in spreading to other sectors/regions (Escalaith, 2021). Out of the two Argentinian sectors in difficulties, one (high-tech) was already in such a situation in the earlier period.

When contrasting the countries classified by development status, it appears that there is more concentration of flagged industries in the same country in the case of developing economies. This points to more systemic than sectorial issues. As we measured growth in real terms, a nominal devaluation is not to be blamed. But we cannot exclude a real overvaluation of the currency which may have affected exports and increased import penetration on the domestic market. This exchange rate effect, for example, is often mentioned in the case of Brazil, which benefited from large commodity export revenues during the “commodity boom” of the 2000s.

## 8. Summary and Conclusions

We organised our (long) journey through the data following the time-honoured general-to-specific perspective, starting with a global perspective to progressively arrive at individual country cases. As mentioned in our general introduction in Vol. I, we do not claim having covered all relevant aspects. Our starting point, as well as our ambition, was to make use of the rich statistical information provided by international input-output tables. Some missing topics — such as human, natural, and physical capital endowments, or macroeconomic preparedness and business climate — could also have helped shedding light on the evolution of (de)industrialisation patterns.

In the process, we had to revise our initial hypothesis: (1) outsourcing is not the dominant explanation of deindustrialisation; (2) “servicification” of industrial production through outsourcing is not a marker of success and (3) supply-side narratives are incomplete.

## 1) Main Takeaways

We saw in Volume I that measuring industrial in constant price projects a different picture than when using current market prices. Results from Artige (2025) even suggest that deindustrialisation in OECD countries, measured from the value-added perspective, is basically a measurement issue and may not exist at constant prices. Our results in Vol. I confirm that the evolution of manufacturing in developed economies, when measured by production at current market prices or in term of employment, roughly follows the deindustrialisation predictions in high-income countries. Because cost of production, market prices and labour productivity are intimately related in the medium-to-long-run, the discussion on deindustrialisation measured from the supply side as a share of GDP at market prices or in terms of employment is probably better analysed from the perspective of technological progress and international competitive advantages.

We then analysed how supply-side restructuring interacts with demand constraints. Contrasting both sides of the supply-demand equation permits to go beyond a simple diagnostic of deindustrialisation as a stagnation of manufacturing production. Considering that the income-elasticity of demand for manufactured products is about or even lower than one in medium to high income countries, it has to be expected that domestic production in countries where demand for manufactured goods is saturated. Hence, it grows at a lower rate than GDP, especially — but not only — at current prices.

Industrial trajectories appear to be conditioned less by factor reallocation strategies than by the compatibility between production structures and effective demand regimes. Accordingly, we distinguish normal and pathologic deindustrialisation, the latter being the conjunction of a stagnating production despite a strong domestic demand for industrial products. We identify a borderline case, when imports substitute home products on the domestic market but exports offset declining domestic sales. Such a case reflects a mismatch between domestic production and domestic consumption that is not symptomatic of deindustrialisation.

On a more micro-economic level, the use of intermediate inputs provides information on the evolution of the production function for each industry. It reveals the extent of domestic and international outsourcing and provides invaluable information on the evolution of business models across countries. Industrial performance is associated with the capacity to reorganise inputs or to externalise activities. Domestic outsourcing may shift value added from one sector to another one, while international outsourcing is a proximate cause of lower domestic value-added per unit of output. Better or cheaper imported inputs can improve sectoral productivity and competitiveness, but this is conditioned by the ability of productive systems to operate under demand regimes that render such reorganisation viable. The net effects in terms of (de)industrialisation are therefore not certain.

Several stylised facts emerged from our Vol. I, complementing the input-output analysis in Vol. II.

- *First*, deindustrialisation is not a uniform process but one marked by regional divergence and gendered impacts.
- *Second*, outsourcing shifts employment into services, altering the sectoral composition of industrial labour without halting its decline.
- *Third*, the dominance of some regions, particularly in Eastern Asia, the resilience and growth of certain industrial regions—such as the EU13— contrasts with the weakness of others, notably Latin America.
- *Fourth*, international outsourcing is not the main cause of deindustrialisation in terms of employment. Reshoring these outsourced jobs would have only a moderate effect on employment in most regions, with the exception of EU15 and North America.

Even in these cases, as reshoring takes also place in partner countries, the net impact would be limited due to the weight of North-North trade in intermediate inputs. In any case, it would certainly not reverse the deindustrialisation trend.

These findings underscore that if deindustrialisation results from global trends, it remains local in its manifestations and consequences. Heterogeneity of outcomes was particularly high in the case of developing countries. This highlights one of the main limitations of the present background paper: there is a limit to what we can learn from stylised facts, and (de)industrialisation cannot be fully understood if one abstracts it from the particular economic and institutional situation of each country.

## 2) Conclusions

Five broad lessons emerge from the analysis.

*Heterogeneity of deindustrialisation.* The phenomenon is multidimensional. Developed economies mainly undergo limited *statistical* deindustrialisation via domestic and international outsourcing; developing ones may face *premature* deindustrialisation. Both can face “pathological” deindustrialisation when slow or stagnating growth takes place despite a dynamic effective demand. Our results reveal that pathological cases in developed economies are mainly found in Western Europe and in Asia-Pacific. Latin America dominates the preoccupying cases in developing countries, together with South Africa.

*Effective-Demand Constraint.* Industrial expansion depends as much on absorption capacity as on supply potential. Weak domestic demand or stagnant exports constrain manufacturing regardless of technological upgrading. On the other hand, a dynamic sector creates additional demand for inputs from other domestic sectors, creating positive industrialisation feedbacks. The effect is observed mainly for high and medium technology industries in developing countries, indicating that in terms of industrialisation, “success breeds success”. Besides the increased size for domestic demand, the correlation observed may be caused by favourable business environment driving investments in medium and high technologies. The relevant question from a policy perspective is not “how to reindustrialise” but, from a supply-demand perspective “how to strengthen the domestic–global linkage of manufacturing demand.”

*Dual Role of Outsourcing.* Domestic outsourcing often signals functional specialisation and efficiency gains. Yet, we observed in the case of mature legacy industries cases of “*Post-Porterian*” type of outsourcing that denote, at the contrary, a weakness. Outsourcing becomes a defensive strategy for bottom-performers. We could not identify cases where international outsourcing of intermediate inputs did erode industrial capabilities. At the contrary, increased reliance on imported inputs was often associated with top performance in both developed and developing economies. This positive outcome signals the role of GVC insertion in developing successful business strategies. The absence of clear cases where outsourcing caused deindustrialisation in our data is not a proof of absence of such an issue. From this perspective, contrasting the EU15 with the EU13 dynamics provides an example of the contribution of supply chain insertion within a regional trade agreement as a source of rapid industrialisation, contributing also to the export success of the GVC lead-firms in Germany. French and UK lead-firms, at the contrary, did not follow the German example and these economies show signs of deindustrialisation.

*GVC integration:* EU13 and East Asia successful examples suggest that GVC-based industrialisation requires also regional lead-firms (from Germany for EU13, from Japan and the USA, then increasingly from China, for East Asia-Pacific). Cases of faster output growth in high-tech than medium and low-tech industries observed in various developing countries is probably explained by GVC integration and initial conditions: Pre-globalisation industrialisation patterns concentrated the capital and knowledge intensive high-tech industries in industrialised countries. More recently, GVC industrialisation contributed to a rapid pace of convergence between developed and developing countries, especially during the hyper-globalisation phase of 1995–2007.

*Importance of the domestic value chain:* we observed in Volume I that some legacy industries in developed economies were able to maintain a higher-than-expected share of domestic value-added considering their higher income per capita. This resilience, the positive correlation between lead-firms and domestic sub-contractors observed in successful emerging countries and the importance of demand on the home-market reveal the importance of developing and maintaining a strong domestic value chain. Doing so is obviously more difficult for the smaller developing economies. Hysteresis works both ways; if deindustrialisation may be slower in developed economies in its initial stages, re-industrialisation may become more difficult if the domestic industrial network becomes too weak.

*A final, more personal reflection:* A background paper is not expected to resolve a research question nor advance theory, and this “essay” remains inconclusive. Beyond the limitations of the data and methodology, a fuller understanding of (de)industrialisation would likely require complementary macroeconomic, structural and institutional context to clarify the underlying drivers. This echoes Breiman (2001) observation about the tension between simplicity and accuracy: as data becomes more complex, models risk losing the clarity they seek to provide.

More fundamentally, the exercise raises an identification problem: does ‘deindustrialisation’ constitute a coherent research object, or is it an elusive construct? It is often approached through employment. Yet Industry 4.0 and advances in robotics suggest the possibility of highly automated production that generates industrial output with minimal labour input. How, then, should such output be measured? Factory-gate prices? Physical quantities? Constant prices? Each one captures different facets of manufacturing. Are they actual reflections of its value? If one aligns re-industrialisation strategies with food-security analogies, the social value in manufacturing is tied to the predictable satisfaction of essential domestic requirements. Again, this would bring us back, inexorably, to the centrality of demand, wouldn’t it? In the spirit of Montaigne’s “*Essais*”, the most honest closing words for this essay may simply be Montaigne’s own: “*Que sais-je?*”

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## Annex A: List of Sectors by Technological Level

The C codes refer to the coding system used in OECD Inter-country Input-Output tables.

<p><b>High and Medium-High Technology</b>  C20 Chemical and chemical products  C21 Pharmaceuticals, medicinal chemical and botanical products  C26 Computer, electronic and optical equipment  C27 Electrical equipment  C28 Machinery and equipment, not elsewhere classified (nec)  C29 Motor vehicles, trailers and semi-trailers  C30 Other transport equipment</p>	<p><b>Medium technology</b>  C22 Rubber and plastics products  C23 Other non-metallic mineral products  C24 Basic metals  C31T33 Manufacturing nec; repair and installation of machinery and equipment  <b>Low and Medium-Low technology</b>  C10T12 Food products, beverages and tobacco  C13T15 Textiles, textile products, leather and footwear  C16 Wood and products of wood and cork  C17_18 Paper products and printing  C19 Coke and refined petroleum products  C25 Fabricated metal products</p>
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## Annex B: Countries included

Country	ISO3	Dev.Clas	Region	Country	ISO3	Dev.Clas	Region
Argentina	ARG	DVG	LAC	Kazakhstan	KAZ	DVG	ECA
Australia	AUS	DVD	EAP_DVD	Lao People's Democratic Republic	LAO	DVG	EAP_DVG
Austria	AUT	DVD	EU15	Latvia	LVA	DVD	EU13
Bangladesh	BGD	DVG	SAS	Lithuania	LTU	DVD	EU13
Belarus	BLR	DVD	ECA	Luxembourg	LUX	DVD	EU15
Belgium	BEL	DVD	EU15	Malaysia	MYS	DVG	EAP_DVG
Brazil	BRA	DVG	LAC	Malta	MLT	DVD	EU13
Brunei Darussalam	BRN	DVD	EAP_DVD	Mexico	MEX	DVG	LAC
Bulgaria	BGR	DVD	EU13	Morocco	MAR	DVG	MNA
Cambodia	KHM	DVG	EAP_DVG	Myanmar	MMR	DVG	EAP_DVG
Cameroon	CMR	DVG	SSA	Netherlands	NLD	DVD	EU15
Canada	CAN	DVD	NAM	New Zealand	NZL	DVD	EAP_DVD
Chile	CHL	DVG	LAC	Nigeria	NGA	DVG	SSA
China <sup>a/</sup>	CHN	DVG	PRC/EAP_DVD	Norway	NOR	DVD	ECA
China, Hong Kong SAR	HKG	DVG	EAP_DVG	Pakistan	PAK	DVG	SAS
China, Taiwan Province	TWN	DVG	EAP_DVG	Peru	PER	DVG	LAC
Colombia	COL	DVG	LAC	Philippines	PHL	DVG	EAP_DVG
Costa Rica	CRI	DVG	LAC	Poland	POL	DVD	EU13
Croatia	HRV	DVD	EU13	Portugal	PRT	DVD	EU15
Cyprus	CYP	DVD	EU13	Republic of Korea	KOR	DVD	EAP_DVD
Czechia	CZE	DVD	EU13	Romania	ROU	DVD	EU13
Côte d'Ivoire	CIV	DVG	SSA	Russian Federation	RUS	DVD	ECA
Denmark	DNK	DVD	EU15	Saudi Arabia	SAU	DVG	MNA
Egypt	EGY	DVG	MNA	Senegal	SEN	DVG	SSA
Estonia	EST	DVD	EU13	Senegal	SEN	DVG	SSA
Finland	FIN	DVD	EU15	Singapore	SGP	DVG	EAP_DVG
France	FRA	DVD	EU15	Slovakia	SVK	DVD	EU13
Germany	DEU	DVD	EU15	Slovenia	SVN	DVD	EU13
Greece	GRC	DVD	EU15	South Africa	ZAF	DVG	SSA
Hungary	HUN	DVD	EU13	Spain	ESP	DVD	EU15
Iceland	ISL	DVD	ECA	Sweden	SWE	DVD	EU15
India	IND	DVG	SAS	Switzerland	CHE	DVD	ECA
Indonesia	IDN	DVG	EAP_DVG	Thailand	THA	DVG	EAP_DVG
Ireland	IRL	DVD	EU15	Tunisia	TUN	DVG	MNA
Israel	ISR	DVG	MNA	Türkiye	TUR	DVG	ECA
Italy	ITA	DVD	EU15	Ukraine	UKR	DVD	ECA
Japan	JPN	DVD	EAP_DVD	United Kingdom	GBR	DVD	EU15
Jordan	JOR	DVG	MNA	United States of America	USA	DVD	NAM
				Viet Nam	VNM	DVG	EAP_DVG

Note: DVD: developed; DVG: developing; a/: China, a developing country in East Asia and Pacific region, is treated as a single region considering the sheer size of its manufacturing sector.

## Annex C: Methodological Note on Labour Accounting in Input-Output Tables

Input-output tables in current USD are converted in jobs equivalent using the apparent labour productivity based on gross output (Output/Number of employees) for {each sector/country/year} triplet.

*Calculations* are based on disaggregated data at the most detailed level of the OECD harmonised input-output tables (Annex A). Results are aggregated into a series of sub-sectors: Agriculture; Mining; low/medium/high technologies industries; business services; construction and other services sectors.

We limit the imputation of labour to the inputs directly purchased by the industry (the  $Z_{ij}$ ). From the Input-Output perspective, those are called the “direct requirements”. We limit our imputations to these direct requirements, as the are those most closely attached to the production function [14]. They correspond to make-or-buy outsourcing decisions made by firms’ management.

It is possible to adopt a more global perspective by imputing all the jobs created along the entire supply chain, including second tiers and third tiers suppliers. The method, in this case, is to use the “total requirement” matrix,  $L = (A - I)^{-1}$ ,  $A = \{a_{ij}\}_{ij}$ , with  $a_{ij} = Z_{ij} / Q_j$ ,  $A$  being the technical coefficient matrix and  $I$  the identity matrix.  $L$  is also known as the “Leontief inverse”. D’Angelo et al. (2025) apply this total requirement approach to quantify the employment implications of reshoring and nearshoring in Germany.

*Proportionality assumption.* If  $Z_{ij}$  is the purchase of inputs by sector “j” from sector “i”, and the labour productivity of supplying sector “i” is  $Q_i/L_i$ , the embodied labour content of  $Z_{ij}$  is equal to  $L_i * (Z_{ij}/Q_i)$ .

*Data sources.* input-output table and labour productivity: OECD and personal imputations for missing countries; employment data are sourced from ILO.

## Annex D: Additional tables

Table 10 Developed countries: Top and Bottom performers, 1995–2019

Top performers				Bottom performers			
ISO3	Industry	CAGR <sup>a</sup>	Region	ISO3	Industry	CAGR <sup>a</sup>	Region
KOR	Man_High	6.2%	EAP	AUS	Man_High	1.9%	EAP
KOR	Man_Low	4.5%	EAP	JPN	Man_High	-0.7%	EAP
BLR	Man_High	5.7%	ECA	JPN	Man_Med	-0.8%	EAP
BLR	Man_Med	6.2%	ECA	JPN	Man_Low	-2.0%	EAP
BLR	Man_Low	6.7%	ECA	CHE	Man_Med	1.6%	ECA
ISL	Man_Med	6.7%	ECA	CHE	Man_Low	1.5%	ECA
RUS	Man_High	6.2%	ECA	UKR	Man_High	2.1%	ECA
RUS	Man_Med	4.9%	ECA	CYP	Man_Med	1.3%	EU13
RUS	Man_Low	5.8%	ECA	CYP	Man_Low	0.3%	EU13
UKR	Man_Low	3.8%	ECA	HRV	Man_High	1.6%	EU13
BGR	Man_High	5.5%	EU13	MLT	Man_High	1.7%	EU13
BGR	Man_Med	5.8%	EU13	BEL	Man_High	2.0%	EU15
BGR	Man_Low	3.8%	EU13	BEL	Man_Med	1.7%	EU15
CZE	Man_High	8.8%	EU13	DEU	Man_Med	1.5%	EU15
EST	Man_High	8.7%	EU13	DEU	Man_Low	0.9%	EU15
EST	Man_Med	7.8%	EU13	DNK	Man_Med	1.1%	EU15
EST	Man_Low	5.7%	EU13	DNK	Man_Low	0.5%	EU15
HUN	Man_High	7.4%	EU13	FIN	Man_Low	1.6%	EU15
LTU	Man_Med	5.7%	EU13	FRA	Man_High	1.9%	EU15
LVA	Man_High	7.7%	EU13	FRA	Man_Med	1.4%	EU15
LVA	Man_Med	4.9%	EU13	FRA	Man_Low	0.7%	EU15
LVA	Man_Low	4.1%	EU13	GBR	Man_High	1.6%	EU15
POL	Man_High	7.3%	EU13	GBR	Man_Med	0.5%	EU15
POL	Man_Med	6.7%	EU13	GBR	Man_Low	1.3%	EU15
POL	Man_Low	5.5%	EU13	GRC	Man_High	1.1%	EU15
SVK	Man_High	11.9%	EU13	GRC	Man_Med	0.7%	EU15
SVK	Man_Med	5.7%	EU13	GRC	Man_Low	1.1%	EU15
SVK	Man_Low	5.5%	EU13	ITA	Man_High	1.7%	EU15
IRL	Man_High	6.6%	EU15	ITA	Man_Med	1.1%	EU15
IRL	Man_Med	5.7%	EU15	ITA	Man_Low	1.1%	EU15
IRL	Man_Low	4.8%	EU15	PRT	Man_Low	1.5%	EU15
LUX	Man_Med	4.8%	EU15	CAN	Man_High	1.6%	NAM
LUX	Man_Low	3.7%	EU15	USA	Man_Med	1.9%	NAM

Note: a/ compound annual growth rate at constant prices, based on current USD value OECD data deflated by UNIDO manufacturing value-added deflator (2015 prices).

Table 11 Developing countries: Top and Bottom performers, 1995–2019

Top performers				Bottom performers			
ISO3	Industry	CAGR <sup>a</sup>	Region	ISO3	Industry	CAGR <sup>a</sup>	Region
KHM	Man_High	9.6%	EAP	THA	Man_Med	3.9%	EAP
KHM	Man_Med	8.3%	EAP	THA	Man_Low	3.7%	EAP
KHM	Man_Low	10.0%	EAP	ARG	Man_High	2.1%	LAC
LAO	Man_High	10.0%	EAP	ARG	Man_Med	2.1%	LAC
LAO	Man_Med	7.5%	EAP	ARG	Man_Low	2.5%	LAC
LAO	Man_Low	6.8%	EAP	BRA	Man_High	3.1%	LAC
MMR	Man_High	10.3%	EAP	BRA	Man_Med	2.9%	LAC
MMR	Man_Med	10.4%	EAP	BRA	Man_Low	3.0%	LAC
MMR	Man_Low	9.8%	EAP	CHL	Man_High	4.1%	LAC
SGP	Man_Med	7.2%	EAP	CHL	Man_Med	2.9%	LAC
VNM	Man_High	13.8%	EAP	COL	Man_High	4.0%	LAC
VNM	Man_Med	11.1%	EAP	COL	Man_Med	3.9%	LAC
VNM	Man_Low	10.2%	EAP	CRI	Man_High	1.6%	LAC
KAZ	Man_High	8.9%	ECA	CRI	Man_Low	1.9%	LAC
KAZ	Man_Med	7.8%	ECA	MEX	Man_High	4.0%	LAC
KAZ	Man_Low	7.6%	ECA	MEX	Man_Med	3.0%	LAC
TUR	Man_High	7.2%	ECA	MEX	Man_Low	3.0%	LAC
CHN	Man_High	10.7%	EAP	PER	Man_Med	3.4%	LAC
CHN	Man_Med	10.4%	EAP	PER	Man_Low	3.4%	LAC
CHN	Man_Low	10.1%	EAP	ISR	Man_High	4.1%	MNA
BGD	Man_High	8.1%	SAS	MAR	Man_Low	3.5%	MNA
BGD	Man_Med	7.8%	SAS	TUN	Man_High	3.1%	MNA
BGD	Man_Low	8.9%	SAS	TUN	Man_Med	3.3%	MNA
IND	Man_High	7.8%	SAS	TUN	Man_Low	2.3%	MNA
IND	Man_Med	7.8%	SAS	ZAF	Man_High	2.5%	SSA
IND	Man_Low	6.7%	SAS	ZAF	Man_Low	2.3%	SSA
CIV	Man_Low	6.9%	SSA				

Note: see Table 10

Table 12 Clustering of countries' industries by technological characteristics, 1995–2019

High-Technology					Medium-Technology					Low-Technology				
H_1	H_2	H_3	H_4	H_5	M_1	M_2	M_3	M_4	M_5	L_1	L_2	L_3	L_4	L_5
<b>0.88</b>	<b>0.90</b>	<b>0.85</b>	<b>0.94</b>	<b>0.85</b>	<b>0.83</b>	<b>0.94</b>	<b>0.88</b>	<b>0.88</b>	<b>0.81</b>	<b>0.85</b>	<b>0.87</b>	<b>0.93</b>	<b>0.88</b>	<b>0.86</b>
BLR	BGD	BGR	AUS	ARG	BRA	ARG	BGD	BLR	CHL	BLR	ARG	AUS	BGD	CZE
BRA	CHN	BRN	AUT	CIV	BRN	AUS	BGR	CZE	COL	CMR	BRA	AUT	BGR	EST
CHL	CZE	IRL	BEL	CMR	CIV	AUT	CHN	KOR	HKG	IDN	CHL	BEL	CHN	HUN
COL	EST	JOR	CAN	CYP	CMR	BEL	CRI	PER	IDN	NGA	COL	BRN	CIV	JOR
CRI	HUN	KAZ	CHE	GRC	EGY	CAN	EST	POL	IND	PAK	CRI	CAN	EGY	KHM
EGY	IND	LTU	DEU	HKG	HRV	CHE	HUN	ROU	MEX	PHL	CYP	CHE	IND	LAO
HRV	KHM	LVA	DNK	MAR	ISR	CYP	IRL	RUS	PHL	SEN	HRV	DEU	IRL	LTU
IDN	LAO	NGA	ESP	MYS	MAR	DEU	JOR	SVK	SEN	THA	MAR	DNK	ISR	LVA
MEX	MMR	ROU	FIN	NZL	MYS	DNK	KAZ	SVN	ZAF	TUR	MEX	ESP	KAZ	POL
MLT	POL	RUS	FRA	PER	PAK	ESP	KHM	THA			MLT	FIN	MMR	ROU
PAK	SVK	SAU	GBR	PHL	TUN	FIN	LAO	TUR			NZL	FRA	MYS	SVK
PRT	VNM		ISL	SVN		FRA	LTU	TWN			PER	GBR	RUS	
SEN			ISR	TUN		GBR	LVA	UKR			PRT	GRC	SAU	
THA			ITA	ZAF		GRC	MMR				SVN	HKG	VNM	
TUR			JPN			ISL	NGA				TUN	ISL		
UKR			KOR			ITA	SAU				UKR	ITA		
			LUX			JPN	SGP				ZAF	JPN		
			NLD			LUX	VNM					KOR		
			NOR			MLT						LUX		
			SGP			NLD						NLD		
			SWE			NOR						NOR		
			TWN			NZL						SGP		
			USA			PRT						SWE		
						SWE						TWN		
						USA						USA		

Note: Fuzzy K–Means clustering based on a set of production function characteristic and contextual variables over the 1995–2019 period. The first line indicates the degree of cohesion of each cluster, between 0 and 1. Results obtained after setting the number of clusters at 5 and the fuzzy clustering factor at 1.2. Clusters are contingent to the variables used for classification, so membership may vary with the inclusion or deletion of one of them.

Table 13 High-technology industries: demand-driven clusters, 1995–2019 and subperiods

Var.	1995-2007					2010-2019					1995-2019							
	C_1	C_2	C_3a	C_3b	C_4	C_5	C_1	C_2a	C_2b	C_3	C_4	C_5	C_1	C_2	C_3	C_4a	C_4b	C_5
	BRN	BLR	ARG	(...)	AUT	BGD	AUT	ARG	(...)	BRN	BGD	HKG	BRN	AUT	BGD	ARG	(...)	AUS
	CHN	CHE	AUS	SAU	BRA	BGR	BLR	AUS	ITA	EGY	BGR	ISR	CHN	CHE	BGR	BEL	PRT	BRA
	CZE	CHL	BEL	SEN	COL	CRI	CHE	BEL	JPN	EST	CHN	JOR	CIV	DNK	EGY	BLR	SWE	CMR
	EST	CYP	CAN	USA	FIN	ESP	DNK	BRA	KOR	IND	CIV	NZL	CZE	KOR	IND	CAN	TUN	CRI
	HUN	DEU	CIV	ZAF	IRL	JOR	LUX	CAN	MLT	IRL	CZE	PAK	EST	LUX	KHM	CHL	USA	HKG
	IND	HKG	CMR		KOR	MEX	MEX	CHL	NLD	KHM	IDN	THA	HUN	MYS	LAO	COL	ZAF	ISL
	KAZ	IDN	DNK		MMR	NGA	POL	CMR	NOR	LAO	ISL	UKR	IDN	NLD	MEX	CYP		ISR
	KHM	ISR	EGY		MYS	NOR	PRT	COL	SWE	LTU	KAZ	USA	IRL	SGP	NGA	DEU		NZL
	LAO	JPN	FRA		NLD	ROU	SGP	CRI	TUN	LVA	MAR		JOR	SVN	PER	ESP		SEN
	LTU	LUX	GBR		PHL	RUS	SVN	CYP	TWN	MMR	MYS		KAZ	THA	POL	FIN		UKR
	LVA	MLT	GRC		SGP	UKR	TUR	DEU	ZAF	PHL	NGA		LTU	TWN	ROU	FRA		
	PAK	SWE	HRV		SVN			ESP		SEN	PER		LVA		RUS	GBR		
	POL	TUN	ISL		THA			FIN		ROU			MAR		TUR	GRC		
	SVK	TWN	ITA					FRA		RUS			MMR			HRV		
	TUR		MAR					GBR		SAU			PAK			ITA		
	VNM		NZL					GRC		SVK			PHL			JPN		
			PER					HRV		VNM			SAU			MLT		
			PRT					HUN					SVK			NOR		
CAGR	(...)							(...)					VNM			(...)		
1	13.8	4.9	5.2		7.6	8.7	2.7	-0.5		6.5	7.6	2.6	9.4	4.6	8.2	2.4		3.4
2	11.4	3.4	4.5		6.1	9.0	0.7	-0.5		6.2	8.0	4.2	8.3	3.5	7.5	1.8		3.4
3	14.3	5.1	7.6		5.0	12.7	2.0	0.8		8.6	4.0	7.6	7.8	3.2	9.3	3.5		6.3
4	21.8	7.6	7.6		10.9	8.3	4.4	0.0		8.2	5.3	-0.8	12.6	6.2	10.3	3.8		3.4

Notes: see below.

Table 14 Medium-technology industries: demand-driven clusters, 1995–2019 and subperiods

Clusters	1995-2007					2010-2019					1995-2019							
	C_1a	C_1b	C_2	C_3	C_4	C_5	C_1	C_2	C_3a	C_3b	C_4	C_5	C_1	C_2a	C_2b	C_3	C_4	C_5
	ARG	(...)	CHN	AUS	BGR	CAN	CIV	BGD	ARG	(...)	EGY	DNK	CRI	ARG	(...)	BGD	BGR	CHL
	BEL	PRT	CZE	AUT	BLR	CMR	CMR	BGR	AUS	ITA	ISL	KOR	EGY	AUS	ITA	CHN	BLR	CIV
	BGD	SWE	EST	BRA	GRC	ESP	JOR	BRN	AUT	JPN	MAR	MYS	IRL	AUT	JPN	EST	CZE	CMR
	BRN	THA	HUN	COL	JOR	HRV	KAZ	CHN	BEL	LVA	MEX	SGP	ISL	BEL	KOR	IDN	HUN	LUX
	CHE	TWN	IND	CRI	MAR	IRL	LUX	CRI	BLR	NLD	PHL	SVN	ISR	BRA	MLT	IND	LVA	PHL
	CHL	USA	ISL	DEU	NGA	KHM	MLT	EST	BRA	NOR	POL	THA	MYS	BRN	NLD	JOR	MAR	RUS
	CIV	ZAF	KAZ	EGY	ROU	LAO	PAK	HKG	CAN	PRT	ROU	TWN	PAK	CAN	NOR	KAZ	MEX	
	CYP		LTU	IDN	SAU	NOR	PER	HUN	CHE	SWE	SEN		SGP	CHE	NZL	KHM	PER	
	DNK		LVA	ISR	SVK	SEN	RUS	IND	CHL	TUN	SVK		TUR	COL	PRT	LAO	POL	
	FIN		MEX	KOR	SVN	UKR		IND	COL	TUR				CYP	SVN	LTU	ROU	
	FRA		POL	LUX				IRL	CYP	UKR				DEU	SWE	MMR	SEN	
	GBR		RUS	MMR				ISR	CZE	USA				DNK	THA	NGA	SVK	
	HKG		TUR	MYS				KHM	DEU	ZAF				ESP	TUN	SAU		
	ITA		VNM	PAK				LAO	ESP					FIN	TWN	VNM		
	JPN			PER				LTU	FIN					FRA	UKR			
	MLT			SGP				MMR	FRA					GBR	USA			
	NLD			TUN				NGA	GRC					GRC	ZAF			
	NZL							NZL	GRC					HKG				
	PHL							SAU	HRV					HRV				
CAGR: <sup>a</sup>	(...)							VNM	(...)					(...)				
1	4.2		13.4	6.6	8.3	8.8	4.0	7.7	-0.6		2.9	3.3	6.5	2.4		10.0	5.9	5.3
2	4.0		12.8	5.5	7.6	9.4	6.3	7.1	-0.9		2.8	3.1	5.5	2.1		9.9	5.2	6.9
3	6.4		15.8	7.0	15.3	10.9	2.7	5.8	0.6		6.9	0.2	5.1	4.0		9.7	9.6	6.6
4	4.1		15.9	9.5	10.4	7.2	-1.5	9.4	0.2		3.8	3.8	8.0	3.2		10.0	7.4	2.4

Notes: see below.

Table 15 Low-technology industries: demand-driven clusters, 1995-2019 and subperiods

Clusters	1995-2007						2010-2019						1995-2019					
	C.1	C.2a	C.2b	C.3	C.4	C.5	C.1a	C.1b	C.2	C.3	C.4	C.5	C.1	C.2	C.3a	C.3b	C.4	C.5
	ARG	BGR	(-)	AUS	BGD	BEL	ARG	(-)	AUT	BGD	CHE	BRN	AUS	BLR	BGD	(-)	ARG	BGR
	AUT	CHN	NGA	CAN	BLR	BRA	AUS	SWE	BEL	BGR	CMR	CIV	CAN	BRN	CHN	TUR	AUT	CHL
	CHE	CMR	POL	CRI	CHL	BRN	CHL	TWN	BLR	CHN	COL	IDN	CRI	COL	CIV	VNM	BEL	CMR
	CIV	CZE	ROU	CYP	COL	IDN	CZE	UKR	BRA	EGY	CRI	IRL	CYP	IRL	EGY	BRA	CZE	
	DEU	ESP	RUS	DNK	EGY	ITA	DEU	CAN	EST	IND	JOR	DNK	LUX	EST	CHE	HUN		
	FIN	EST	SVK	GRC	MMR	LUX	DNK	CYP	ISL	LTU	LAO	FIN	NZL	IDN	DEU	ISR		
	FRA	HRV	TUR	ISL	PER	MYS	FIN	ESP	ISR	MAR	LVA	FRA	RUS	IND	ESP	MAR		
	GBR	HUN	UKR	KOR	SAU	NLD	FRA	GRC	KHM	MEX	MLT	GBR	THA	JOR	GRC	MEX		
	HKG	IND	VNM	MAR	SGP	PHL	GBR	ITA	MMR	PER	PAK	HKG		KAZ	HRV	MYS		
	ISR	IRL		MLT		THA	HKG	JPN	MYS	SGP	POL	ISL		KHM	ITA	NGA		
	JPN	JOR		NOR			HRV	LUX	NGA		RUS	KOR		LAO	JPN	PAK		
	NZL	KAZ		PAK			HUN	NLD	NZL			MLT		LTU	NLD	PHL		
	PRT	KHM		SEN			KAZ	PRT	PHL			NOR		LVA	PRT	ROU		
	SVN	LAO		TWN			KOR	TUN	ROU			SVN		MMR	TUN	SEN		
	SWE	LTU					NOR	TUR	SAU			SWE		PER	USA	SGP		
	TUN	LVA					SVK	USA	SEN			TWN		POL	ZAF	SVK		
	USA	MEX					SVN	ZAF	THA			UKR		SAU				
CAGR: <sup>a</sup>	ZAF	(-)					(-)		VNM					(-)				
1	3.3	9.9		4.8	7.6	5.6	0.2		-0.3	6.1	1.2	5.0	2.1	5.2	8.2		1.8	5.0
2	2.6	9.3		5.1	6.2	5.3	0.2		-1.1	6.2	1.2	4.9	2.1	4.6	7.9		1.4	4.8
3	6.9	14.2		9.0	7.4	5.1	1.8		1.0	7.5	5.0	2.2	4.5	4.8	9.2		4.0	8.5
4	6.0	11.9		3.9	12.8	4.4	0.1		2.3	4.8	1.7	7.3	2.1	6.5	9.0		4.1	5.0

Notes: a/ CAGR, average annual growth at current prices in USD of: 1/ Output, 2/ Domestic consumption of home products, 3/ Imports, 4/ Exports. Some columns are split for layout purposes. (...) indicates data to be continued or being resumed. Source: Author, based on Fuzzy K-Means clustering. The cluster composition is based on the most probable country assignment according to their score.

Table 16 Manufacturing direct and indirect related employment, by region (1995 and 2019)

Origin:	Same sector			Same sector & embodied Business Services			Embodied in imported industrial inputs		
	High Tech.	Medium Tech.	Low Tech.	High Tech.	Medium Tech.	Low Tech.	High Tech.	Medium Tech.	Low Tech.
<b>Manuf. Sector:</b>									
<b>EAP_DVD</b>									
1995	5.1%	3.6%	8.4%	6.8%	4.4%	10.7%	0.7%	0.4%	1.3%
2019	3.9%	2.3%	4.7%	5.5%	2.9%	6.5%	0.8%	0.3%	0.6%
<b>EAP_DVG</b>									
1995	4.7%	2.8%	7.0%	6.1%	3.2%	8.6%	1.6%	0.4%	0.7%
2019	3.7%	2.4%	7.6%	5.5%	3.0%	9.8%	0.9%	0.3%	0.4%
<b>ECA</b>									
1995	5.0%	4.4%	8.9%	6.2%	5.3%	10.9%	0.6%	0.4%	0.6%
2019	3.7%	3.1%	6.5%	4.9%	4.2%	8.5%	0.8%	0.5%	0.6%
<b>EUI3</b>									
1995	5.5%	5.7%	13.7%	6.2%	6.3%	15.7%	0.6%	0.4%	1.0%
2019	5.6%	4.7%	8.9%	6.8%	5.4%	10.5%	1.5%	0.5%	0.8%
<b>EUI5</b>									
1995	6.0%	5.0%	9.5%	7.4%	5.7%	11.6%	1.8%	1.2%	1.9%
2019	4.1%	3.1%	5.6%	5.4%	3.7%	7.1%	1.4%	0.6%	1.0%
<b>LAC</b>									
1995	2.7%	3.5%	9.2%	3.9%	4.2%	12.3%	0.2%	0.1%	0.2%
2019	2.5%	2.7%	6.5%	3.8%	3.5%	9.3%	0.3%	0.1%	0.2%
<b>MNA</b>									
1995	3.0%	3.5%	9.5%	3.9%	4.0%	11.4%	0.3%	0.3%	0.7%
2019	2.4%	2.7%	7.3%	3.4%	3.3%	9.3%	0.4%	0.3%	0.5%
<b>NAM</b>									
1995	5.4%	3.2%	6.7%	7.5%	4.0%	8.8%	1.4%	0.5%	1.1%
2019	3.6%	2.3%	4.1%	4.8%	3.0%	5.5%	1.0%	0.4%	0.5%
<b>China</b>									
1995	7.2%	6.6%	7.3%	8.8%	7.4%	8.8%	0.0%	0.0%	0.0%
2019	8.6%	4.5%	6.8%	12.0%	5.9%	9.4%	0.2%	0.1%	0.1%
<b>SAS</b>									
1995	1.0%	2.2%	8.1%	1.6%	2.6%	9.8%	0.0%	0.0%	0.1%
2019	1.3%	2.7%	10.4%	2.2%	3.4%	13.0%	0.0%	0.0%	0.1%
<b>SSA</b>									
1995	1.2%	1.9%	7.2%	1.7%	2.3%	9.3%	0.1%	0.0%	0.1%
2019	0.8%	1.8%	7.7%	1.2%	2.2%	9.7%	0.1%	0.0%	0.1%

Notes: In percent of total country employment, simple average of country indicators