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DRAWING VALUE CURVES: LESSONS FROM FINANCIAL STATEMENTS OF THE WORLD'S BIGGEST MANUFACTURING CORPORATIONS*

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INTRODUCTION

After the 1980s the process of productive and financial internationalization has intensified, covering the majority of the countries. New economic and political arrangements led by Transnational Corporations (TNC) and States reorganized global flows of knowledge, goods, services and capital. The international financial crisis in the second half of 2000s had important consequences in productive and trade structures of both developed and developing countries, further changing their insertion in global value chains (GVC) and challenging them to strategically improve

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them. “GVC” is a nomenclature from the 1990s and 2000s, which arrived in the wake of the discussions about globalisation (Humphrey & Schmitz, 2000; Humphrey, 2004; Gereffi, Humphrey & Sturgeon, 2005; Sturgeon, 2008).¹ In general the value chain is about all the activities that firms and workers perform from the creation until the consumption of a product. Therefore, GVC organize the production and trade around the world, having economic, political and social effects. In this sense, understanding the different value chains—and their implicit international division of labour—is crucial for explaining, in addition, why one decade after the crisis the World-System (Wallerstein, 2004) has become more concentrated in terms of power and wealth distribution².

TNC have been deepening their political and economic power in international relations due to, as Strange (1991) identified, two major structural changes: first in production activities and second in financial decisions. Those changes have in common the general aims of getting more profits, gaining market share and fostering corporate growth (Penrose, 1959). The productive change is related to product, process and innovation, including new managerial systems for goods and services value chains that, according to Strange, drive the enterprises on *how* to compete on the world market; the financial change drives on *why* the decisions (including production

1 “A variety of terminologies have been used to capture the development of new global production and distribution systems, including “global production networks” (Henderson *et al.*, 2002), “international production networks” (UNCTAD, 2002b), “globalization of production” (Gourevitch *et al.*, 2000), “global commodity chains” (Gereffi and Korzeniewicz, 1994) and “international value-added chain” (Kogut, 1984). This paper uses the term “global value chain” as it is derived analytically from the work of the global value chain initiative” (Humphrey, 2004, p. 1). The co-organizers of the GVC Initiative were Gary Gereffi of the Duke University Global Value Chains Center; John Humphrey of the institute for Development Studies at the University of Sussex; and Timothy Sturgeon, of the Industrial Performance Center at the Massachusetts Institute of Technology. “This group met under the auspices of the “Global Value Chains Initiative,” sponsored largely by the Rockefeller Foundation (a meeting held in Rockport, Massachusetts in April 2004 was sponsored by the Alfred P. Sloan Foundation (Sturgeon, 2008, p. 4).

2 “In 2016, the share of total national income accounted for by just that nation’s top 10% earners (top 10% income share) was 37% in Europe, 41% in China, 46% in Russia, 47% in us-Canada, and around 55% in sub-Saharan Africa, Brazil, and India. In the middle east, the world’s most unequal region according to our estimates, the top 10% capture 61% of national income” (Alvaredo *et al.*, 2018, p. 8).

and operational) are made, seeking the highest profitability that can be achieved. Productive and financial decisions are strategic, especially during the crisis periods of economic cycles. Therefore, it is not surprising that TNC (and States) do not share detailed information on the configuration and determinants of their value chains, which makes the task of understanding GVC even more complex.

The aim of this paper is, first, to discuss the theory and the data for understanding GVC: *is GVC a theory? What is the data for GVC analyses?* The second aim is to analyze the financial statements of the top manufacturing TNC in order to learn about value curves: *what do the TNC financials tell about GVC of different manufacturing sectors? Do cost structures less concentrated in tangible production activities provide more profit?* Regarding the first two questions, section 1 presents a methodological discussion about GVC theory (subsection 1.1) and data (1.2), from the critical point of view of the Latin-American structuralism. Section 2 presents the methodology and data (2.1), and the outcomes and discussion (2.2) of our analysis on financial statements of top manufacturing TNC. The assessment includes the ten biggest public companies of each manufacturing division, in order to investigate their cost structures and profits in the ten latest available years by means of the data sources (2008-2017, values in current US dollars), inspired by the method of Linden *et al.* (2007a, 2007b). Our intention is to get the current picture of TNC value chains, which can be provided by the decade that goes from the beginning of the international crisis until today. The conclusions restate the main lessons about the drawing of value-added curve per activity, which suggest that smiles may not necessarily be a fine image for manufacturing GVC.

1. THEORIES AND DATA FOR UNDERSTANDING GVC

1.1. What is the theory for GVC? Or is GVC a theory?

In 1992, Stan Shih, founder of Acer company, showed a value-added curve for the computer industry, which then “has served to convince our [Acer’s Strategic Business Units] colleagues to concentrate their efforts and pursue the highest professional value-added without distraction”, baptized

“smiling curve” (chart 1).³ The draw was, then, a rapidly regarded representative for the electronics industry (Dedrick & Kramer, 1998; Dedrick *et al.*, 1999), for knowledge-intensive’s (Mudambi, 2008) and even for the whole manufacturing industry (Baldwin, 2012). Considering three sets of activities and tasks—pre-production, production, and post-production—the smiling curve represented in chart 2 shows that pre and post production groups (intangibles) add more value than the manufacturing itself (tangible). Some key activities prior to the tangible production are Research & Development (R&D), design, and logistics/ purchase of inputs for manufacturing. After it, logistics, marketing and sales activities add intangible value to goods and services be ready to customers.

Chart 1. Stan Shih’s smiling Curve for PC

3 “To convince the Strategic Business Units (SBUs) to give up the system assembly business and focus on its expertise, I have to prove to them that assembly is the part with the lowest added value. In the beginning of 1993, I communicated face-to-face with our colleagues. Starting from the analysis of added value on the traditional industries, and on to the change of value-added in vertical integration when the paradigm change took place in the computer industry. We concluded with a new value-added curve, which has changed to an upward curve from the original downward curve. The system assembly business, which used to have the highest value-added, has become the part with the lowest value-added. (...) I sketched this curve and explained it to the colleagues. They understood it all of a sudden. Later, Simon Lin walked over and told me, “Our colleagues like this curve very much. They decide to name it the ‘smiling curve’?” (Shih, 1996, chapter 11, p. 5).

Chart 2. OECD smiling curve for GVC

Sources: (1) Shih (1996), Dedrick & Kramer (1998) apud Dedrick *et al.* (1999, p. 7), based on Acer company documents; (2) OECD, 2013, p. 216, based on Shih (1992), Dedrick & Kramer (1998), Baldwin (2012).

Due to the processes of outsourcing, reallocation and servicing in general, the value chain quickly became more internationalized during the 1990's and 2000's. The term "global value chain" was stamped by specialists reunited in the meeting GVC Initiative (GVCI)⁴ promoted by the Rockefeller Foundation in 2004. GVC as a holistic concept soon became dominant and came to be a main concern of multilateral organizations, countries, companies and societal institutions on business, economic, political and social issues related to the globalization of production and finance. Recently, Gereffi & Stark (2016) reviewed the GVC ideas and reconsidered it not as a theory, but a *framework*, a *methodology* or a *tool*:

"The GVC framework allows one to understand how global industries are organized by examining the structure and dynamics of different actors involved in a given industry. In today's globalized economy with very complex industry interactions, the GVC methodology is a useful tool to trace the shifting patterns of global production, link geographically

4 "The Duke Global Value Chains Center is the home of the GVC Initiative. In 2014, the Center received support to upgrade and expand the GVC website and host a Global Summit to bring together GVC practitioners and academics to facilitate and enhance communication between research and application" (GVCI, 2018).

dispersed activities and actors within a single industry, and determine the roles they play in developed and developing countries alike. The GVC framework focuses on the sequences of value added within an industry, from conception to production and end use. It examines the job descriptions, technologies, standards, regulations, products, processes, and markets in specific industries and places, thus providing a holistic view of global industries both from the top down to the bottom up” (Gereffi & Stark, 2016, p. 6).

With the aim of understanding the globalization process, the GVCi started with the notion of a value-added chain, focusing on the strategies of firms and countries in the global economy (Gereffi et al., 2005). Based on previous theories of industrial organization (like transactions cost, network, firm capabilities and learning), a theory for governance was designed to explain the fragmentation of the production world-wide. Its precursor was the “global commodity chain” framework, developed by Gereffi in the 1990s to associate the value-added chain concept (especially from management, engineering and geography) to the global organization of industries—initially distinguishing buyer from producer-driven global commodity chains (Gereffi, 1999). Then, “from commodity chains to value chains”, the analysts of the GVCi worked to design an “interdisciplinary theory building in an age of globalization” (Sturgeon, 2008, title), with a very specific scope and modular approach,⁵ “to develop a theory that could help policy-makers explain and predict governance patterns in cross-border production networks”. (Sturgeon, 2008, p. 4).

Analytically constructed at first (and not empirical, although it had some sort of support in the observation of reality), the types of governance are five

5 “It is better, in my view, to develop discrete theoretical areas to deal with specific questions. A theory with a modest and clearly defined explanatory scope, one that identifies one or a few important causal mechanisms that can be used to partially explain and predict outcomes, can have great utility. What is important is to recognize the limits inherent in such partial theories and to actively seek compatibility and linkages with complimentary frameworks. Not least, this “modular” approach to theory building is useful for researchers because it directs them to a manageable set of questions that can be tested in the field or applied to specific policy problems. But because of the great variety of causal forces at work in the global economy, it is incumbent upon those who develop and apply fractional theories to policy and strategy to be cautious, and to actively consider alternative explanations and approaches” (Sturgeon, 2008, p. 2).

(Gereffi *et al.*, 2005): markets, modular, value chains, relational, captive and hierarchy—in a scale from less to more vertical integration, or lower to higher degree of explicit coordination or power asymmetry. The operation of the governance, according to the authors, depends on three factors: “complexity of inter-firm transactions”, “the degree to which this complexity can be mitigated through codification”, and “the extent to which suppliers have the necessary capabilities to meet the buyers’ requirements”. Those factors influence the opportunity cost of outsourcing, which in the end is a financial calculation (Dehning *et al.*, 2007).

Besides governance, *upgrading* was another key concept spread by GVC. The notion of upgrading is far from being consensual in the debate of GVC.⁶ Due to its broad implications, upgrading can be understood as the economic and social improvement of the activities and tasks performed by people of companies and countries, moving from low-value to relatively high-value activities that leverage the quantity and quality of jobs created, improving local working and living material conditions (Gereffi, 2005; Barrientos *et al.*, 2011a; Barrientos *et al.*, 2011b; Gereffi, 2014). Governance strategic decisions impact *what* value will be or not vertically integrated and *where* (Kaplinsky & Morris, 2001). Therefore, these decisions differentiate who produces each activity of the chain from low to high value added, impacting the profitability of the companies, the labour conditions, gender and race issues, the consequences for the environment and the general impact in the development process of regions and countries (Carr *et al.*, 2000). That is why the debate on upgrading had large room to expand, with many case studies in product, firm, industry, cluster or country levels. In the end, even for the GVC, “for development purposes, the critical question is the contribution of such global production systems to sustainable increases in incomes and employment in developing countries” (Humphrey, 2004, p. 2).

Indeed, to be a comprehensive theory, GVC would need more time to establish clear basic criteria (conceptual definitions, domain limitations, relationship-building, and predictions), to define key variables and the domain, to build internally consistent relationships, and to make specific

6 Often the GVC narrative reinforces only the operational dimension of upgrading: to scale up in the value chain by six different ways, 1) business process; 2) product; 3) increase to scale; 4) vertical integration; 5) horizontal integration; 6) clustering (Sturgeon *et al.*, 2014, p. 149).

predictions (Wacker, 1998). So GVC framework lacks theoretical articulation, missing a more coherent explanatory body of causalities and mechanisms (Yeung & Coe, 2015): it consists of a *descriptive* approach based on the general view and decisions of the firm.

In our view, GVC framework shall be analysed considering the political economy of the historical process, as well as its distributive effects. That is precisely the mayor concern of the Latin-American structuralism, whose authors had built their own interpretation about centre-periphery relations and the growth possibilities for developing economies since its insertion in international trade, production and finance. Despite its variety of thoughts (see Rodriguez (2009) for an excellent review), there is a common perception that the capitalist international mode of production embeds many material-historical asymmetries that prevent the development and further the dependency of peripheral countries.

Dependency in the periphery was historically constructed from the association of domestic to foreign elites, which drove not only technologically and financially subordinated productive and trade relationships, but also the replication of consumption, education, ideological and cultural standards.⁷ Indeed, dependency had many local variations during the post-war period (Bambirra, 1972) and the globalization process afterwards. But, in general, dependency relationships have been shaped mainly by the interests of capital markets from the centre due to their monopolistic control of large-scale capital and complex technology (Dos Santos, 1970, 2015). TNC have penetrated in the periphery seeking for cheap supply of inputs, domestic markets and export platforms. For structuralists, TNC' local production, as well as primary exports production, were traditionally characterized by a structural heterogeneity of wages and productivity between tradable and non-tradable sectors, binding the domestic growth dynamics (Pinto, 1969; Cardoso & Reis, 2016). Moreover, along the globalization process of XX and XXI centuries, TNC have developed international

7 The dependency theories had different streams of thoughts, summarized by Blomstrom & Heltne (1984) in four: a) the auto-criticism of the developmentalism—including Furtado and Sunkel, already presented; b) the “neo-marxist” interpretation of Ruy Mauro Marini, Vania Bambirra, Theotonio dos Santos, in special; c) the associated dependency version of Fernando Henrique Cardoso and Enzo Faletto; d) and the view of Andre Gunder Frank.

value chains which high-value activities remain in the centre, while low value-added ones are performed in the South (ILO, 2002; Globberman, 2011; Cardoso & Reis, 2016), though China may be consolidating as the biggest exception.⁸ For the structuralist approach, this configuration enlarges the development gap between centre and periphery because the more knowledge and technology-intensive is the local addition of value to the production, the greater is the stimuli to supply and demand dynamics (Mc Millan & Rodrik, 2011) if there are institutions (in special, State policies) that diminishes structural heterogeneity and lead to power and income redistribution (Medeiros & Trebat, 2017).

Examining the demand side, upgrading makes the accumulation sustainable insofar the growth of productive investment generates jobs and/ or increase labour's income, helping also to include discriminated groups within the economic and political system. The raise in the total amount of and average income, by the Keynesian multiplier effect, stimulates investment in other economic activities, generating diversification and intensifying the complexity of economic and social organization (Hidalgo & Hausman, 2009). In addition, the expansion of the level of economic activity may increase governmental tax revenues, allowing greater government spending on social and urban infrastructure. Supply-side impacts, in turn, include spillovers and linkage effects of technologic innovation that sustain the upgrading, raising overall productivity and, maybe, wages. Moreover, the supply of public goods—notably infrastructure—contribute to the reduction of production costs, enhancing private investment and accumulation (Aschauer, 1989). For instance, improving the reach and quality of public goods such as education and health, as well as boosting public investment in science and technology, enhance new upgrading possibilities.

However, upgrading may not necessarily be related to these demand and supply effects that dynamize the economy and improves wealth and power distribution, due to three criticisms made by Smichowski *et al.* (2016).

8 Since the eighties, the participation of China in world manufacturing has grown very fast, so that in this decade she has become the top world manufacturer. In addition, her weight in world high-technology manufacturing production and exports have also considerably increased, accompanied by upgrading movements in different GVC (see, for example, UNIDO 2018).

Firstly, GVC gains may be generated in reasons other than productivity and spillovers, like market power related to economic barriers, protection of standards and intellectual property rights. Secondly, “immiserizing growth processes” may happen, which “occurs when an increase in quality or quantity of output resulting from productivity gains is more than compensated by diminishing prices, resulting in lower value capture” (idem, p. 19), leading to social downgrading. Thirdly, even if there are productivity gains they may not be translated into social upgrading, nor higher profits necessarily translate into higher investment. In conclusion, when developing countries engage in GVC it is likely the asymmetry of power and wealth will be increased, instead of reduced, because TNC will foster profit and market share—not only of their products and services, but also of inputs, especially raw materials and labour, squeezing their prices and bargain margins.

That is why upgrading and external insertion in GVC should be planned by companies and States considering social development goals.

Therefore, this paper considers “GVC” as a *metaphor*, “a heuristic tool for focusing research on complex and dynamic global industries”—which was indeed the suggestion of one of the GVC leaders (Sturgeon, 2008, p. 20). It is safer to regard GVC as a framework, and *very carefully* use it for normative goals. This metaphor, substantialized in a drawing, helps to illustrate the structuralist view of long-term economic and social development: it is associated to structural and institutional changes in the productive conditions of a place, derived from commercial and productive upgrading that subvert, otherwise than further, the concentration of power and wealth of TNC. Due to the cruciality of TNC decisions in everything regarding GVC, it is imperative to understand them better, especially regarding their managerial and financial strategies. One of the difficulties for that is the lack of GVC curves or maps, as it is explained in next subsection. The more the maps get clarified, the better the identification of governance and upgrading opportunities, both for companies and governments development plans.

1.2. What is the data for GVC analyses?

Empirically speaking, GVC analyses face many obstacles. Available data is not enough not only for drawing value curves or maps, but also for understanding path-dependence processes of chains’ evolution and effects,

regarding markets and, in special, the socio-economic development of countries and regions. In this sense, quantitative and qualitative information are lacking at firm and at country levels (UNIDO, 2018).

Three basic points can be underlined to explain the empirical obstacles for GVC analyses. In the first place, manufacturing chains are very different between themselves, with varying range of indexes for structures, conduct and performance—as would examine the traditional model of Bain (1950) for industrial organization; or different sets of five forces (Porter, 1990); specific demand and supply management processes (Lambert, 2004); irregular hierarchies and governances (Humphrey & Schmitz, 2000), and varying degrees of asymmetric power and wealth (Dos Santos, 2015). Therefore, the identification of a single product value chain should include not only figures from supply chain stakeholders or market structure, but also at least the key institutions and the general supply-side and demand-side features of each product market. On the one hand, it is difficult to find data—such as output, consumption, revenue, wage, value added, exports, prices—at more than 4 digits level, and also to identify the players (and their shares) in each chain. On the other hand, tracking the chains' political institutional aspects is complex, like governance contracts, international trade agreements, market regulation, etc.

Secondly, in association to the first point, the chains result from path dependence processes which determinants of GVC activities' governance and spatial location are not just relative costs (as the theory of comparative advantages of international trade would affirm, see Barrientos *et al.*, 2011). That is, not only the relative endowment of factors (capital and labour) and their respective prices (especially wages) that separate the world into producers of primary products, manufacturers and services of different technological and knowledge intensities. There are several other issues to be investigated both at firm and the country levels, in terms of trade and productive structure, material-spatial conditions; institutions (including macroeconomic regime, property rights); skills, industrial capabilities and ownership, infrastructure; State strategy and geopolitics (UNIDO, 2018; Cardoso & Reis, 2016). Thus, normative recommendations in favor of free trade, labour market flexibility, and reduction of trade and financial protectionism may not only be inefficient, but also undesirable: they can increase power and wealth concentration at main TNC and States from the centre, deepening world development and distribution asymmetries.

Thirdly, once the chains are dominated by TNC, whom are responsible for the main decisions on what to produce in each region/ country, corporate data would be necessary to clearly identify the chain. But such information is super strategic, a key source of differentiation and competitive advantage; thus, rarely publicized. Nevertheless, companies themselves and industrial associations sponsor studies about value chains in order to improve the efficacy of their managerial, operational and productive activities. In other words, they are willing to improve the knowledge about the value creation in the markets they have products, especially concerning sectorial and macroeconomic perspectives that brings light about the entire environment of competitors, stakeholders, governments and so forth.

Then, in order to address the three points, ideally, comprehensive political economy case studies would be needed to understand GVC. In absence of cases, some macro and firm data can be analysed in order to get lessons about the picture of value-added chains. For the structuralist approach, at the country level, it is crucial to have the sectorial profile of production, employment and trade—relying both on traditional data (in gross values) and on value added data (for example, OECD/ WTO, UNCTAD, WIOD).

UNIDO database provides sectorial manufacturing structural indicators, what is useful for our analysis in section 2 because it brings the big picture of world production in terms of the industries' shares in employment, value added and wages. These are key elements of the GVC macro-structure, a basic starting point for the Latin-American structuralist approach. Table 1 shows UNIDO's figures for the distribution of employment, value added, wages and salaries among manufacturing divisions by technology-intensity (our selected sample in 2015 has 56 countries, including most of main world producers, except China and Japan). Table 1 also contains the wage shares of valued added per industry, what is important to examine the distributive conflict over the surplus. According to the structuralist theory, the distributive conflict is one of the main determinants of the productive structure and economic specialization in centre-periphery relationships (Serrano & Medeiros, 2004)).

In 2015, food and beverages have the biggest share in selected countries' value added (14%) and employment (15.8%), while machines and

Table 1. Selected countries' distribution of total employment, value added, and wages and salaries among manufacturing divisions and wages and salaries' shares of value added, 2015 (%)

Manufacturing Divisions	Share of Total employees	Share of Total Value-added	Share of total Wages and salaries	Wages and salaries' share of value-added per sector
Low technology	50%	42%	38%	34%
. weighted average per employee		49%	45%	
Food and beverages	15.8%	14.0%	11.5%	31.0%
Tobacco products	1.0%	1.1%	0.3%	9.8%
Textiles	4.7%	1.6%	1.8%	41.4%
Wearing apparel, fur	5.0%	1.1%	1.3%	45.3%
Leather, leather products and footwear	1.8%	0.6%	0.6%	41.8%
Wood products (excl. furniture)	2.7%	1.6%	2.1%	50.6%
Paper and paper products	2.4%	3.0%	2.9%	37.0%
Printing and publishing	2.0%	1.8%	1.7%	37.3%
Coke, refined petroleum products, nuclear fuel	0.8%	5.0%	1.8%	13.7%
Furniture; manufacturing n.e.c.	5.2%	4.3%	4.7%	41.4%
Fabricated metal products	8.8%	7.8%	9.2%	44.9%
Medium technology	15%	13%	13%	37%
. weighted average per employee		9%	9%	
Non-metallic mineral products	5.3%	3.5%	3.9%	42.6%
Rubber and plastics products	5.5%	4.5%	4.6%	39.2%
Basic metals	4.4%	5.2%	4.2%	30.9%
Medium high/ high technology	35%	45%	49%	42%
. weighted average per employee		42%	46%	
Chemicals and chemical products	6.5%	13.8%	9.2%	25.3%
Machinery and equipment n.e.c.	10.3%	9.9%	14.7%	56.2%
Office, accounting and computing machinery	4.4%	5.8%	7.4%	48.8%
Radio, television and communication equipment	0.0%	0.0%	0.0%	28.3%
Medical, precision and optical instruments	0.3%	0.1%	0.1%	48.7%
Electrical machinery and apparatus	4.0%	3.6%	4.6%	48.0%
Motor vehicles, trailers, semi-trailers	6.3%	10.0%	8.3%	31.4%
Other transport equipment	3.0%	1.9%	5.2%	48.5%
Total manufacturing divisions selected*	100%	100%	100%	38%

Source: Elaborated by the authors based on INDSTAT2 ISIC Rev. 3 UNIDO (last access January 2018). *the sample includes 56 countries. Three manufacturing sectors were not considered in the table: Other manufacturing except medical and dental instruments, Repair and installation of machinery and equipment, and Recycling.

equipment presents the highest share in wages and salaries (14.7%). Low technology-intensive industries have half of the sample's employment in manufacturing, 42% of value-added and 38% of wages and salaries. Those industries in general show the lowest wage and salaries shares in total value added, except wood products, and noting that wages represent less than 15% of the value of tobacco products and coke and refined oil. Differently, high and medium-high technology-intensive industries have 49% share in world wages and salaries, though 45% in value-added and

35% in employment. Weighted average per employee shows that mid-high and high technology-intensity divisions have actually a smaller share of total value added (42%) and of total wages and salaries (47%) than the arithmetic sum of non-weighted value added or wages and salaries' shares (45% and 49%, as just said). This seems to confirm the structuralist general assumption that the more sophisticated the production, the higher are the wages and productivity per employee. Notwithstanding, the relationship may be not that direct, as it was explained before, due to differences in market concentration, workers' power of bargain, etc. Again, case studies are needed to explain, because the different sizes, market and geopolitical structures of the sectorial chains are influencing the shares.

Regarding exports, although trade in value added (TIVA) data does not show the activities and tasks performed by each country, and despite some statistical issues, at least TIVA tracks where the value is being generated in world flows of goods and services. Some of the institutions that provide trade in value added data are the Institute of Developing Economies (IDE-JETRO), UNCTAD (United Nations Conference on Trade and Development), WIOD (World Input-Output database, Database of Input-Output Matrices funded by the European Commission) and WTO (World Trade Organization) together with OECD (Organization for Economic Cooperation and Development). The method to extract trade in terms of value-added is the cross-analysis of input-output matrices, which allows the understanding of productive complementarities and the insertion of countries in value chains. In hand of these data, especially GVC forward and backward participation indexes,⁹ it is possible to contrast with trade, production and employment structure in gross values. The differences of GVC participation between sectors and countries are clues to comprehend their impact in the economic dynamics and social structures, as a manifestation of the uneven material distribution associated to the kind of activity performed by the companies of each country, in terms of sophistication or amount of value-added. This sort of data has been assessed by many authors, following the OECD/ WTO (2013) and UNCTAD (2013) reports about their trade in value added databases, for example Banga (2013), Miroudot

9 Backward GVC index is the share of foreign value added in the exports of a country, and forward GVC index is the share of domestically produced value added in the exports of other economies (OECD/ WTO, 2013).

Er De Backer (2013), Timmer *et al.* (2014), Baldwin & Lopez-Gonzalez (2015), UNIDO (2018).

Trade in value added data, on the one hand, helps to illustrate how international the value network of the domestic firms (including TNC) is. On the other hand, it also tells us how dependent of imported value-added the exports of a country are. Nevertheless, at the national level, its value does not necessarily mean anything good or bad, although there is a judgement in the mainstream narrative in favor of enlarging participation on GVC (once again, beginning by OECD/WTO, 2013). First, economies vary on trade size and profile, so that general comparisons of GVC indexes are imprecise and incorrect. Secondly, in every sector and division of economic activities there are products from low to high prices, or from low to high technology, and based on low to high value-added activities. Thirdly, as affirmed before, trade in value added does not inform about the kinds of activities performed. Thus, as discussed in last section, if what matters is how the countries are engaging in GVC and *what are the benefits and problems* for the development and redistribution of power and wealth between centre and periphery, and between social classes, more pieces of information are needed.

Therefore, at the firm level, another suggestion for getting general learnings about GVC in absence of case studies, based on the structuralist perspective, is to examine figures of companies and markets, not only industrial organization indicators, but also financial ones. In attention to the fact that the leading TNC have a major role in the shape of GVC, one idea that we develop in the next section of this paper is taking corporate data related to its costs and revenues, provided by the financial analysis annually published by public companies. Financial analysis is used for managerial aims by companies and analysts in general. It was applied also in some pioneer GVC studies on electronics (Dedrick *et al.*, 1999; Linden *et al.* 2007a, Linden *et al.* 2007b, Dedrick *et al.* 2008), which idea we discuss in the next section. As demonstrated in section 2.1, that data show the internal budget's distribution into different kinds of activities and tasks—though in general terms, of the entire business activities of the firms—disregarding the variety of markets they play and the location where they produce.

2. LESSONS FROM FINANCIAL STATEMENTS OF THE WORLD'S TOP MANUFACTURING CORPORATIONS TO DRAW VALUE CURVES

2.1. What do the TNC financials tell about GVC of different manufacturing sectors?

In spite of the misleading generalization of the smiling curve, there is a strong hypothesis in the literature on GVC stating that the value added by activity varies across companies, sectors and chains (Shih, 1996; OCDE, 2013). Perhaps, the chains' shapes are so different that value added in each productive phase may not even draw a curve. One of the best ways to investigate that is case studies, such as the original contribution, in the end of the 1990's and 2000's, of Jason Dedrick, Kenneth Kramer, Greg Linder and co-authors about Acer, Compaq and Apple. The chains of *ipods* and *iphones* became well-known examples to demonstrate how trade data in gross values were not telling much about which countries are actually adding value to products.

In every supply chain, there are producers that buy inputs from others for producing manufactures. The value added to the product is generated by the labour force and by the means of production of the companies. The sum of value added by all producers of the chain, plus taxes, will generate the price of the product. Analogously, in the supply approach of national accounting, value added in the production is the difference between output (at basic prices) and intermediate consumption (at purchaser prices). Gross national product would be, then, the sum of the value-added in all sectors of the economy. This differs from the income approach, which sums net profits of firms and wages of individuals to arrive at GNP (Linden *et al.*, 2007a). As OECD explains, value added reflects the contribution of labour and capital to production, which are imperfectly mirrored in the costs and profits of a company.

“At the firm level, value added equals total revenue minus externally acquired inputs. By the logic of income accounting, it is also roughly equal to the wages, profits, depreciation and interest expense of the firm. At the national level, the aggregation of within-border value

added across all companies equals Gross Domestic Product, which, by a logic similar to the firm level, equals the sum of wages and profits earned by workers and firms located there. The distribution of value added across organizational and national boundaries thus directly concerns variables of importance to policy makers". (Linden *et al.*, 2007a, pp. 3-4)

Linden *et al.* (2007a) calculated the value added at each stage of the electronics supply chain by estimating the selling price of that stage's output and subtracting the cost of all purchased inputs. The authors used financial assessments to understand the relationship between margin and the cost structure, showing the value-added chain of some electronics. As Dedrick *et al.* (2008) observe, product-level data are "extremely hard to obtain",¹⁰ but some industrial analysis exhibit input process and wholesale prices, allowing for the estimation of value added. As a matter of fact, this calculation should also regard taxes and margins, too, though the authors assume that it can be neglected. Nevertheless, as the authors affirm, information about pure value added at the firm level is not available because publicly-listed companies often do not publicize figures about labour expenses in production, which are actually included in the cost of goods sold (COGS, or cost of sales). COGS means costs directly attributed to the production of a good, including materials, direct labour and manufacturing overhead. The difference between COGS and net sales is gross profit (or gross margin). It includes operational expenses (also wages of operational activities), like Selling and marketing expenses and General and Administrative Expenses (SG&A), Research & Development (R&D), rent, insurance, amortization, depreciation and net profit, but excludes direct labour in production—which would be needed to have the exact value added.

In order to do not miss the information about labour, our idea to get some lessons on value added from financial statements is to analyse the cost

¹⁰ "Product-level data are extremely hard to obtain directly from electronics industry firms, who jealously protect information about the pricing deals they have negotiated, and often require the silence of their suppliers and contractors through non-disclosure agreements. For many electronic products, lists of components and their factory prices are available from industry analysts. These "teardown" reports capture the composition of the product at a specific point in time. A teardown report can be used to estimate a product's value added by subtracting the input prices from the wholesale price" (Dedrick *et al.*, 2008, p. 8).

structure of the companies. That sorts of financial data show the internal budget's distribution into different kinds of activities and tasks—though in general terms, of the entire business activities of the firms—disregarding the variety of markets they play and the location where they produce. The operating expenses (OPEX) include all expenses related to business management such as SG&A and R&D,¹¹ and also its wages. The sum of COGS and OPEX is what we have called in this paper “Total Cost” (TC), which allows the understanding of cost allocation at different activities from the company's standpoint. COGS and the OPEX shares of TC bring some light on whether more spending with intangible activities contribute or not for leveraging the profitability of the firm. Therefore, the greater breakdown on OPEX, R&D and SG&A, is important for drawing or mapping value chains since high value-added functions inside the company are usually attributed to expenses shown by standard definition in OPEX. Generally speaking, we can assume that tangible activities in the smiling curve concept are usually demonstrated in the COGS, while the intangibles are usually demonstrated in the OPEX¹².

Thus, with data in hand of the biggest corporations of each manufacturing division, it is possible to compare the cost structures of different industries in order to verify how much they invest in the extremes of the smiling curve, R&D and SG&A, and in production itself. The financial indicators selected for our analysis also included total revenue and Earnings before Interest and Taxes (EBIT). The EBIT, or Operating Profit, is a widely used metric for tracking industrial operations profitability of a company during a specific year. The operating profit is given by subtracting OPEX, depreciation and amortization from gross profits.

11 Many companies do not publish detailed information on R&D and SG&A, so they were excluded from any specific analysis in regards to those indicators, but not excluded from analysis regarding total cost.

12 This concept is not precise since there can be different interpretations on whether an expense should be classified as COGS or OPEX for accounting purposes. For example, some companies allocate their R&D expenses at the COGS group on their Income Statements. Even still, looking at the total R&D expenses for the selected companies, less than 13% (or US\$ 30Bn out of US\$ 234Bn) were classified inside the COGS group. Thus, the concept of tangibles and intangibles remains valid for a more general analysis, but this differentiation should be taken into account for case studies on isolated companies or sectors.

The data collected in Bloomberg terminal comprises main indicators from the consolidated financial reports disclosure of approximately 250 public-listed companies,¹³ which were grouped by sector according to the U.S. government Standard Industrial Classification (SIC). The SIC segmentation is closely comparable to the ISIC classification of the United Nations Statistic Division (UNSTATS), Rev.4¹⁴. The industrial classification is detailed in appendix 2 and the main figures and companies of each sector in appendix 3. All data were converted into USD and were analyzed in nominal terms. Data considers *financial consolidation in the company's parent group level*, not specific subsidiaries (subsidiaries were not analyzed independently). The analysis consisted of the period from 2008 to 2017,¹⁵ for the purpose of understanding the recent trends of each specific industry.

The top 10 companies of each sector based on 2017 revenue were regarded as representative of the major TNC that lead GVC in each industry. This selection still kept close to 67% of total revenue for the total industrial division of the sample considered public companies. Some of those sectors are highly concentrated on the top 10 companies, reaching above 85% of the specific industry in the petroleum, tobacco, leather products, computer and miscellaneous manufacturing. Indeed, all sectors have high a level of revenue concentration of the top 10 companies, so that the least concentrated reaches a share of 47% of the total specific industry (see table 2). For the ten most representative industries in terms of size, this concentration index reaches 86%. The total selected companies account for a US\$ 6.6 Trillion turnover in 2017, led by the petroleum refining industry (US\$ 1.5T) and transportation (US\$ 1.2T),—which do not have a large share in world employment, value added and wages and salaries, as table 1 illustrated—followed by computer and office equipment (US\$ 620Bn), electronic and electrical equipment (US\$ 574Bn), food (US\$ 440Bn) and pharmaceuticals (US\$420Bn).

¹³ We have used the Bloomberg terminal filter for 'Public Companies', thus selecting companies which have shares traded on stock exchanges and have to attend to public disclosure requirements, assuring in this sense the quality of financial data.

¹⁴ For the ISIC Classification see UNIDO.

¹⁵ 2017 or most recent fiscal year, 12 months basis.

Table 2. Industry size according to revenue, revenue of selected companies, share of the industry in the revenue of the sample, revenue of selected industries compared with total industry in 2017, USD current

Industry	Industry Size ¹ (Revenue - USD Bn)	Selected Companies ² (Revenue - USD Bn)	Selected Companies Revenue (% of Total)	Revenue of Selected Companies over Industry Size
Petroleum Refining and Related Industries	1,711	1,447	22%	85%
Transportation Equipment	1,718	1,243	19%	72%
Computer and Office Equipment	707	620	9%	88%
Electronic & Other Electrical Equipment	1,211	574	9%	47%
Food and Kindred Products	776	440	7%	57%
Pharmaceuticals	727	420	6%	58%
Chemicals and Allied Products	701	391	6%	56%
Measuring, Analyzing, Controlling Instruments	510	267	4%	52%
Primary Metal Industries	377	243	4%	65%
Industrial and Commercial Machinery	376	208	3%	55%
Stone, Clay, Glass, and Concrete Products	135	114	2%	84%
Paper and Allied Products	144	106	2%	74%
Rubber and Miscellaneous Plastics Products	113	89	1%	78%
Fabricated Metal Products	134	78	1%	58%
Tobacco Products	72	71	1%	100%
Miscellaneous Manufacturing Industries	76	66	1%	87%
Printing, Publishing, and Allied Industries	102	59	1%	58%
Apparel and Other Made From Fabrics	65	52	1%	79%
Lumber and Wood Products	41	33	1%	80%
Furniture and Fixtures	30	23	0%	76%
Leather and Leather Products	24	23	0%	95%
Textile Mill Products	26	22	0%	84%
Total	9,777	6,590	100%	67%

1) Revenues of Public Companies available in the Bloomberg Platform

2) Top 10 companies by industry

Source: Elaborated by the authors based on Bloomberg/ Financial statements.

2.2. Does a cost structure less concentrated in tangible production activities provide more profit?

Table 3 present COGS over total cost in 2017 by industry, in average percentage. Clearly, COGS has the largest share of total cost (76% on average) in most industries, except pharmaceuticals. For the purpose of understanding how much the top manufacturing TNC of different industries spend in productive (tangible) activities compared to operation expenses (intangible), table 3 also shows a classification—in relative terms among the sectors—from high to low concentration of COGS over Total Cost. The first quartile of higher COGS/Total Cost Sectors was classified as “High”, second quartile as “mid-high”, third as the “mid-low” and forth as the “low” COGS concentrated. Most of high and mid-high COGS are intermediary and

Table 3. COGS over Total Cost in 2017 by industry, USD current

Industry	COGS % of Total Cost	Change in COGS participation (2017 vs. 2008)	COGS Concentration
Petroleum Refining and Related Industries	96%	-1%	High
Primary Metal Industries	96%	2%	High
Transportation Equipment	88%	3%	High
Paper and Allied Products	88%	-1%	High
Lumber and Wood Products	86%	-1%	High
Fabricated Metal Products	84%	-3%	High
Textile Mill Products	83%	15%	Mid-High
Industrial and Commercial Machinery	80%	-2%	Mid-High
Stone, Clay, Glass, and Concrete Products	79%	-1%	Mid-High
Computer and Office Equipment	78%	1%	Mid-High
Miscellaneous Manufacturing Industries	76%	0%	Mid-High
Printing, Publishing, and Allied Industries	76%	0%	Mid-low
Electronic & Other Electrical Equipment	75%	2%	Mid-low
Chemicals and Allied Products	74%	-2%	Mid-low
Furniture and Fixtures	74%	-2%	Mid-low
Food and Kindred Products	73%	-0%	Mid-low
Rubber and Miscellaneous Plastics Products	72%	-4%	Low
Tobacco Products	67%	-3%	Low
Measuring, Analyzing, Controlling Instruments	66%	-4%	Low
Apparel and Other Made From Fabrics	57%	-6%	Low
Leather and Leather Products	56%	1%	Low
Pharmaceuticals	39%	-0%	Low

Source: Elaborated by the authors based on Bloomberg/ Financial statements.

capital goods manufacturers, while most of mid-low and low COGS are consumption goods producers.

Analyzing throughout the years in chart 3, it can be depicted that most of the industries do not show significant change in the COGS/Total Cost structure, although some have been decreasing smoothly over time, such as Apparel, Measuring and Controlling, Tobacco. Albeit this cannot be stated as a trend for the specific industry, since more statistical econometric analysis or specific case studies for each selected company should be added, it could indicate a change towards a high level of expenditures

on the OPEX side (business management, marketing and R&D). In other words, these sectors may be moving faster towards the smiling curve concept of value-adding expenses because they are investing more in intangible activities in relation to tangible. On the other hand, the general trend has been characterized by a stable cost structure since the international financial crisis.

Chart 3. Cost of Goods Sold participation over Total Operational Cost structure (%), 2008-2017, USD current

Source: Elaborated by the authors based in Bloomberg/ Financial statements.

Moreover, the cost structure analysis shows that both R&D and SG&A are in high account for those industries at the low-COGS quartile. As mentioned before, these costs designate the intangible activities of the value curve, both left (pre-production activities, which includes R&D) and right (post-production activities, including sales and marketing). Table 4 provides the average share of R&D and SG&A expenses in sales by industry and by group of COGS concentration. The pharmaceutical industry, in this sense, seems to have a value curve as the smiling picture: it leads R&D percentage in sales is 15%, accounting for 26% of the total R&D expenditures of our sample, amounting to US\$ 61Bn in 2017. In addition, the pharmaceutical industry has one of the highest SG&A percentage over sales and continuously reports higher margins than average. Nevertheless, some of the industries that are classified in high and mid-high COGS, which coincides

Table 4. R&D expenses detailed by sector,
and its relations between EBIT Margin and the industry size
(revenue of the selected companies)

COGS Concentration	Industry	R&D % of sales	SG&A % of Sales	EBIT Margin	Revenue ¹ (% of Total)	Number of Companies
High	Total	2.5%	5.9%	7.3%	47%	34
	Transportation	4.0%	7.7%	7.8%	19%	10
	Fabricated Metal	1.9%	12.3%	11.8%	1%	5
	Primary Metal	1.0%	4.1%	7.5%	4%	8
	Paper	0.5%	23.2%	8.6%	2%	6
	Petroleum Refining	0.4%	1.4%	6.1%	22%	5
Mid-High	Total	4.9%	13.2%	13.8%	15%	33
	Computer	5.7%	12.6%	15.8%	9%	10
	Machinery Equip.	4.0%	11.4%	12.0%	3%	10
	Miscellaneous	4.0%	19.4%	6.3%	1%	6
	Non-metallic Minerals	0.7%	21.0%	4.8%	2%	7
Mid-Low	Total	4.9%	19.5%	11.4%	22%	28
	Electronic	7.8%	15.6%	8.6%	9%	9
	Chemicals	3.0%	18.2%	13.5%	6%	8
	Furniture	1.5%	30.2%	6.8%	0%	6
	Food	1.4%	30.0%	15.0%	7%	5
Low	Total	10.7%	26.1%	18.3%	12%	26
	Pharmaceuticals	14.7%	28.3%	21.8%	6%	10
	Measuring, Controlling	5.1%	22.9%	13.4%	4%	10
	Rubber & Plastic	1.4%	22.3%	9.6%	1%	6

1) Sectors excluded from the analysis due to R&D data not available: apparel, leather products, lumber and wood, publishing, textile and tobacco

Source: Elaborated by the authors based in Bloomberg/ Financial statements.

with UNIDO's classification of medium high/ high technology industries, have a significant expenditure on R&D, highlighted by the transportation industry (4%), electronic and electrical equipment (8 %) and computers (6%). Other divisions with relevant R&D expenditures are measuring, analyzing (5%), chemicals (3%) and industrial and commercial machinery (4%). With concerns to SG&A expenses, the figures are higher than R&D's because SG&A comprehend almost all the other kinds of OPEX. Anyway, definitely, the share of SG&A over sales are in general higher in high-technology intensive industries. Only Paper, Non-metallic minerals and Miscellaneous—classified in high or mid-high COGS—reach a higher than 15% level in SG&A as percentage of sales.

Regarding profitability, our data analysis also shows that companies with “low-COGS” concentration are on average those who are reporting greater

margins, although moving towards a higher level of dispensing in value-added active does not necessarily establish a path to higher profitability, as it can be seen in the apparel industry (which struggles to reach an “above average” EBIT Margin). Still, a general figure can be extracted, as showed in chart 4, and conclusions might suggest that the smiling curve can explain value creation only for some sectors, especially the ones more technology-intensive such as pharmaceuticals and computers. However, as it was said, the share of tangible activities’ expenses in the total cost is high for all sectors, even in those sectors comprised of high technology industries. Moreover, it has remained quite stable for most of the sectors in the last ten years. Thus, tangible or productive activities of the value chain yet are still fundamental for the world top companies in terms of costs.

Chart 4. Relationship between Cost of Goods Sold Concentration and EBIT margin for the 10 top public companies, per manufacturing divisions, 2017 (USD current)

Source: Elaborated by the authors based in Bloomberg/ Financial statements.

CONCLUSIONS

This paper discussed in the first section the theory and the data for understanding GVC: *is GVC a theory? What is the data for GVC analyses?* The second section presented our original analysis of the financial statements of the

top manufacturing TNC in order to learn about value curves: *what do the TNC financials tell about GVC of different manufacturing sectors? Do cost structures less concentrated in tangible production activities provide more profit?*

We have explained in section 1 that GVC is a key concept in the World-System, the other face of the international labour division. GVC is not a theory, but a framework, rapidly adopted by firms, States, and multilateral institutions to design public policies. Since the 2000's the GVC has been more concerned about taking into the social and political issues related to the internationalization of TNC, however still detached of a comprehensive theory which especially considers the class struggle between capital and labour, or centre and periphery.

Therefore, section 1.1 criticized GVC from the Latin-American structuralist perspective. This approach is especially concerned with understanding the mechanisms in which the trade and productive profiles affect the economic dynamic of a country or region, especially its distributive effects. During the globalization process in XX and XXI centuries, TNC have developed international value chains from which high-value activities remain in general in the centre (but China is consolidating as an impressive exception), while low value-added ones are performed in the South. Such configuration enlarges the development gap between centre and periphery because the first concentrates more knowledge and technology-intensive GVC activities, which in theory generate greater stimuli to supply and demand dynamics. However, the different stimuli resulted from the specialization in GVC will have uncertain impacts in income distribution inside the regions, depending on the presence and quality of specific institutions (in special, State policies such as the macroeconomic regime, property rights, market regulation etc.) that diminishes structural heterogeneity. The metaphor of GVC, substantialized in a drawing, is useful as an illustration, but for the structuralists it derives from long-term economic and political relationships. Due to the cruciality of TNC decisions in everything regarding GVC, it is imperative to understand them better, especially regarding their managerial and financial strategies.

However, GVC analyses face many empirical obstacles, as shown in section 1.2. Available data is not enough not only for drawing value curves or maps, but also for understanding path-dependence processes of chains' evolution and effects, regarding markets and, in special, the socio-economic

development of countries and regions. Traditional data is not able to show which countries are responsible for the different activities that add value to a product or service, both at country and firm levels. This would be key to map the chains, revealing if their values-added draw a smiling curve or not. But once the shapes of GVC are mainly related to TNC' productive and financial decisions, case studies are needed.

At the firm level, we highlighted that some general learnings about GVC can be discovered from the financials of companies and markets, as discussed in 2.1. In our own analysis of the financial statements of the world's biggest corporation in manufacturing, we built the indicator "total cost" in order to contrast their spending on tangible (COGS) and intangible costs (OPEX), in a broad sense. This also made possible the classification of different industries into four groups, from high to low COGS. A main result of our analysis shown in 2.2 was that COGS is still very high across industries, so that operation on goods sold accounts for the largest share of their costs. In addition, it has remained quite stable for most of the sectors in the last ten years. Few companies are increasing the level of expenditures on the OPEX side (business management, marketing and R&D). Nevertheless, companies with "low-COGS" concentration, usually high-technology intensive, are on average those reporting greater margins—what could mean that they are moving towards a smiling curve of the firm. Apparently, then, the smiling curve works better to explain value in high technology-intensive industries such as pharmaceuticals and computers. But this is not a rule and more data and econometric models would be need to better understand this. However, it would be necessary to investigate COGS and OPEX structures in detail, in order to get the precise distribution of firms' expenses in the different kinds of tangible and intangible activities.

Therefore, our cost structure analysis of top manufacturing TNC' financial statements provided the general conclusion that tangible activities still are the core expense of most industries, especially intermediary and capital goods producers. However, high technology industries are spending more in intangible activities, from both sides of the smile curve. It is important to acknowledge that the relationship between profits, cost structure and value added is not direct, so cost structure analyses do not provide the value curve itself. Another limitation is that each cost structure was analyzed in aggregate figures, so that it would be necessary to investigate the financials of their different products and markets.

Finally, though not in the scope of this investigation, the question of who is smiling in the value chain is utmost. Wage shares below half of the value added in the majority of the sectors (table 1) and the high margins of the companies in all sectors, especially high technology-intensive and low-COGS ones, confirm that employees are most likely not capturing well the value generated by their labour. And, if we think about world wealth and power structures, the dominance of TNC and States in the international division of labour is leaving little space for socio-economic development and redistribution between centre and periphery.

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APPENDIX 1: SIC AND ISIC REV.4 CLASSIFICATION COMPATIBILITY, TOP 10 COMPANIES OF EACH DIVISION

SIC Classification	SIC Code	Comparable ISIC Code	Companies included (top 10 by Revenue)
Apparel and Other Made From Fabrics	23	14	VF; PVH; Ralph Lauren; Cintas; Under Armour; Carter's; G-III; Gildan Activewear; Lululemon Athletica; Columbia Sportswear
Chemicals and Allied Products	28	20	DowDuPont; BASF; Procter & Gamble; Unilever; LyondellBasell; Nutrien; Alfa SAB; PPG; Monsanto; Ecolab
Computer and Office Equipment	35	26; 262	Apple; Hitachi; IBM; HP; Cisco; Toshiba; Wistron; NEC; Western Digital; Seagate Technology
Electronic & Other Electrical Equipment ¹	36	26, 27	General Electric; Siemens; Sony; Panasonic; Intel; NTT; Midea; Taiwan Semiconductor; Nokia; Onex
Fabricated Metal Products ³	34	25	Stanley Black & Decker; Parker-Hannifin; Ball; SKF; Amcor; Crown; Silgan; Snap-on; CLL Industries; Greif Inc
Food and Kindred Products	20	10.11	Nestle; PepsiCo; Archer-Daniels-Midland; Bunge; Tyson Foods; Coca-Cola; Danone; Kraft Heinz; Mondelez; Fomento SAB
Furniture and Fixtures	25	31	Leggett & Platt; Steekase; Tempur Sealy; Dorel Industries; Herman Miller; HNI; Vitro SAB; La-Z-Boy; Sleep Number; Oppen Home
Industrial and Commercial Machinery ¹	35	28	Caterpillar; Deere; Case New Holland; Cummins; Eaton; Komatsu; TechnipFMC; Illinois Tool Works; ASML Holdings; AGCO Corp
Leather and Leather Products	31	15	Michael Kors; Tapestry; Skechers; Caleres; Wolverine World Wide; Exceed; Steven Madden; Zhejiand Aokang Shoes; Vera Bradley; Fuguiniao Co
Lumber and Wood Products ⁴	24	16	Masco; West Fraser Timber; Universal Forest Products; JELD-WEN; Canfor; Louisiana-Pacific; Norbord; Masonite; Patrick Industries; Interfor
Measuring, Analyzing, Controlling Instruments ²	38	26	Fresenius; Canon; 3M; Medtronic; Northrop Grumman; Raytheon; Fujifilm; Thermo Fisher Scientific; Ricoh; Danaher
Miscellaneous Manufacturing Industries	39	32	Johnson Controls; Doosan; Hasbro; Mattel; Aalberts; Indutrade; Hillenbrand; Acushnet; Evoqua Water; Elders Ltd
Paper and Allied Products	26	17	International Paper; Kimberly-Clark; WestRock; Stora Enso; UPM-Kymmene; Avery Dennison; Packaging Corp of America; Sappi; Domtar; Sonoco
Petroleum Refining and Related Industries	29	19	China Petroleum & Chemical; BP; Exxon Mobil; TOTAL; Chevron; Phillips; Valero Energy; Marathon Petroleum; Statoil; Repsol
Pharmaceuticals	28	21	Johnson & Johnson; Pfizer; Novartis; Sanofi; Merck; Bayer; GlaxoSmithKline; AbbVie; Abbott; Gilead
Primary Metal Industries	33	24	ArcelorMittal; POSCO; Aluminum Corp of China; Nucor; Kubota; Arconic; United States Steel; Alcoa; Gerdau; Corning
Printing, Publishing, and Allied Industries	27	18	Thomson Reuters; RELX; News Corp; RR Donnelley & Sons; Pearson; Wolters Kluwer; Quad/Graphics; Quebecor; Gannett; Cimpres
Rubber and Miscellaneous Plastics Products	30	22	NIKE; Goodyear; Newell Brands; Berry Global; Carlisle Cos; Alaxis; Cooper; AptarGroup; Tupperware Brands; Deckers Outdoor
Stone, Clay, Glass, and Concrete Products	32	23	CRH; LafargeHolcim; Cemex; Origin Energy; Owens-Illinois; Fletcher Building; Owens Corning; Sika; Grupo Carso SAB; Wienerberger
Textile Mill Products	22	13	Mohawk Industries; Lenta; Interface; Luthai Textile; Albany International; Bros Eastern; Sri Rejeki; Hangzhou First Applied Material; Unifit; Xerium
Tobacco Products	21	12	Philip Morris; Altria; Imperial Brands; Swedish Match; Vector; Standard Diversified; Turning Point Brands; Electronic Cigarettes; 22nd Century; Healthier Choices Mgt
Transportation Equipment	37	29, 30	Toyota; Daimler; Ford; General Motors; Honda; Fiat Chrysler; Boeing; United Technologies; Lockheed Martin; Honeywell

1) except Computer Equipment

2) Photo, Medical, Optical; Watch, Clock

3) except Machinery and Transportation Equipment

4) except Furniture

Sources: Elaborated by the authors based on Bloomberg for SIC and UNIDO for ISIC.

APPENDIX 2: FINANCIALS PER INDUSTRY (ALL INDUSTRIES)—IN USD MM

Industry	IncomeStatement	2017	2016	2015	2014	2013	2012	2011	2010	2009
Apparel and Other Finished Products Made From Fabrics and Similar Materials	Revenue	51,752	49,148	47,283	46,120	43,017	38,489	34,055	28,249	24,395
	COGS	26,723	25,563	24,698	23,983	22,332	20,297	18,222	14,889	13,477
	Gross Profit	25,029	23,585	22,585	22,137	20,685	18,192	15,832	13,360	10,918
	SG&A	19,630	17,849	16,479	16,181	15,245	13,240	11,712	9,926	8,068
	R&D	0	0	0	0	0	0	0	0	0
	OPEX	20,493	18,090	16,489	16,280	15,307	13,252	11,730	10,302	8,332
Chemicals and Allied Products	EBIT	4,536	5,495	6,097	5,857	5,379	4,941	4,102	3,059	2,586
	Revenue	390,982	362,019	395,347	368,417	369,943	364,137	370,238	320,253	285,291
	COGS	251,815	231,740	256,669	244,243	242,829	239,770	243,652	205,912	180,382
	Gross Profit	138,945	130,076	138,468	124,174	127,114	124,367	126,585	114,341	104,910
	SG&A	69,570	64,970	70,113	64,240	68,818	67,794	65,812	60,964	61,004
	R&D	10,548	10,456	9,094	6,304	6,171	5,842	5,729	5,051	4,909
Computer and Office Equipment	OPEX	89,185	81,365	86,547	71,444	77,083	77,279	72,946	68,510	70,127
	EBIT	49,760	48,710	51,921	52,730	50,031	47,088	53,639	45,831	34,782
	Revenue	620,251	587,850	636,127	619,487	696,747	712,453	647,284	573,485	528,869
	COGS	403,360	382,344	407,350	402,830	462,561	467,225	434,724	388,360	365,892
	Gross Profit	215,476	204,284	227,539	215,404	232,553	243,629	211,007	183,585	161,317
	SG&A	78,339	77,276	80,990	85,627	98,153	100,007	93,684	87,006	84,450
Electronic & Other Electrical Equipment & Components, except Computer Equipment	R&D	35,317	33,306	31,577	30,710	31,950	31,899	30,213	28,310	28,074
	OPEX	117,203	114,155	115,559	117,713	134,566	155,525	128,894	119,202	118,808
	EBIT	98,272	90,130	111,980	97,691	97,987	88,104	82,113	64,383	42,510
	Revenue	574,067	533,750	525,349	548,926	560,379	611,452	646,493	595,220	590,514
	COGS	359,035	324,547	320,214	336,615	349,006	363,773	388,615	351,198	361,453
	Gross Profit	181,144	179,513	178,668	186,371	182,883	217,060	227,513	214,680	198,471
Fabricated Metal Products, except Machinery and Transportation Equipment	SG&A	85,490	81,408	82,625	85,148	91,302	75,519	75,022	70,915	75,464
	R&D	42,788	40,302	33,868	35,458	39,584	36,580	35,122	31,085	30,940
	OPEX	133,355	124,219	123,696	125,040	132,717	158,898	161,651	154,316	160,551
	EBIT	47,790	55,294	54,972	61,331	50,165	58,162	65,862	60,364	37,921
	Revenue	78,088	71,677	72,623	76,543	73,539	74,890	73,574	61,460	52,555
	COGS	57,158	52,768	53,893	57,304	55,417	56,803	55,568	46,598	41,056
Food and Kindred Products	Gross Profit	20,097	18,105	17,918	18,428	17,543	17,573	17,491	14,423	11,069
	SG&A	8,146	7,890	7,446	7,763	7,749	7,929	7,865	6,719	5,032
	R&D	978	935	974	997	793	719	727	572	572
	OPEX	11,144	10,830	9,959	10,448	10,691	10,309	10,043	8,864	6,938
	EBIT	8,954	7,275	7,959	7,980	6,852	7,264	7,448	5,559	4,131
	Revenue	439,794	435,873	454,122	500,356	482,325	474,044	455,904	398,668	376,506
Furniture and Fixtures	COGS	284,030	278,806	295,431	335,008	326,520	322,989	305,139	258,977	243,761
	Gross Profit	155,764	157,067	158,690	165,349	155,805	151,055	150,765	139,690	132,745
	SG&A	95,484	98,146	100,852	105,361	100,300	98,439	97,194	89,537	88,410
	R&D	3,344	3,387	3,353	3,373	3,124	3,018	2,972	2,698	2,421
	OPEX	106,159	105,716	105,367	116,237	108,160	103,957	102,323	93,043	92,272
	EBIT	49,605	51,350	53,323	49,112	47,644	47,098	48,442	46,647	40,473
Industrial and Commercial Machinery	Revenue	23,240	21,948	21,675	20,732	19,767	18,284	17,613	15,596	15,123
	COGS	14,408	13,572	13,899	13,628	12,322	11,266	11,068	9,749	9,369
	Gross Profit	7,407	7,695	7,179	6,498	6,248	5,736	5,337	4,662	4,479
	SG&A	4,608	4,614	4,373	4,237	3,814	3,038	2,778	2,461	2,825
	R&D	193	210	193	169	171	142	128	110	102
	OPEX	5,624	5,651	5,419	5,348	4,846	4,434	3,974	3,602	3,798
Leather and Leather Products	EBIT	1,782	2,044	1,761	1,151	1,402	1,302	1,363	1,060	680
	Revenue	207,976	180,503	199,163	225,017	228,463	230,583	217,550	143,388	125,407
	COGS	146,260	128,830	142,578	161,340	164,376	165,280	156,547	101,278	91,995
	Gross Profit	60,736	50,803	55,731	62,793	63,133	64,309	60,006	41,044	32,106
	SG&A	23,682	21,502	22,349	26,004	25,755	24,928	23,162	17,672	16,841
	R&D	8,402	7,774	8,164	9,043	8,659	8,299	7,538	5,469	4,737
Lumber and Wood Products, except Furniture	OPEX	35,760	33,596	34,440	38,250	36,014	35,067	32,292	24,965	24,598
	EBIT	24,976	17,207	21,291	24,544	27,119	29,243	27,714	16,080	7,507
	Revenue	22,721	21,151	20,148	18,734	16,951	14,127	12,314	11,119	9,354
	COGS	9,886	9,424	9,026	8,421	7,468	6,225	5,723	5,082	4,359
	Gross Profit	11,342	10,784	10,301	9,623	8,962	7,485	6,370	5,864	4,878
	SG&A	7,814	7,200	6,747	6,063	5,492	4,750	4,210	3,828	3,341
Measuring, Analyzing, Controlling Instru; Photo, Medical, Optical; Watch, Clock	R&D	0	0	0	0	0	0	3	0	0
	OPEX	8,890	7,859	7,318	6,531	5,971	5,115	4,548	4,029	3,554
	EBIT	2,453	2,925	2,983	3,091	2,991	2,370	1,822	1,834	1,324
	Revenue	33,012	29,374	27,209	27,118	27,404	24,168	22,592	19,155	15,700
	COGS	24,763	22,842	21,978	22,033	21,848	19,762	18,080	14,642	12,432
	Gross Profit	8,249	6,532	5,099	5,085	5,556	4,406	3,547	3,551	2,550
	SG&A	3,207	2,986	2,795	2,727	2,891	2,796	2,794	2,266	2,182
	R&D	0	57	0	0	0	0	0	0	0
	OPEX	4,080	3,742	3,571	3,492	3,634	3,587	3,966	3,490	3,026
	EBIT	4,169	2,790	1,528	1,593	1,922	819	-419	61	-476
	Revenue	266,686	245,210	233,702	237,616	242,778	246,684	240,408	227,954	210,860
	COGS	152,490	139,123	135,380	139,305	143,268	145,290	141,673	136,588	129,983
	Gross Profit	113,450	105,363	98,135	98,093	99,509	101,394	98,736	91,367	80,877
	SG&A	61,101	56,162	53,676	53,566	54,399	55,874	54,218	47,793	45,876
	R&D	13,547	12,838	11,437	11,503	12,147	13,677	12,446	12,161	11,418
	OPEX	77,646	71,903	67,037	65,978	67,752	70,436	67,584	64,410	58,833
	EBIT	35,804	33,460	31,097	32,116	31,757	30,959	31,151	26,957	22,044

APPENDIX 2 (CONT.): FINANCIALS PER INDUSTRY (ALL INDUSTRIES)—IN USD MM

Industry	IncomeStatement	2017	2016	2015	2014	2013	2012	2011	2010	2009
Miscellaneous Manufacturing Industries	Revenue	66,227	55,139	51,693	77,362	49,188	50,685	33,114	35,277	47,940
	COGS	43,395	36,107	33,300	56,313	30,713	32,117	17,664	19,155	30,613
	Gross Profit	19,748	16,241	14,714	17,181	14,869	15,146	11,940	13,266	14,814
	SG&A	12,407	10,140	9,251	10,977	9,247	9,630	7,806	8,779	10,022
	R&D	1,196	1,178	1,268	556	513	477	257	219	306
	OPEX	14,426	12,124	11,537	12,425	11,080	11,630	8,563	9,526	14,387
	EBIT	5,322	4,117	3,177	4,756	3,789	3,515	3,377	3,740	427
Paper and Allied Products	Revenue	106,067	100,466	101,806	108,737	105,945	109,228	107,428	98,189	90,295
	COGS	61,547	57,821	57,897	60,138	57,527	61,610	58,485	53,302	47,672
	Gross Profit	21,863	20,694	21,257	21,242	20,329	19,490	18,889	18,605	18,606
	SG&A	20,054	19,482	19,857	22,079	22,465	22,654	22,639	19,923	18,812
	R&D	331	208	186	395	447	266	218	214	226
	OPEX	11,828	11,100	12,837	12,965	12,721	13,948	11,099	10,026	13,895
	EBIT	10,035	9,594	8,419	8,277	7,609	5,542	7,790	8,579	4,711
Petroleum Refining and Related Industries	Revenue	1,447,485	1,151,685	1,373,742	2,094,564	2,226,864	2,261,870	2,226,610	1,728,669	1,367,205
	COGS	745,907	834,538	720,469	1,143,028	1,223,846	1,245,965	1,247,647	989,527	756,024
	Gross Profit	121,926	105,894	109,293	190,331	218,346	243,095	264,316	167,902	170,129
	SG&A	28,961	37,773	30,869	32,135	32,750	33,466	48,790	45,385	44,539
	R&D	2,746	2,887	2,929	3,580	3,673	3,339	3,257	3,173	2,979
	OPEX	54,991	91,635	82,818	81,093	45,955	46,990	34,323	35,301	49,906
	EBIT	66,935	14,259	26,474	109,239	172,391	196,106	229,992	132,601	120,223
Pharmaceuticals	Revenue	420,322	405,730	411,126	420,232	408,351	413,075	428,549	420,532	367,189
	COGS	126,193	118,234	126,114	133,214	133,240	131,127	136,627	134,172	110,106
	Gross Profit	290,727	283,739	281,346	284,261	272,300	279,161	289,004	285,299	256,145
	SG&A	118,974	112,119	117,566	121,129	117,364	119,841	126,437	127,824	108,542
	R&D	61,754	59,996	55,236	54,368	53,394	53,322	54,904	55,662	49,582
	OPEX	199,021	189,571	173,829	190,614	184,900	191,393	204,585	208,073	175,841
	EBIT	91,706	94,167	107,517	93,648	87,400	87,768	84,419	77,226	80,304
Primary Metal Industries	Revenue	243,249	207,417	223,205	271,387	276,063	266,184	283,715	226,101	170,948
	COGS	144,992	174,176	198,619	237,448	245,199	242,128	247,135	195,112	154,442
	Gross Profit	28,269	29,500	19,940	32,467	29,393	23,015	35,421	29,751	15,418
	SG&A	8,976	11,331	11,958	13,102	13,250	12,566	12,626	11,196	10,646
	R&D	2,211	1,708	2,093	2,238	2,336	2,270	2,147	1,982	1,695
	OPEX	9,877	17,271	19,151	20,406	21,982	17,591	17,362	14,851	15,319
	EBIT	18,392	12,230	789	12,061	7,411	5,425	18,059	14,900	99
Printing, Publishing, and Allied Industries	Revenue	59,292	58,749	59,358	62,689	67,014	67,024	64,932	62,082	57,392
	COGS	20,837	20,626	20,713	21,589	25,066	24,773	19,926	19,166	18,822
	Gross Profit	18,983	18,665	18,815	19,961	20,318	20,413	17,809	17,190	17,208
	SG&A	22,568	22,776	22,889	24,429	25,298	25,380	25,361	24,948	21,812
	R&D	243	221	194	175	165	129	94	78	60
	OPEX	12,549	17,026	14,524	12,308	15,071	16,052	11,863	10,005	11,987
	EBIT	6,434	1,639	4,292	7,654	5,247	4,362	5,946	7,184	5,221
Rubber and Miscellaneous Plastics Products	Revenue	88,520	83,571	74,156	73,621	71,426	70,998	70,223	61,657	56,616
	COGS	57,241	52,881	44,399	45,679	45,520	46,520	46,751	40,369	36,489
	Gross Profit	31,279	30,690	26,376	25,278	23,467	22,271	21,220	19,256	17,804
	SG&A	20,802	20,064	17,248	16,632	14,911	14,058	13,662	12,760	11,944
	R&D	238	236	180	186	187	163	172	140	107
	OPEX	21,716	21,079	17,601	17,372	16,158	15,405	15,510	14,128	14,014
	EBIT	9,563	9,611	8,775	7,905	7,310	6,867	5,710	5,128	3,790
Stone, Clay, Glass, and Concrete Products	Revenue	113,798	109,198	104,956	107,933	110,804	107,973	106,342	93,271	90,789
	COGS	65,003	58,826	56,880	58,915	59,459	59,198	60,013	53,273	54,203
	Gross Profit	28,881	32,005	26,024	28,348	27,477	26,523	27,086	24,800	24,582
	SG&A	22,672	22,022	21,039	19,673	20,424	19,573	19,820	17,709	17,523
	R&D	479	509	475	457	454	432	298	270	238
	OPEX	22,298	21,407	21,105	19,942	18,905	18,820	19,570	17,428	12,168
	EBIT	6,583	10,599	4,919	8,407	8,573	7,703	7,516	7,372	12,414
Textile Mill Products	Revenue	21,930	19,362	17,987	18,545	17,420	14,632	14,034	12,264	9,285
	COGS	14,531	11,640	10,837	11,675	11,036	9,176	8,817	7,802	6,103
	Gross Profit	5,745	5,517	5,014	4,917	4,464	3,759	3,590	3,248	2,344
	SG&A	3,162	2,957	2,931	2,844	2,638	2,220	2,019	1,927	1,759
	R&D	92	69	67	89	83	82	83	82	81
	OPEX	3,368	3,145	3,123	3,040	2,852	2,554	2,358	2,220	2,140
	EBIT	2,377	2,372	1,890	1,877	1,612	1,205	1,231	1,027	203
Tobacco Products	Revenue	71,495	69,665	68,429	73,429	74,414	74,637	74,688	70,086	67,163
	COGS	31,323	30,584	30,420	33,819	33,144	34,072	35,290	33,536	32,734
	Gross Profit	40,143	39,025	37,983	39,566	41,224	40,523	39,355	36,455	34,323
	SG&A	8,523	8,830	8,371	8,505	8,457	9,086	7,679	7,878	13,906
	R&D	21	17	16	17	16	430	15	28	28
	OPEX	15,399	15,444	15,280	16,142	15,854	16,277	14,989	14,364	14,625
	EBIT	24,745	23,581	22,702	23,423	25,370	24,246	24,366	22,092	19,699
Transportation Equipment	Revenue	1,242,932	1,190,372	1,176,113	1,207,271	1,188,335	993,297	969,226	885,691	831,231
	COGS	964,702	927,172	925,740	966,657	952,426	810,542	772,466	714,360	697,272
	Gross Profit	230,688	220,541	212,509	212,640	210,527	157,870	171,036	153,179	106,423
	SG&A	96,229	95,484	93,564	100,233	96,327	86,631	85,163	80,364	84,103
	R&D	50,252	47,430	43,922	40,075	39,476	36,736	35,855	24,660	34,115
	OPEX	133,852	131,534	125,385	135,518	130,523	142,036	112,717	105,199	116,556
	EBIT	96,836	89,006	87,124	77,122	80,005	15,834	58,320	47,980	-10,134

APPENDIX 3: FINANCIALS PER INDUSTRY (INDUSTRIES WITH R&D DISCLOSED)— IN USD MM

Industry	Income Statement	2017	2016	2015	2014	2013	2012	2011	2010	2009
Chemicals and Allied Products	Revenue	355,828	328,344	357,963	328,023	330,963	324,957	331,286	292,167	263,604
	COGS	224,342	206,091	229,061	213,170	213,283	211,015	215,860	185,243	163,389
	Gross Profit	131,485	122,252	128,902	114,853	117,680	113,943	115,426	106,924	100,215
	SG&A	64,825	60,259	65,532	59,642	64,690	63,896	62,151	57,997	58,614
	R&D	10,548	10,456	9,094	6,304	6,171	5,842	5,729	5,051	4,909
	OPEX	83,624	76,471	82,061	66,922	72,937	73,325	69,440	65,678	67,963
	EBIT	47,861	45,781	46,841	47,931	44,743	40,617	45,986	41,246	32,252
Computer and Office Equipment	Revenue	620,251	587,850	636,127	619,487	696,717	712,453	647,284	573,485	528,869
	COGS	403,350	382,344	407,350	402,830	462,561	467,225	434,724	388,360	365,802
	Gross Profit	215,476	204,284	227,539	215,404	232,553	243,629	211,007	183,585	161,317
	SG&A	78,339	77,276	80,990	85,627	98,153	100,007	93,684	87,060	84,450
	R&D	35,317	33,306	31,577	30,710	31,950	31,899	30,213	28,310	28,074
	OPEX	117,203	114,155	115,559	117,713	134,566	155,525	128,894	119,202	118,808
	EBIT	98,272	90,130	111,980	97,691	97,987	88,104	82,113	64,383	42,510
Electronic & Other Electrical Equipment & Components, except Computer Equipment	Revenue	549,570	515,945	505,668	532,046	540,555	586,535	621,851	575,486	568,645
	COGS	341,114	311,639	306,632	324,452	334,376	343,865	368,890	335,706	344,307
	Gross Profit	174,568	174,616	172,569	181,654	177,689	212,051	222,596	210,438	193,748
	SG&A	85,490	81,408	82,625	85,148	91,302	75,519	75,022	70,915	72,981
	R&D	42,788	40,302	33,868	35,458	39,584	36,580	35,122	31,085	30,940
	OPEX	127,450	119,795	118,320	120,823	127,696	154,462	157,624	151,123	156,527
	EBIT	47,119	54,821	54,249	60,831	49,992	57,589	64,972	59,315	37,222
Fabricated Metal Products, except Machinery and Transportation Equipment	Revenue	51,711	48,965	51,273	53,988	52,070	53,888	52,924	43,458	36,509
	COGS	37,668	35,913	37,865	40,254	39,036	40,523	39,544	32,688	28,504
	Gross Profit	13,306	12,331	12,666	12,988	12,511	12,904	12,917	10,379	7,616
	SG&A	6,374	6,324	6,038	6,250	6,393	6,731	6,717	5,686	4,171
	R&D	978	935	974	997	793	719	727	572	572
	OPEX	7,184	7,295	6,936	7,441	7,876	7,710	7,607	6,646	4,941
	EBIT	6,122	5,036	5,730	5,547	4,634	5,194	5,310	3,733	2,674
Food and Kindred Products	Revenue	235,087	230,668	237,624	258,606	229,714	223,291	224,057	214,287	195,786
	COGS	120,859	117,678	124,099	139,725	119,945	117,294	117,549	111,512	94,481
	Gross Profit	114,229	112,991	113,525	118,881	109,769	105,998	106,508	102,774	101,305
	SG&A	70,613	71,837	73,695	77,304	72,454	71,119	71,060	68,056	69,984
	R&D	3,344	3,387	3,353	3,373	3,124	3,018	2,972	2,698	2,421
	OPEX	78,949	77,893	76,388	86,891	79,161	75,433	75,458	73,755	72,955
	EBIT	35,279	35,097	37,137	31,990	30,609	30,565	31,051	29,019	28,350
Furniture and Fixtures	Revenue	12,751	13,037	12,920	12,286	10,969	9,788	9,195	8,209	7,995
	COGS	7,846	8,018	8,206	7,939	7,052	6,234	5,933	5,352	5,323
	Gross Profit	4,905	5,019	4,714	4,347	3,916	3,554	3,263	2,857	2,672
	SG&A	3,849	3,815	3,614	3,473	3,049	2,613	2,331	2,107	2,055
	R&D	193	210	193	169	158	138	123	110	102
	OPEX	4,039	4,044	3,842	3,814	3,212	2,764	2,465	2,246	2,325
	EBIT	866	976	873	533	704	791	797	611	347
Industrial and Commercial Machinery	Revenue	207,976	180,503	199,163	225,017	228,463	230,583	217,550	143,388	125,407
	COGS	146,260	128,830	142,578	161,340	164,376	165,280	156,547	101,278	91,995
	Gross Profit	60,736	50,803	55,731	62,793	63,133	64,309	60,006	41,044	32,106
	SG&A	23,682	21,502	22,349	26,004	25,755	24,928	23,162	17,672	16,841
	R&D	8,402	7,774	8,164	9,043	8,659	8,299	7,538	5,469	4,737
	OPEX	35,760	33,596	34,440	38,250	36,014	35,067	32,292	24,965	24,598
	EBIT	24,976	17,207	21,291	24,544	27,119	29,243	27,714	16,080	7,507
Measuring, Analyzing, Controlling Instru; Photo, Medical, Optical; Watch, Clock	Revenue	266,686	245,210	233,702	237,616	242,778	246,684	240,408	227,954	210,860
	COGS	152,490	139,123	135,380	139,305	143,268	145,290	141,673	136,588	129,983
	Gross Profit	113,450	105,363	98,135	98,093	99,509	101,394	98,736	91,367	80,877
	SG&A	61,101	56,162	53,676	53,566	59,309	55,874	54,218	47,793	45,876
	R&D	13,547	12,838	11,437	11,503	12,147	13,677	12,446	12,161	11,418
	OPEX	77,646	71,903	67,037	65,978	67,752	70,436	67,584	64,410	58,833
	EBIT	35,804	33,460	31,097	32,116	31,757	30,959	31,151	26,957	22,044

APPENDIX 3 (CONT.): FINANCIALS PER INDUSTRY (INDUSTRIES WITH R&D DISCLOSED)—IN USD MM

Industry	Income Statement	2017	2016	2015	2014	2013	2012	2011	2010	2009
Miscellaneous Manufacturing Industries	Revenue	30,200	28,853	29,067	32,710	33,450	34,829	16,653	13,516	26,486
	COGS	20,597	19,063	18,758	21,729	22,111	23,428	8,396	6,612	17,945
	Gross Profit	9,564	9,790	9,379	10,036	10,443	10,582	7,445	6,281	7,987
	SG&A	5,856	5,574	5,678	6,325	5,954	6,179	4,389	3,659	4,800
	R&D	1,196	1,178	1,268	556	513	477	257	219	306
	OPEX	7,663	7,378	7,825	7,541	7,506	8,102	5,415	4,449	6,156
	EBIT	1,900	2,412	1,554	2,494	2,937	2,481	2,020	1,833	1,831
Paper and Allied Products	Revenue	61,346	57,215	61,084	67,703	67,782	72,228	72,950	67,156	60,756
	COGS	28,618	26,318	28,263	30,116	29,717	34,072	33,134	31,505	26,734
	Gross Profit	10,072	8,946	10,169	10,613	10,352	10,413	10,138	9,764	10,408
	SG&A	14,220	13,667	14,435	16,508	17,104	17,400	17,803	15,390	14,464
	R&D	331	208	186	395	447	266	218	214	226
	OPEX	4,784	4,103	5,254	6,778	7,104	8,588	6,012	5,120	9,908
	EBIT	5,287	4,843	4,916	3,835	3,249	1,825	4,126	4,645	500
Petroleum Refining and Related Industries	Revenue	734,513	595,644	705,012	1,088,178	1,164,638	1,224,340	1,227,418	990,252	811,592
	COGS	424,606	347,919	420,911	656,336	696,040	726,995	713,609	593,339	440,536
	Gross Profit	93,842	59,097	78,524	141,240	161,140	173,096	195,134	117,874	136,284
	SG&A	10,631	10,503	11,424	12,788	13,161	14,744	31,212	29,639	30,734
	R&D	2,746	2,887	2,929	3,580	3,673	3,339	3,257	3,173	2,979
	OPEX	48,977	53,798	73,057	76,907	41,654	40,476	30,865	28,528	43,982
	EBIT	44,865	5,299	5,467	64,333	119,486	132,620	164,269	89,347	92,303
Pharmaceuticals	Revenue	420,322	405,730	411,126	420,232	408,351	413,075	428,549	420,532	367,189
	COGS	126,193	118,234	126,114	133,214	133,240	131,127	136,627	134,172	110,106
	Gross Profit	290,727	283,739	281,346	284,261	272,300	279,161	289,004	285,299	256,145
	SG&A	118,974	112,119	117,566	121,129	117,364	119,841	126,437	127,824	108,542
	R&D	61,754	59,996	55,236	54,368	53,394	53,322	54,904	55,662	49,582
	OPEX	199,021	189,571	173,829	190,614	184,900	191,393	204,585	208,073	175,841
	EBIT	91,706	94,167	107,517	93,648	87,400	87,768	84,419	77,226	80,304
Primary Metal Industries	Revenue	210,746	180,948	195,191	232,775	239,587	227,426	243,807	192,883	148,710
	COGS	116,445	150,370	172,152	202,737	211,541	206,582	210,667	163,792	131,809
	Gross Profit	24,313	26,836	18,394	28,566	26,574	19,804	31,982	27,852	15,813
	SG&A	8,601	11,076	11,543	12,579	12,640	11,912	11,893	10,586	10,028
	R&D	2,211	1,708	2,093	2,238	2,336	2,270	2,147	1,982	1,695
	OPEX	8,411	15,871	16,813	18,221	18,192	15,655	15,616	13,293	13,833
	EBIT	15,902	10,965	1,581	10,345	8,382	4,149	16,366	14,559	1,980
Rubber and Miscellaneous Plastics Products	Revenue	16,956	16,284	16,316	16,999	16,319	16,401	16,168	13,896	12,374
	COGS	11,140	10,437	8,078	8,706	8,501	8,776	9,029	7,526	6,072
	Gross Profit	5,816	5,847	4,856	5,628	5,378	5,418	4,878	4,337	3,979
	SG&A	3,774	3,436	2,811	3,345	2,650	2,541	2,357	2,084	1,787
	R&D	238	236	180	186	187	163	172	140	107
	OPEX	4,181	3,988	2,817	3,741	3,610	3,519	3,303	2,941	2,802
	EBIT	1,635	1,859	2,039	1,888	1,769	1,899	1,575	1,396	1,177
Stone, Clay, Glass, and Concrete Products	Revenue	70,054	68,307	65,674	65,261	64,974	65,031	64,955	57,876	56,346
	COGS	43,419	37,868	37,357	37,343	37,818	38,372	38,061	33,991	34,558
	Gross Profit	17,949	21,376	17,014	19,316	19,202	18,501	18,666	17,011	16,590
	SG&A	14,706	14,245	14,006	12,574	13,066	13,370	13,327	11,582	11,325
	R&D	479	509	475	457	454	432	298	270	238
	OPEX	14,600	13,858	13,929	13,597	13,277	14,118	13,491	11,856	11,831
	EBIT	3,348	7,519	3,084	5,720	5,926	4,383	5,175	5,156	4,759
Transportation Equipment	Revenue	1,242,932	1,190,372	1,176,113	1,207,271	1,188,335	993,297	969,226	885,691	831,231
	COGS	964,702	927,172	925,740	966,657	952,426	810,542	772,466	714,360	697,272
	Gross Profit	230,688	220,541	212,509	212,640	210,527	157,870	171,036	153,179	106,423
	SG&A	96,229	95,484	93,564	100,233	96,327	86,631	85,163	80,364	84,103
	R&D	50,252	47,430	43,922	40,075	39,476	36,736	35,855	24,660	34,115
	OPEX	133,852	131,534	125,385	135,518	130,523	142,036	112,717	105,199	116,556
	EBIT	96,836	89,006	87,124	77,122	80,005	15,834	58,320	47,980	-10,134