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Prices of value added and competitiveness in global value chains

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Abstract

Measuring international competitiveness is a highly contested issue in contemporary economics. The emergence of global value chains limits the accuracy of traditional export-based measures and calls for the employment of techniques capable of accounting for value added input of individual economies into global production and trade.

The paper aims to contribute to the global value chains literature by developing a framework both for distinguishing diverse modes of competitiveness and for the identification of successful cases of upgrading. It adapts an established method of export price comparisons to the context of global value chains and proposed a bi-dimensional technique based on the dynamics of the volumes and prices of GVC Income. As it concerns the technical side of the paper, it takes advantage of an input-output analysis and additive decomposition technique in order to disentangle the value-added-based measure of GVC Income, as well as the prices and volumes components of its dynamics.

Empirical analysis, based on World Input-Output Database, demonstrates that countries differ significantly not only in terms of total GVC income dynamics, but also in terms of the modes chosen to build their competitive position in the global economy. In particular, upgrading throughout the period was achieved only by a few Central, Eastern European and emerging countries. The chances of successfully upgrading changed drastically in time, with the stage of the global business cycle and the balance between global demand and supply. In particular, catching-up possibilities by upgrading, strong in early 2000's, decreased significantly after the Economic Crisis. The key reason, next to weak demand, that stands behind these developments is the impressive expansion of China, which has been on an upgrading path since 2005.

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1 Introduction

For the global economy, recent decades were a period of profound structural change. A number of low- and middle-income countries have become deeply integrated into international trade and capital networks, an accompanying phenomenon being their growing contribution to global manufacturing exports and output. During this period production processes were subject to international fragmentation, and global value chains emerged as the structures of a new international division of labour (Gereffi, 2005).

A well-established stylized fact relates to an increasing share of foreign intermediate inputs in exports, the so-called vertical specialization. It implies that the performance of national economies should be assessed in terms of the domestic value added contribution to exports (Koopman et al., 2010; Baldwin and Lopez-Gonzalez, 2015). One of the measures developed for such purposes is the Global Value Chain (GVC) Income, which captures the total domestic value added embodied in global manufacturing final goods (Timmer et al., 2013)[1]. Its dynamics, presented in the Figure 1, demonstrates the impressive growth of China, followed until 2008 by Central and Eastern Europe (CEE) and by other emerging economies (EME). Southern (SE) and North-Western (NWE) Europe performed moderately well, while other High-Income Economies (HIE) stagnated throughout the period.

However, it is worthwhile posing questions as to the quality of this expansion (expressed in monetary terms) of low- and middle-income countries, i.e. whether they were competing only by means of low costs and traditional production structures, or whether they managed to upgrade the quality and innovativeness of their products and processes? Early accounts highlighted China's or India's low costs of production as their major advantage (Samuelson, 2004), yet the later ones noticed an increasing degree of sophistication in both countries' technology and exports (Brandt and Thun, 2010; Wang and Wei, 2010; Altenburg et al., 2008). Nonetheless, other authors doubt that such analyses properly consider the quality of domestic value added, mistaking it with the sophistication of whole exported goods (Amiti and Freund, 2010; Li et al., 2011). Similar questions are expressed in the case of Central and Eastern Europe, where growth had hitherto been concentrated in the area of multinational corporations. In turn, Wood (2017) argues that globalization actually led to

[1]Technical details are elaborated in a further part of the paper.

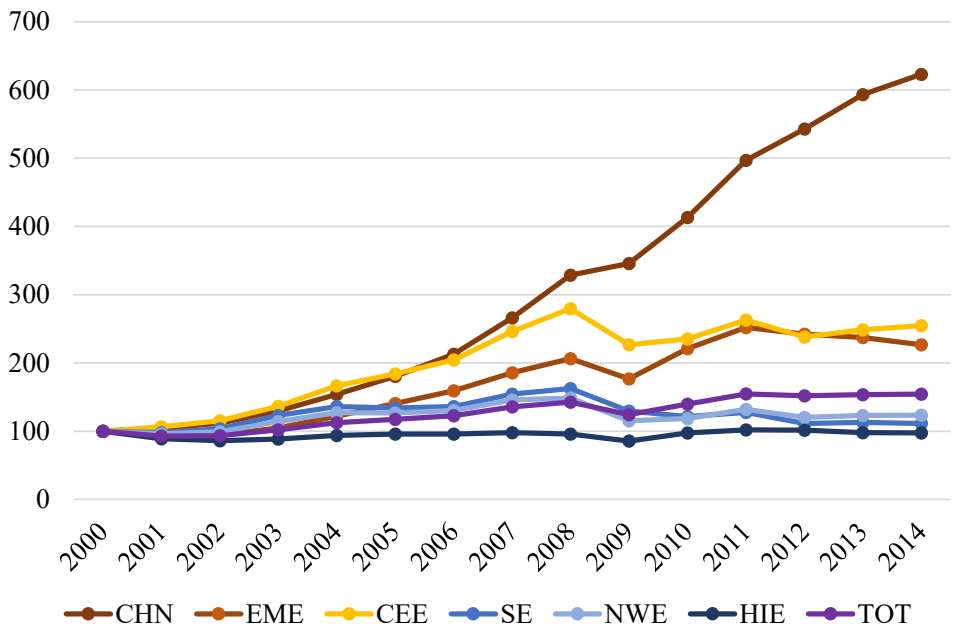

Figure 1: Dynamics of GVC Income in USD2000, country groups, value for 2000 = 100
Source: own elaboration based on WIOD data.

further specialization in terms of factor endowments, with growing differences (in terms of skill levels) between developed and developing countries.

These contradictory views are indicative of the challenges relating to the measurement of the performance and competitiveness of nations in global value chains. The complexity of real-world economic processes and flows frustrates attempts of systematic quantitative depictions. Analyses of inter-country input-output tables are one of the techniques which address such challenges, and their proliferated usage in recent years has led to successful description of many aspects of global economy. Their usefulness in distinguishing between price- and non-price competitiveness, or to assess upgrading in GVC has nonetheless been limited.

In this paper, I aim at contributing to the presented question by focusing on a particular aspect of the organization of GVCs, namely the prices of value added. I adopt the concepts and techniques of export price comparisons in the context of global value chains, and propose a framework of identification with regards to diverse modes of competitiveness. Then, I apply it empirically to WIOD data in order to answer following questions:

1. To what extent does price- and non-price competitiveness prevail in countries partic-

ipating in global value chains?

2. Which countries manage to achieve upgrading in GVCs? What are the actual paths of building competitiveness in global value chains?

3. Is competitiveness in GVCs related to countries' level of development? Does catching-up via upgrading in GVCs take place?

2 Product prices as indicators of international competitiveness

International competitiveness can be described as a general capability of national economies to generate income through their participation in international exchange and division of labour (Buckley et al., 1988; Siggel, 2006). As a starting point, two ways of increasing the national income can be distinguished - that of producing and selling more goods and services, and that of selling the same quantities more expensively[2]. The two ways naturally stand in contradiction to one another, since market competition tends to punish the expensive producers, and reward the cheap ones.

However, the trade-off between price and quantity growth is not necessarily directly proportional. Available strategies always range from penetration to monopolistic pricing, but their effectiveness varies according to the existing market conditions (Dosi, 1984). Demand rigidities, differentiated products and imitation lags may allow firms to increase prices and sustain market shares. Conversely, at a high price-elasticity of demand or given intensive competition, it may pay off for a company to set a relatively low price, with the sole aim of market expansion. Thus, given sectoral specificity, nominal revenue is the primary indicator of the competitiveness of an individual company or whole industry (in an international perspective).

Observation of prices may, nonetheless, be informative itself, and is actually being used to distinguish between price- and non-price-competitiveness. On the one hand, relatively low

[2]Hereafter, 'price' will be understood as the international one, i.e. expressed in a single currency, including the impact of exchange rates.

prices of production or export baskets serve as an indicator of price-competitiveness, perceived implicitly as something beneficial (Durand and Giorno, 1987; Lewney et al., 2012). In particular, they allow firms from low- and middle-income economies to expand their exports. Looking for the opportunities to reduce prices of offered goods and services, especially by means of technical change, is perceived here as the basic mechanism of competition (Shaikh, 2016).

On the other hand, comparison of prices or unit values of individual goods is a way to analyse the quality or innovativeness of exports (Aiginger, 1997; Evgeniev and Gereffi, 2008; Silver, 2010). Here, conversely, competitiveness is associated with high or increasing relative prices. For instance, Kaplinsky and Paulino (2005) observed that, under specific assumptions, unit prices of exports can reflect the innovation intensity of goods.

The apparent contradiction in the way competitiveness is analysed points to the requirement of more complex, bi-dimensional measures. It is not the price dynamic itself which matters, but its relation to the change of market shares, in real or nominal terms. Price competitiveness may be a viable strategy, but only so long as it leads to a growth of revenues. Similarly, setting high prices (when supported by non-price advantages) may not undermine the market position of a company. Kaplinsky and Readman (2005) argue that achieving both improved price relations and increased, or at least stable, market shares in a specific industry, characterizes successful upgrading, i.e. developing some new advantages over the competitors.

I argue that the proposed framework can be used as a descriptive tool not only at a level of narrow industries, but also for large sectors or whole export baskets (and for certain reasons it may be even preferable). The importance of aggregate price relations for national development is well established in international economics. Prices of traded products, analysed traditionally by means of real effective exchange rates or terms of trade, serve as remunerations of domestic factors of production, and hence as means for social and economic reproduction (Lipschitz and McDonald, 1992). This means that competing on the basis of low prices, although beneficial for shares in global exports, may undermine the ability to invest, innovate and consume. The significance of technology- and quality-based competitiveness (in comparison to the cost-based variant) for economic growth has been supported

also on the empirical grounds (Fagerberg et al., 2007). However, certain conceptual adjustments need to be made to the end that both structural and macroeconomic factors are being properly appreciated.

On the one hand, industries exhibit great heterogeneity on both the supply and demand side, with concomitant consequences for the potential effectiveness of price- and non-price modes of competitiveness. Sectoral supply and demand expand at different rates, due to the existing inter-industry variation in terms of the pace of technical change, the length of imitation lags, as well as price- and income-elasticities of demand. In turn, the existing industrial structure is highly relevant to the macroeconomic performance achieved (Dosi et al., 1990). In particular, a specialization in the production of simple, standardized goods, with technologically unsophisticated content and no significant barriers to entry, makes expansions of output difficult to reconcile with an increase or even mere stability in the prices of goods - as observed initially by R. Prebisch (1950) and H. Singer (1950). This may refer to primary products from agriculture and mining (except for rare minerals), but also to low-technology manufacturing and services (Singer, 1982; Sarkar and Singer, 1991; Ocampo and Parra-Lancourt, 2010) [3]. Accounting for structural differences between economies may therefore be informative for the aggregate assessments I wish to render with regards to this topic[4].

On the other hand, for a number of reasons, the role of specialization patterns ought not to be overestimated. It has been recognized that certain institutional and horizontal differences between low- and high-income economies do not support price increases in the latter, even when controlling for their disadvantageous industrial structure, which has been described as the Kindleberger-effect(Kindleberger, 1958). Empirical analyses of the underlying structural aspects point to substantial differences across countries in performance within individual industries, differences more relevant for aggregate performance than structural ones (Lall, 2000; Kaplinsky and Paulino, 2005).

First and foremost, it is the quality of the entire national systems of innovation which allows an economy to gain absolute technological advantages in multiple industries (Tsaliki et al.,

[3]For extended overviews see: Kaplinsky (2006); Toye and Toye (2003); Mayer (2002)

[4]Structural decomposition of aggregate changes into components of particular industries and chains will be conducted in a planned extension of the paper.

2017). Another relevant factor is the bargaining power of workers and the existing amount of national surplus labour. In particular, void of bottom-up pressure from labour, companies in low-income economies are able to expand production and increase employment without parallel an accompanying growth in wages and prices (Lewis, 1954; Emmanuel, 1972; Ricci, 2016). Classical political economists listed these two factors to be relevant, firstly, for the task of building dynamic export industries and, secondly, for making productive use of export incomes (Prebisch, 1950; Singer, 1950; Kindleberger, 1958).

Secondly, the costs and prices in exporting industries are influenced by intermediate inputs from either primary and energy sectors or from services. The dense inter-industry linkages exhibited in modern economies leads ones to the conclusion that the dynamics of export prices in individual industries are driven not only by their internal competitiveness, but also by the access to inputs from efficient upstream sectors of the economy.

Thirdly, domestic attempts at improving price relations in international trade can be undermined by adverse movements in the prevailing exchange rates (subject to conditions of domestic price stickiness). Systematic currency depreciation, even if it were beneficial in the short-term for market-seeking exporting companies, diminishes the nation's aggregate purchasing power. In low-income economies, this may be driven by sustained current account deficits resulting from foreign debt payments or outflows of profit remittances driven by multinational companies (Rogoff, 1996) or due to speculative behaviour on the part of currency markets (Reich, 2007). Conversely, pegged currencies usually move prices in the member states in the opposite direction, by depreciating real exchange rate in strong economies, and appreciating it in relatively weak ones.

Presented arguments suggest that explanations of international variation in price dynamics cannot be reduced to strategic firm- or industry-level price competitiveness. They reflect changes in the bargaining power of nations in international exchange. While the mode of competing (including deliberate currency devaluations) surely has an impact, the aggregate prices of production are determined mostly by broad technological advantages, which are further reflected in existing industrial structures, the demonstrated ability to employ labour force and and the capability of offsetting potential adverse exchange rates movements. Thus, the approach proposed in this paper focuses on country-level assessments of

competitiveness.

3 Context of global value chains

The emergence of global value chains contributes to the presented picture in several ways. Firstly, many final goods are nowadays actually co-produced by companies from different countries, with input prices being a crucial parameter for the internal organization of value chains. Besides the price-setting of final goods, there are many negotiations between the constituent members of supply chains over the prices of intermediate inputs. At this stage, the role of lead firms needs to be appreciated, seeing as they are often able to exert close control over their suppliers or purchasers (not to mention their own foreign affiliates) at several tiers of a supply chain. In turn, pricing mechanisms in the global economy are largely administered in governance relations, and are far from market-based. Arguably, this state of affairs is disadvantageous mostly for the peripheral factory-economies, the ones most distant from the multinationals' headquarters (Maizels, 1984; Gereffi et al., 2005; Heintz, 2006; Dedrick et al., 2009). Presumably, multinational corporations also influence international prices through a macroeconomic channel, as remittances of their profits contribute to peripheral countries' current account deficits and lead to a depreciation of their exchange rates (Bornschier and Chase-Dunn, 1985). The resulting price dynamics can, in turn, be seen as a reflection of the bargaining power existing in the relations of international actors within a value chain.

Secondly, the emergence of global value chains in recent decades was made possible by the inclusion into the global network of capitalist relations of new and large regions hitherto more isolated from international trade. It has brought with it the parallel effects of an expansion in the supply of manufactured goods, growing demand for standardized consumer products, growing demand for natural resources, and increasing global surplus labour, available directly and indirectly for manufacturing production (Kaplinsky, 2006; Milberg and Winkler, 2013). All of them have profound (and often unpredicted) consequences for producers and workers around the world, by creating new market opportunities, but also new and often very distant competitors.

Most importantly, increasing global demand brings with it significant growth opportunities

not only for high-income, core economies, but also for more peripheral ones. However, their weak bargaining position in GVCs–additionally weakened by the fact that other low-income countries behave in the same way–means that simple expansions of output need not result in sustained long-term benefits (Milberg and Winkler, 2013). This is why individual companies and indeed entire countries attempt to upgrade their position in value chains, i.e. to improve their bargaining position vis a vis other constituent economies of the chain, and to therefore perform tasks which allow them to generate and capture higher value added. In other words, they attempt to move from a price-based type of competitiveness to a non-price one.

The different types of upgrading, identified in the empirical literature (Humphrey and Schmitz, 2002; Radosevic and Yoruk, 2015), are associated with various probabilities of achieving sustained economic and social benefits. Process upgrading, which is achieved by improving labour productivity, may result in a cost advantage over competitors and increase a country's share in global markets. However, these advantages might turn out to be short-lived in an environment where multiple suppliers compete with each other to bear oligopolistic pressure from lead firms in GVCs. Conversely, either improving the quality and innovativeness of products offered or pivoting to more sophisticated business functions and are, arguably, more viable ways of strengthening the bargaining position in longer time horizon (Kaplinsky and Readman, 2005). The fragmentation of value chains by means of off-shoring is another important mechanism that serves to maintain high margins and prices of production in core economies, while at the same time expanding production at low prices in peripheral ones (Dolan and Humphrey, 2000; Humphrey et al., 2000; Bair and Gereffi, 2001; Egger and Egger, 2004).

Thirdly, the slicing-up of value chains leads traded goods to be composed of an increasing share of foreign intermediate inputs, which in turn causes certain challenges for the ways in which competitiveness is measured (Sturgeon and Gereffi, 2009; Johnson, 2014). In relation to the research purpose, it implies that analyses of value added flows and price-setting along the chain (and not only of the exported goods ultimately concluded with) are necessary in order to observe the performance of individual countries. As a matter of fact, it is a common and very informative method used in qualitative studies of individual GVCs

(Ponte and Ewert, 2009; Dedrick et al., 2009).

In addition, the within-industry variability of business activities may often nowadays be larger than the across-industry variant. For instance, R&D activities within traditional industries such as food or textiles production might well lead to much more beneficial price dynamics than would simple, labour-intensive tasks performed within automotive or electronics value chains. It might also present opportunities for producers in low-income countries to improve the quality and extent of the performed processing of goods, as in the case of the de-commodification of many primary products described by Kaplinsky (2006). Nonetheless, an existing functional heterogeneity of industry-level activities undermines the reliability of a traditional analysis of specialization patterns.

Value chains also include many service-type activities, a state of affairs which is reflected in the increasing amount of value added provided in the form of services embodied in traded goods Timmer et al. (2013). Thus, it is often the aggregate performance of the entire domestic supply chain (including primary sector, manufacturing, market and public services, and utilities) and not of individual industries which determines the results achieved in international exchange. It might be also expected that the distinction between tradable and non-tradable sectors has been blurred, and the latter ones have become increasingly subject to international competitive pressures.

Quantitative analyses of international flows of value added (based on input-output techniques) address the identified limitations of the traditional research approach (itself based on gross trade data) and have increasingly been used to properly assess specialization patterns and trade performance (Koopman et al., 2010; Timmer et al., 2013, 2015; Baldwin and Lopez-Gonzalez, 2015; Amador and Cabral, 2016). However, the question of price dynamics has so far not been properly recognized in this strand of GVC literature. A standard procedure is to use single, homogeneous price deflators for all results (accounted in nominal units), e.g. the CPI index for United States. For reasons stated above, such applications might lead to a biased assessment of the examined countries' real shares in global manufacturing production and may furthermore provide us with a mistaken evaluation of the processes of upgrading. The results of such applications can only be interpreted safely in terms of the distribution of nominal income.

4 Analytical framework and methods

Building upon the aforementioned theoretical considerations, I aim to develop a technique for the measurement of the international competitiveness of national economies that would allow for answering the following research questions:

1. What is the exact nature of price- and non-price competitiveness of countries participating in global value chains?

2. Which countries manage to upgrade in GVCs? What are the actual paths of building competitiveness in global value chains?

3. Is competitiveness in GVCs related to the countries' attained level of development? Does catching-up via upgrading in GVCs take place?

The starting point is the framework proposed by Kaplinsky and Readman (2005), and employed later on by Bernhardt and Milberg (2011), according to which the dynamics in two dimensions, nominal market shares and prices, are analysed simultaneously in order to assess economic performance ex-post. The authors observe relative changes in the unit prices of exports and in the market shares of specific industries in order to assess patterns of competitiveness. They distinguished four basic scenarios, all of them related to possible combinations of performance in both dimensions. According to Kaplinsky and Readman (2005, p. 700), who analysed the furniture industry:

> (...) data show that there is scope for a range of strategic positions. The dominant one appears to have been a focus on process competitiveness, but there is also scope for countries to target product upgrading. It is significant that none of these positions is defined by the per capita income of the exporting countries. Each quadrant of innovation positioning is made up of participants from the range of per capita income groupings.

I slightly modify their approach by choosing real market shares (denoting quantities supplied) and relative prices as the basic two dimensions of analysis, with nominal market shares (denoting incomes) as their product. I also expand the number of combinations

to six. In particular, price competitiveness (reducing the prices and increasing the corresponding quantities offered) can either be effective or not depending on the outcome in nominal terms (revenues). Similarly, increasing prices at the cost of real sales may reflect either a true loss of price competitiveness (falling revenues) or monopolistic practices (rising revenues). All six scenarios are listed in table 1.

The proposed framework focuses on the ultimate effects of international competition in

Table 1: Modes of competitiveness in GVCs, ex-post assessment

Relative quantity change	Relative price change	Mode	Examples
Loss	Deterioration	Downgrading	Industrial decline, domestic recession
	Minor improvement (income loss)	Loss of price comp.	Failed product upgrading, domestic inflation, exchange rate overvaluation
	Signif. improvement (income gain)	Monopoly position	Focus on core competences and offshoring, monopolistic practices
Gain	Signif. deterioration (income loss)	Ineffective price comp.	Domestic deflation, wage squeeze
	Minor deterioration (income gain)	Effective price comp.	Process upgrading without parallel wage growth, exchange rate devaluation
	Improvement	Upgrading	Product innovation, functional upgrading,

Source: own elaboration based on Kaplinsky and Readman (2005).

terms of actual market prices and quantities. Notably, diverse real-world scenarios can exhibit particular outcomes, as can be seen in the last column of table 1. In turn, the interpretation of results needs to be undertaken in a cautious manner and compared with detailed knowledge about the actual functioning of specific economies. What's more, over long periods of time, varying combinations of specific models may ultimately lead to similar final outcomes. For instance, upgrading can initially result from price competitiveness, only to be followed by an enforcement of monopoly practices.

I aim to delineate certain methodological limitations of unit price data in the context of global value chains, due to:

1. a high and diversified share of foreign intermediates in exported goods across countries, which itself leads to the requirement of focusing on domestic value added in exports only;

2. the large heterogeneity of the concept of value added, which might refer to various actual business activities within industries, and makes comparisons difficult even in narrowly-defined industries;

3. the contribution of multiple domestic sectors toward the production of traded goods, which in turn requires making the value chain as such into the basic unit of analysis;

4. the diverse price dynamics across contributing industries.

The construction of the research approach consists in linking concepts and methods of global value chains analyses with the techniques of index theory and price analysis. Input-output techniques and World Input-Output Tables are employed to estimate the GVC Income, which is a proper, value-added-based, measure of countries' participation in global manufacturing production. Indices of prices and volumes of value added from WIOD Socio-Economic Accounts are then used to disentangle both dimensions of the existing GVC Income dynamics. Here, an additive decomposition technique is employed, which is considered appropriate for this type of data.

A literature review has identified only a few attempts at this type of analysis that actually combined the input-output framework typical of quantitative GVC research with an account of international price differences. Fujikawa and Milana (2002) measured and decomposed sectoral price gaps between China and Japan, and disentangled the effects of productivity and input price gaps. They found out that almost 500% difference of the price of final goods between the two countries was a result of much higher unit costs of primary inputs in Japan, which were offset only to a moderate extent by the higher total factor productivity in this country. Antille and Fontela (2003) applied a dynamic framework to assess the evolution of the terms of trade of Switzerland in the period of 1990-95. They conclude that the country was able to make large gains from foreign innovations, thanks to an access to cheaper goods due to being subject to an exchange rate appreciation. At the same time, its specialization in high-tech goods protected the market shares and incomes

from exports.

U.-P. Reich (2007, 2013) in subsequent articles analysed pervasive international differences and the scale of so-called unequal exchange in a broad, cross-country fashion. He computed the real exchange rates of particular countries, based on their PPP levels from the International Comparison Program and employed them to deflate nominal flows of value added. He demonstrated that high-income economies were actually large net importers of resources, which was not reflected in their nominal trade balances. China, on the contrary, was a major global exporter of resources, for which it received only minor remuneration. Similar conclusions are reached by A. Ricci (2016), who combined data on price dynamics from WIOD Socio-Economic Accounts with World Bank series of real exchange rates. He estimated the differences between the nominal and real value added of respective economies at, e.g. for 2007: China: -10.94% of value added, India: -17.00%, Central and Eastern Europe -7.52%, Germany +4.65%, USA +1.39%. All these studies, although effectively measuring the impact of international price differences, might be subject to a bias resulting from the use of universal indices of consumer prices.

The adopted research approach consists of a combination of two techniques, inter-country input-output analyses (ICIO) and price indexes. Firstly, the data requirements briefly need to be discussed.

4.1 Data on values and prices

Analyses based on trade flows and unit prices of exports are not adequate for the GVC reality, in which foreign intermediate inputs are used extensively in production, and the domestic content of exports is often very low. Thus, data on value added is required, which is itself being measured by means of national accounts (United Nations Statistical Commission and others, 2009; Eurostat, 2014). In the standard approach of national statistics value added is a residual variable, equal to gross output minus the intermediates, minus indirect taxes net of subsidies. Flows of nominal value added between countries and sectors can be estimated by input-output techniques (explained in section 4.2).

The key research challenge is to properly measure price indices of sectoral value added for a broad sample of countries. Ideally, comparative data on price levels of value added in

narrow industries and in subsequent years would be required. In addition, the data should distinguish regarding the use of value added, i.e. according to who buys intermediate or final goods from an industry.

Available data on the price levels of value added do not fulfill these requirements (Timmer, 2017), and it would therefore be risky to use it for a dynamic cross-country comparisons. However, in contrast to the analyses of levels, growth decompositions can be performed on the sole basis of nominal values and price indices data. Therefore, we only conducted a dynamic analysis for 2000-2014 with the aim of decomposing the growth of value added into its main factors.

Another challenge is related to the fact that value added is a very heterogeneous concept, even within narrowly defined industries. Thus, instead of measuring its quantities (which are specific), only so-called volumes are calculated in the procedure of double deflation, i.e. by subtracting deflated intermediate inputs from deflated gross output. In that way volumes of value added are a statistical residual, subject to a choice of methodology by national offices (cf. OECD, 2011). Indices of prices of value added are obtained in the final step - by dividing nominal value added by its volumes. Price indices of value added actually reflect the difference between growth rate of nominal income and estimated volumes of value added. The latter category should include all non-price effects, related to quality or structure of production. Introduction of chain-linking (i.e. re-weighting of price indices on a yearly basis) into the methodology of national statistics of most high-income and emerging economies makes data on prices more reliable in this respect.

In some analyses, homogeneous deflators of nominal value added, based on Consumption PPPs are used (e.g. Reich, 2007; Ricci, 2016). Although the PPP data from the International Comparison Programme is reliable also in large samples of countries, it has certain limitations. It may lead to a bias due to the possible differences between the PPPs of consumer baskets and those of domestically produced goods (Feenstra et al., 2009) and it furthermore does not takes into account the existing inter-industry variation (Inklaar and Timmer, 2014).

In the adopted approach, indices of prices of value added from the 2016 release of WIOD Socio-Economic Accounts (Timmer et al., 2012) were used. The dataset includes 43 coun-

tries [5] and 56 industries, in the period 2000-2014. It is also consistent with another required dataset, the World Input-Output Tables.

Arguably, the proposed technique has its limitations. Industry disaggregation on the 2-digit level can be perceived as lacking enough detail to capture the actual heterogeneity of economic activity. The diverse quality of national data sources might lead to biased assessments in certain cases. Input-output calculations are based on the assumption of homogeneity of value added and its price dynamics within industries, irrespective of its destination, which might be problematic in case of large sectors, only partially involved in global value chains. I argue, however, that the advantages of the value added-based measures outweigh the disadvantages. The only alternative, namely using gross trade data in narrow industries, is difficult to reconcile with the increasingly complex input-output structures of national economies.

4.2 Accounting for Global Value Chains

The application of ICIO methods has become a standard approach in the quantitative analyses of global value chains and is commonly used to map international flows of value added for relative broad samples of high-income and emerging economies and also allows for an application to the relevant sectoral dimension. The description of ICIO methods used in this paper will focus on the most important issues. A detailed derivation and discussion of all presented concepts can be found in the works of Koopman et al. (2010) and Timmer et al. (2013).

All calculations are based on the 2016 release of World Input-Output Database (Timmer et al., 2015), which presents direct flows of gross output between countries and sectors for the period of 2000-2014. It includes 43 countries (and Rest of the World as a separate unit) and 56 economic industries[6].

[5] In order to ensure a clarity of presentation, the sample was divided into 5 groups, China constituting a separate entity: Emerging Economies, EME: Brazil, India, Indonesia, Mexico, Turkey, Russia; Central And Eastern Europe, CEE: Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia; Southern Europe, SE: Cyprus, Greece, Italy, Malta, Portugal, Spain; North-Western Europe, NWE: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, UK; High-Income Economies, HIE: Australia, Canada, Japan, South Korea, USA.

[6] The rest of the World was omitted as a producing unit due to the lack of credible data regarding prices. This means that analyses do not include ca. 10-15% of World GVC Income. The value added contribution

The following notation will be used:

$z_{i,r}$ - gross output of sector i in country r ($\boldsymbol{Z}$ in a matrix form denoting flows between all country-industries);

$f_{j,s}$ - final demand for goods of sector j in country s ($\boldsymbol{f}$ in a vector form for all country-industries);

$\boldsymbol{A}$ - technology matrix containing coefficients of direct intermediate inputs per unit of output of country-industries;

After transformations, by means of the so-called Leontief-inverse matrix $\boldsymbol{L}$, the following identity is obtained linking together output, the technology matrix and the final demand:

$$\boldsymbol{Z} = (\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{F} = \boldsymbol{L}\boldsymbol{F}, \tag{1}$$

where $\boldsymbol{F} = diag(\boldsymbol{f})$, and $\boldsymbol{I}$ is an identity matrix.

In order to disentangle value added flows (in comparison to gross output flows), let us pre-multiply both sides of equation (1) with a diagonal matrix $\boldsymbol{Y}$, in which each diagonal element $y_{i,r}$ is a ratio of value added to gross output in industry i in country r. Under these conditions, a following relation holds:

$$\boldsymbol{V} = \boldsymbol{Y}\boldsymbol{L}\boldsymbol{F}, \tag{2}$$

where each element of $\boldsymbol{V}$, $v_{i,r}(j,s)$ informs us about the total value added of industry i in country r embodied in the final goods of industry j in country s. Proper summations of the columns or vectors of this matrix will give us the required information about the prevailing global value flows. In particular, in order to obtain the GVC Income of sector i in country r the matrices are multiplied:

$$\hat{\boldsymbol{V}} = \boldsymbol{V}\boldsymbol{U}, \tag{3}$$

where $\boldsymbol{U}$ is a diagonal matrix with 1 in places related to manufacturing industries and 0 elsewhere.

of the 43 main economies regarding the production of final goods in the Rest of the World was included.

Summation in rows of matrix $\hat{\boldsymbol{V}}$ informs us about the total value added of particular country-industries in global manufacturing value chains, or the so-called GVC income of industry (e.g. value added contribution of the Polish mining industry to total global manufacturing production).

The investigations will focus on GVC Income of entire national economies, being a sum respective values for particular industries. It involves therefore total value added contribution (of both directly tradable and non-tradable industries) of a country for global production of manufacturing final goods. Compared to other measures of competitiveness, usually based on gross exports, GVC Income focuses therefore on production, and its area particularly subject to international competition. It implies also giving attention to prices of production, and not to ones of consumption or imports (as in terms of trade analysis).

4.3 Decomposition of price and volume effects

The following procedure of disentangling the contributions of prices and volumes to the growth of value added is based on the work of U.-P. Reich (2016).

Firstly, let us observe that value added in an individual industry in year t can be calculated as a product of the value added in the base period and indices of prices and volumes, p and q, in year t:

$$v_{i,r}(t) = v_{i,r}(0)p_{i,r}(t)q_{i,r}(t) \quad [\$t] \tag{4}$$

In order to make data from different countries comparable, price indices in domestic currency $\bar{p}_{i,r}$ need to be adjusted to the impact of changes in the exchange rate in relation to the US dollar e: where: $p_{i,r} = \bar{p}_{i,r}(t)e_r(t)$.

Secondly, values from eq. 4 ought to be expressed in constant units, i.e. they should be corrected for the impact of changes in the value of the US Dollar in time. One way of doing it, is to divide price indices by an index of the general price level in the United States (e.g. a CPI index). Thus, indices of relative prices or "real prices" for each country and sector are obtained:

$$r_{i,r}(t) = \frac{p_{i,r}(t)}{P(t)} \tag{5}$$

and real values, u:

$$u_{i,r}(t) = v_{i,r}(0) r_{i,r}(t) q_{i,r}(t) \quad [\$0] \tag{6}$$

Moving to country-level aggregates, real GVC income of country r, $U_r(t)$, equals a sum of the products of three elements:

$$U_r(t) = \sum_i v_{i,r}(0) r_{i,r}(t) q_{i,r}(t) \quad [\$0]. \tag{7}$$

The decomposition of the aggregate dynamics of eq. 6 into the contributions of volumes and relative prices has been identified as a major problem in index theory. Standard multiplicative decomposition techniques are not appropriate for chained indices, while logarithmic Törnquist-type decomposition is subject to inadequacies in multi-period calculations (Balk and Reich, 2008; Balk, 2008).As a solution to this U.-P. Reich (2016) proposed an additive decomposition technique. It focuses on the existing differences of values, which for a single industry and at a certain point time take the form of a following differential of eq. 6:

$$du = (r dq + q dr) v(0) \quad [\$(0)] \tag{8}$$

Aggregation over all industries in country r results in:

$$dU_r = \sum_i (r_{i,r} dq_{i,r} + q_{i,r} dr_{i,r}) v_{i,r}(0) = \sum_i r_{i,r} dq_{i,r} v_{i,r}(0) + \sum_i q_{i,r} dr_{i,r} v_{i,r}(0) = Q_r + R_r \quad [\$0] \tag{9}$$

An empirically applicable form should be based not on continuous data, but on differences recorded over the subsequent years. It can be achieved by means of a linear discrete approximation of Q_r and R_r, which requires us to adopt industry weightings from either the base or final period. Here, weights from the base period were used to assemble an aggregate volumes index (Laspeyres-type), while the ones from final period were used to compose a price index (Paasche-type):

$$\Delta U_r^t = \sum_i r_{i,r}^{t-1} \Delta q_{i,r}^t v_{i,r}(0) + \sum_i q_{i,r}^t \Delta r_{i,r}^t v_{i,r}(0) = Q_r + R_r \quad [\$0] \tag{10}$$

Aggregation over multiple years, from 0 to t: $\Delta U_r^{0t} = Q^{0t} + R^{0t}$, requires a time integral of 10, which for Q and R separately results in:

$$\begin{aligned} Q_{r,L}^{0t} &= \textstyle\sum_i v_i^0 \sum_{s=1}^{t} r_i^{s-1} \Delta q_i^s \qquad [\$(0)] \\ R_{r,P}^{0t} &= \textstyle\sum_i v_i^0 \sum_{s=1}^{t} q_i^s \Delta r_i^s \qquad [\$(0)] \end{aligned} \tag{11}$$

Using reverse weights for both indices results in:

$$\begin{aligned} Q_{r,P}^{0t} &= \textstyle\sum_i v_i^0 \sum_{s=1}^{t} r_i^s \Delta q_i^s \qquad [\$(0)] \\ R_{r,L}^{0t} &= \textstyle\sum_i v_i^0 \sum_{s=1}^{t} q_i^{s-1} \Delta r_i^s \qquad [\$(0)] \end{aligned} \tag{12}$$

In the analysis averages of Laspeyres and Paasche indices were used (Fisher-type), which exhibit the characteristic of minimizing the impact of structural change on aggregate assessments:

$$\begin{aligned} Q_{r,F}^{0t} &= \tfrac{Q_{r,L}^{0t} + Q_{r,P}^{0t}}{2} \qquad [\$(0)] \\ R_{r,F}^{0t} &= \tfrac{R_{r,L}^{0t} + R_{r,P}^{0t}}{2} \qquad [\$(0)] \end{aligned} \tag{13}$$

In the final step, all values concerning absolute changes (in constant USD) were normalized by dividing by initial GVC Income:

$$\begin{aligned} IU_r^{0t} &= \tfrac{\Delta U_r^{0t}}{V_r(0)} \\ IQ_{r,F}^{0t} &= \tfrac{Q_{r,F}^{0t}}{V_r(0)} \\ IR_{r,F}^{0t} &= \tfrac{R_{r,F}^{0t}}{V_r(0)} \end{aligned} \tag{14}$$

Empirical investigations focused on the values of 14. First of the presented indexes can be interpreted as the percentage change of real GVC Income. It is, thus, a commonly used measure of competitiveness, in which countries' growth of current-USD value added in global manufacturing production is adjusted by the US CPI index. The two latter ones result from the decomposition of the total growth of real GVC Income into the contributions of, respectively, volumes and relative prices. Their calculation accounts for the fact that actual dynamics of prices of value added differs across countries and industries participating in GVCs.

Values of the two components, IQ and IR, serve jointly the purpose of the bi-dimensional assessment of competitiveness in GVCs, in accordance with the specific modes enlisted in

table 1. Since competitiveness and upgrading here are understood as relative concepts, their assessment required a comparison of the relevant countries' performance with global averages. For this purpose, the global indexes of 14 and adequate differences for particular countries were composed.

5 Results

5.1 Competitiveness of national economies

The real values of GVC Income and their changes, decomposed into contributions of volumes and prices, are presented in table 5.1.

In the period of 2000-2014 total GVC Income, i.e. the real value of global manufacturing

Table 2: GVC Income, levels and decomposition of changes, summary

Group	Levels (in M USD 2000)		Changes (in M USD 2000)			Changes (in % of GVCI 2000)		
	GVCI 2000	GVCI 2014	$\Delta U^{0,2014}$	$Q_F^{0,2014}$	$R_F^{0,2014}$	$IU^{0,2014}$	$IQ_F^{0,2014}$	$IR_F^{0,2014}$
CHN	376 584	2 346 543	1 969 959	1 708 644	261 315	523%	454%	69%
EME	639 183	1 449 600	810 417	483 670	326 747	127%	76%	51%
CEE	95 637	243 630	147 992	94 049	53 944	155%	98%	56%
SE	419 267	466 985	47 718	-95 704	143 421	11%	-23%	34%
NWE	1 382 129	1 705 440	323 312	49 749	273 562	23%	4%	20%
HIE	3 013 502	2 932 826	-80 676	475 578	-556 255	-3%	16%	-18%
Total	5 926 302	9 145 023	3 218 721	2 715 986	502 734	54%	46%	8%

Source: own elaboration.

Note: GVCI - real GVC Income; $\Delta U^{0,2014}$ - change of GVCI; $Q_F^{0,2014}$ - volumes contribution; $R_F^{0,2014}$ - relative prices contribution; $IU^{0,2014}$ - % change of GVCI; $IQ_F^{0,2014}$ - volumes contribution (in perc. pts.); $IR_F^{0,2014}$ - relative prices contribution (in perc. pts.); CHN - China; EME - Emerging Economies, CEE - Central and Eastern Europe;SE - Southern Europe; NWE - North-Western Europe; HIE - High-Income Economies.

final goods, increased by 54%. Most of this growth was due to an expansion of production, while relative prices (in comparison to US CPI) contributed 8 percentage points. This means, however, that using a homogeneous US-deflator leads to an upward bias during the assessments of dynamics of the prevailing global value chains output. Even more complex-

ity is revealed by decomposing the performance of particular economies.

Mediocre or even negative changes of GVC Income in developed countries was the result of different combinations of volumes and prices dynamics. The economies of Southern Europe experienced a drop in volumes of VA supplied to GVCs, accompanied by an inflation of the relative prices of value added. Conversely, the group of High-Income Economies managed to increase their volumes of value added in GVCs, but they did so at a cost of decreasing relative prices. North-Western Europe performed best of the three groups, due to both price and volumes growth.

Set against this background, the expansion in terms of GVC Income in all groups of low- and middle-income countries was impressive. Interestingly, the contribution of relative prices in China, other Emerging Economies and the CEE group was very similar, and what differentiated their performance was their ability to increase the volumes of value added in GVCs.

Our results lead us to refined assessments of structural change in the global economy. The evolution of the structure of GVC Income is demonstrated in table 3.

Shares of country-groups of the total nominal GVC Income are presented in the first two

Table 3: GVC Income shares, by country-group

Group	GVC Income share (in %)			Δ share (in perc. pts.)		Price impact (in perc. pts.)
	2000	2014	2014 (at constant 2000 prices)	at current prices	at constant 2000 prices	
CHN	6.4%	25.7%	24.1%	+19.3%	+17.8%	+1.5%
EME	10.8%	15.9%	13.0%	+5.1%	+2.2%	+2.9%
CEE	1.6%	2.7%	2.2%	+1.1%	+0.6%	+0.5%
SE	7.1%	5.1%	3.7%	-2.0%	-3.3%	+1.4%
NWE	23.3%	18.6%	16.6%	-4.7%	-6.8%	+2.1%
HIE	50.8%	32.1%	40.4%	-18.8%	-10.5%	-8.3%

Source: own elaboration. Note: symbols as in table 5.1.

columns of the table. The results support the established stylized facts about global production, namely the enormous gains in the importance of China, the smaller gains made by other emerging regions, and the relative decline of developed countries. However, the decomposition of the total effect in final two columns sheds new light on the problem. Had

the prices been constant in the period of 2000-2014, the position of China in GVCs would not have changed much. Shares of other groups, however, were strongly influenced by existing price dynamics. EME and CEE benefited a lot from price increases, while in SE and NWE prices were the only factor that contributed positively to the shares of GVC Income. Other High-Income Economies, in particular Japan and the USA, lost over a third of their initial share, with both factors contributing to the fall of their competitive position.

The performance of individual economies in comparison to global average was mapped in figure 2. The dots represent differential changes in both dimensions, while the diagonal lines illustrate points denoting the same aggregate change of GVC Income achieved by different combinations of prices and volumes growth (with the red line indicating total change equal to the world average). Notably, the point for China (61%, 408%) did not fit in the figure.

The figure supports the above observations, but it allows us to add a few points. The diverse locations of the countries on the diagonal lines reflect the variations of their performance in terms of GVC Income growth. However, it is the significant horizontal and vertical dispersion of points that needs to be attended to.

The 1^{st} quadrant of the figure represents countries that achieved upgrading in GVCs, which included only emerging economies and CEE countries. However, modes of competitiveness differed a lot even within this group. China, for instance, more than quadrupled its GVC income thanks to volumes growth, but its relative price contribution only lay at 61 percentage points, while India grew only when measured in terms of volumes. It corresponds to the price competitiveness of both economies, with large surplus labour, but also to their general industrial strategy of market expansion, pursued by i.a. currency devaluation. Conversely, the GVC income share of Estonia, Bulgaria and Romania grew mostly thanks to price increases, driven most probably by capital inflows and domestic technology upgrading.

Many countries are situated in the 2^{nd} quadrant, i.e. relative price growth and loss of volume shares in GVCs. For only some of them this combination guaranteed gains in terms of income shares (dots above the 0% line). These included resource-based economies and financial centres, as well as small CEE countries hit by recession. It suggests that benefiting from monopoly practices was restricted to the cases in which there exists an ownership of

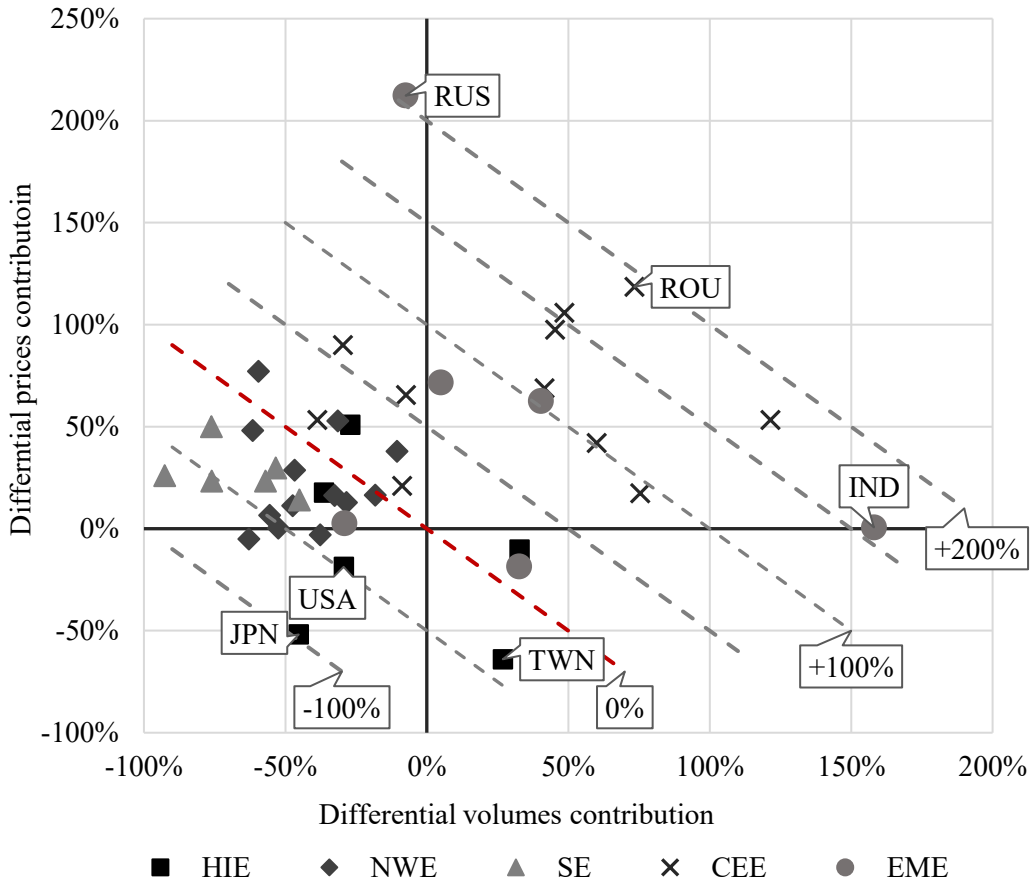

Figure 2: Relative GVC income growth, contribution of volumes and prices, 2000-2014
Source: own elaboration.
Note: China (61%, 408%).

rare assets, attractive for global capital.

Countries below the 0% line, mostly from Southern and North-Western Europe, can be perceived as having lost their competitiveness due to i.a. high costs of production. Notably, Canada and Mexico are situated here as well, which reflects a decline in the price competitiveness of two constituent manufacturers of the so-called Factory America at the hand of the growing competition from Asia.

The 3^{rd} quadrant, i.e. the cases of downgrading and loss of GVC income shares, includes old industrial leaders such as the USA and Japan. In the face of the expansion of global production networks and the emergence of new centres of manufacturing production, their dominant position in the international division of labour (reflected by both high prices and high levels of output) has been undermined.

Finally, few countries occupy the 4^{th} quadrant, which indicates that building competitiveness on the basis of process improvements and low-priced value added was actually difficult. Only South Korea and Turkey managed to achieve expansion of real production and nominal income under conditions of relative domestic deflation.

These basic results already demonstrate the usefulleness of the proposed method of measuring international competitiveness. Decomposition of prices and volumes contributions showed that different modes of building a countries' competitive position in GVCs were available. In turn, a refined view of structural change in global economy was obtained.

5.2 Global dynamics and conditions for upgrading

In the second step, a detailed analysis of the impact of prices and volumes dynamics on GVC Income on annual data was conducted. Growth paths in both dimensions of total GVC Income and of global production are presented in Figure 3.

As a consequence of this, periods of distinct patterns of dynamics can be distinguished.

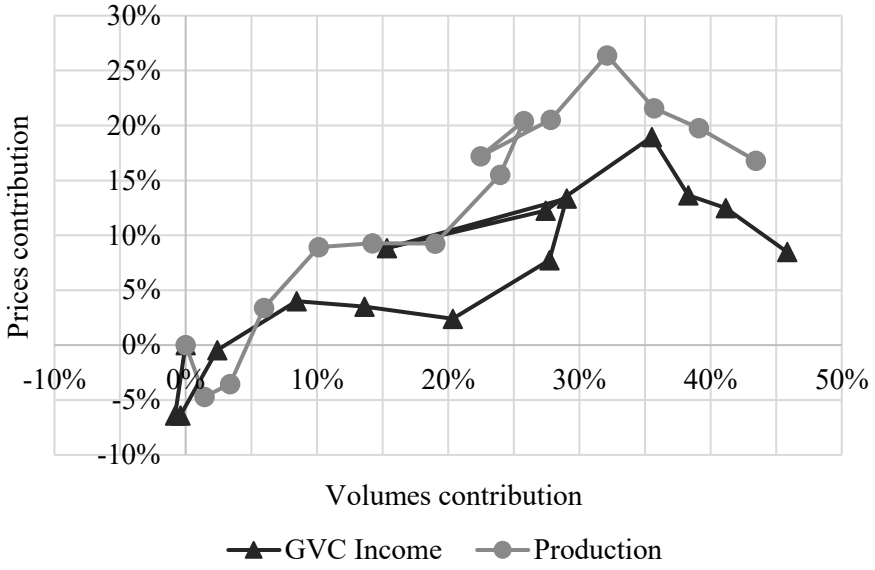

Figure 3: Dynamics of global GVC Income and Production, 2000-2014
Source: own elaboration.

After the first two years of recession, GVC Income was growing with contributions made both by volumes and by relative prices. Then, after 2004, the prices of value added in

GVC declined for two subsequent years, whereas output grew uninterrupted. This might be interpreted in the sense that global supply caught up with global demand, such that competitive pressures intensified in 2005-2006. The years 2007-2008 were again characterized by global inflation, driven presumably by a debt-fuelled expansion of demand. The Economic Crisis of 2009 is clearly visible in the figure as a substantial drop in prices and volumes of value added. However its impact was quickly reversed in 2010-2011. The last three years of analysis were characterised by the combined effects of the expansion of output and deflation, which reflects a strong accumulation of global production potential, accompanied by weak aggregate demand.

The comparison of GVC Income and Global Production series suggests that, although moving in parallel, manufacturing value chains are much more volatile and subject to stronger cost-pressures, than are aggregate economies. The generation of services, both private and public, seems to fulfill a stabilising role in the business cycles.

The fluctuations of aggregate dynamics found its counterpart in the performance of individual economies, as presented in Table 4 and Figure 4.

The distribution of modes of competitiveness in the analysed sample of 43 economies

Table 4: Modes of national competitiveness in GVCs, sub-periods, country count

$\tilde{I}Q$	$\tilde{I}R$	Mode	2000-14	2000-04	2004-08	2008-09	2009-14
-	-	Downgrading	4	4	8	18	22
	+($\tilde{I}$U-)	Loss of price comp.	16	3	9	8	9
	+($\tilde{I}$U+)	Monopoly position	9	14	12	2	2
+	-($\tilde{I}$U-)	Ineffective price comp.	1	1	2	4	3
	-($\tilde{I}$U+)	Effective price comp.	2	1	1	6	3
	+	Upgrading	11	20	11	5	4

Source: own elaboration.

Note: $\tilde{U}$, $\tilde{Q}$ and $\tilde{R}$ stand for relative (in comparison to World average) indices of, respectively, GVCI growth, volumes and prices contributions; -/+ stand for negative/positive values of a variable.

was subject to profound changes over time. During the first two periods before the Crisis upgrading and monopoly position were the two dominant modes, and indeed many countries managed to increase relative prices, volumes and incomes in GVCs. Manufacturing decline in the USA, deflation in Japan, and the price-competitiveness strategy of China,

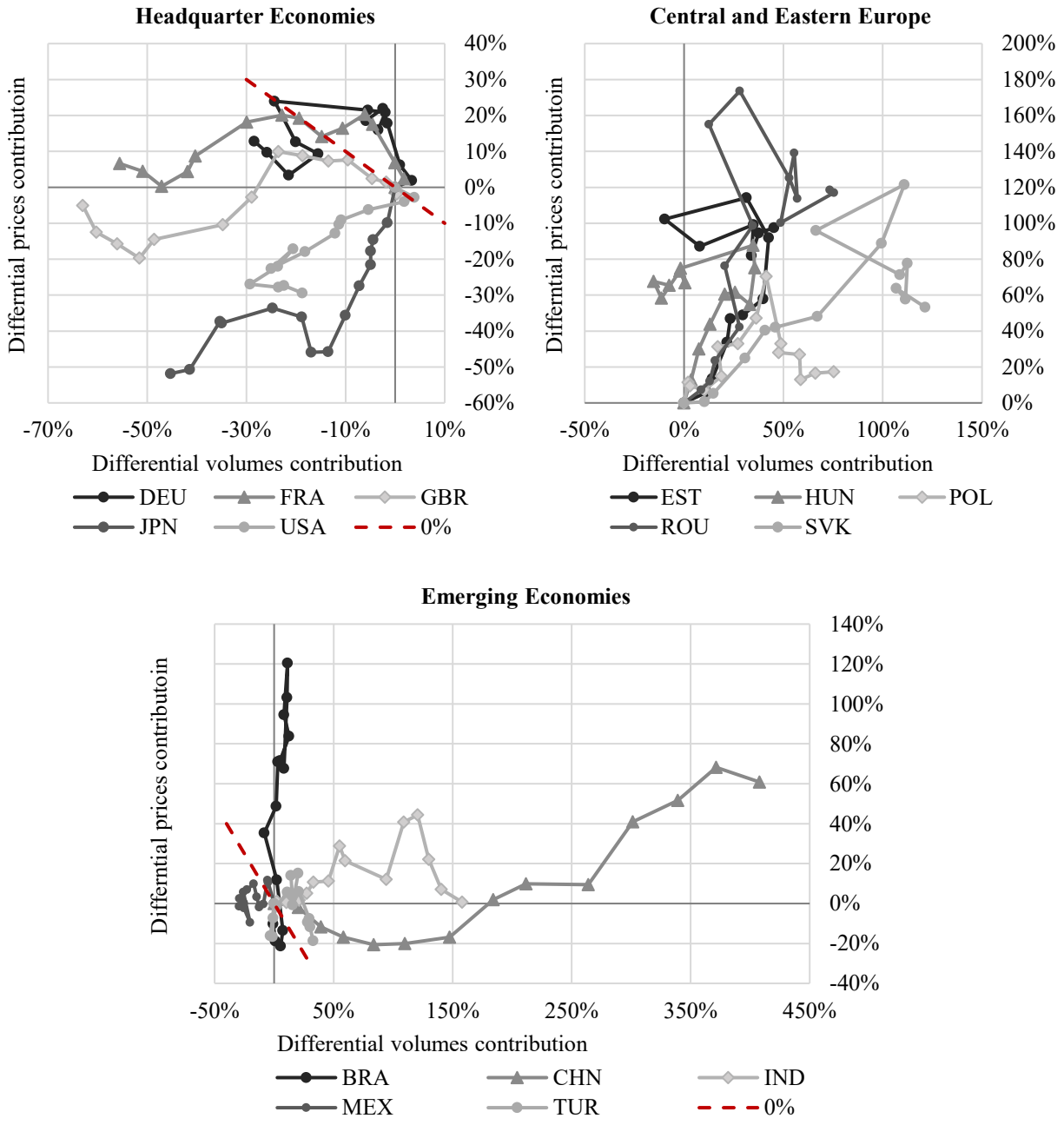

Figure 4: Paths of competitiveness in GVCs, chosen countries, 2000-2014
Source: own elaboration.

accompanied with strong global demand, opened up space for non-price competitiveness in many economies, including CEE, NWE and EME. This was a period of a true shift in the structure of GVCs.

However, the crisis of 2009 reversed this picture. Upgrading became extremely difficult,

and many countries started to either lose price competitiveness or to downgrade. For developed countries it amounted to a continuation or even a deterioration of previous tendencies, although some headquarter economies (Germany and USA) managed to take advantage of the crisis to rebuild their position.

More importantly, the upgrading paths of certain emerging and CEE economies came to a stop. Their post-2009 development resembled the price competitiveness strategy, according to which various attempts (e.g. austerity policies, wage restraint, currency depreciation) were undertaken to defend their market shares. The cases of Poland, Slovakia and Turkey demonstrate that it may be not enough to gain in terms of nominal income. In 2009-2014 only Taiwan, Estonia and India were able sustain market shares by cutting the relative prices of their value added.

The key reason that stands behind these developments is to be found in the impressive expansion of China. After a period of price competitiveness, in 2005 Chinese prices of value added started to increase, marking the point after which China has been on an upgrading path, which is in line with other empirical analyses of this economy (Altenburg et al., 2008; Gereffi, 2008; Wang and Wei, 2010). Due to the absolute size of the Chinese economy, it was left with little space for upgrading elsewhere.

All in all, the results suggest that performance of individual economies and chances of successfully upgrading change with the stage of the global business cycle. In particular, they support the notion of a difficult post-crisis environment in which non-price factors, in particular technological capabilities and proximity of demand, determine the competitive performance of nations (Fagerberg and Srholec, 2016). One can expect that upgrading in China and weak global demand will continue to place mounting pressure on the competitiveness of many middle- and high-income economies.

5.3 Catching-up in GVCs

In the final step, a standard β-convergence framework was used to investigate whether competitiveness in GVCs was related to the catching-up process undergone by various national economies. For this purpose, first, the annual growth rates of real GVC income, as well as the contributions of prices and volumes, were regressed on lagged natural logarithms

of nominal GDP per capita, with the inclusion of time dummies, according to equation 15:[7].

$$y_{i,t} = \alpha_0 + \beta gdp_{i,t-1} + \mu_t + e_{i,t} \tag{15}$$

where $y \in \{IU_r^{t-1,t}, IQ_{r,F}^{t-1,t}, IR_{r,F}^{t-1,t}\}$.

A negative value of β would suggest that countries at a lower initial level of development had achieved a higher level of growth of a specific variable, which in turn contributed to their catching-up.

Second, taking into account that price and volumes growth might contradict each other, the β-convergence equation was regressed with volumes growth as the target, all the while controlling for price competitiveness:

$$IQ_{r,F}^{t-1,t} = \alpha_0 + \beta gdp_{i,t-1} + \gamma IR_{r,F}^{t-1,t} + \mu_t + e_{i,t} \tag{16}$$

Here, a negative γ would either illustrate the trade-off between prices and volumes growth, or, alternatively, the extent of the possible benefits to be gained from price competitiveness. All equations were regressed by means of the OLS-method and are specified to incorporate robust standard errors. The estimations were also repeated in annual samples in order to observe potentially resulting stability or possible time trends in the catching-up process. Results were reported in Table 5 and in Figures 5 and 6.

The estimated values of β were negative and significant for all three variables, which

Table 5: β-convergence of GVC Income factors growth, 2000-2014

Variable	β	t_β	γ	t_γ	R^2
IU	-0.0267^{***}	-9.03			0.6508
IR	-0.0073^{***}	-2.70			0.4888
IQ	-0.0194^{***}	-9.82			0.5464
IQ	-0.0201^{***}	-10.24	-0.098^{***}	-2.94	0.5540

Note: N = 602, T = 14, OLS with robust standard errors.
Source: own elaboration.

confirms the existence of catching-up by means of upgrading in GVCs in the analysed

[7]Alternative regressions were calculated on lagged GVC income per employed person, but the results were almost identical. GDP per capita (in PPPs) performed much worse as the main explanatory variable.

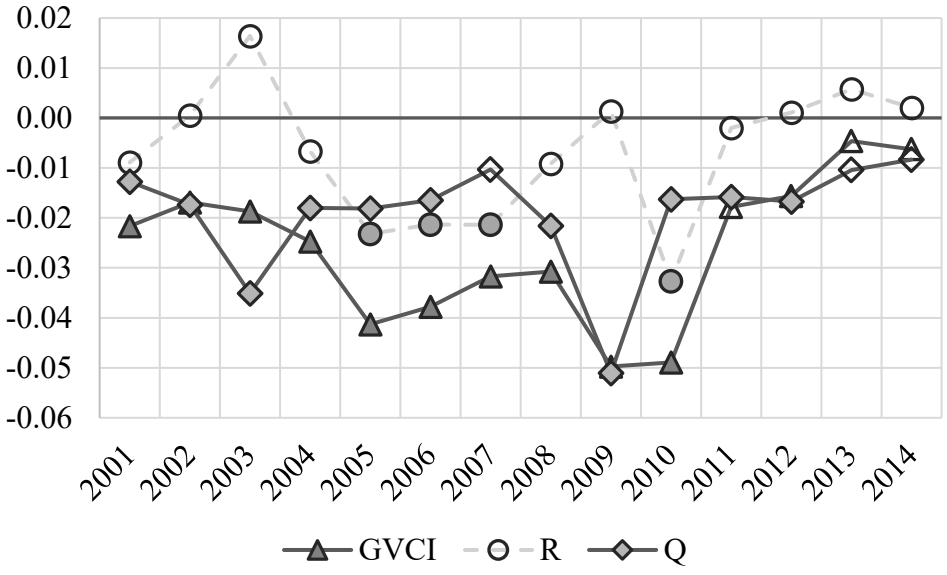

Figure 5: β-convergence of GVC Income factors, parameters in annual estimations
Note: shaded data points represent statistical significance at p-value 0.1.
Source: own elaboration.

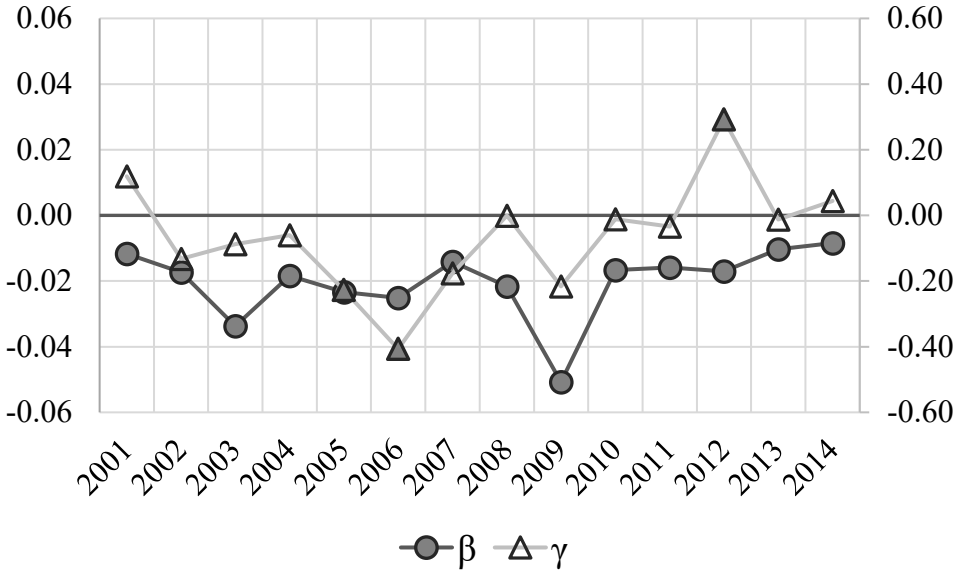

Figure 6: Volumes growth, parameters in annual estimations
Note: shaded data points represent statistical significance at p-value 0.1. Values for γ on right axis.
Source: own elaboration.

sample. Economies initially lagging-behind were benefiting mostly from volumes growth. Interestingly, R^2 was the highest for real GVC Income, indicating that the diverse dynamics of volumes and prices across countries was levelled up in the aggregate. However, one should be cautious when drawing any more general conclusions regarding the impact of globalisation on convergence, because the sample is relatively small and biased towards middle- and high-income economies.

Annual estimations demonstrate that, firstly, the relation between GDP per capita and the growth of volumes in the GVC was quite stable. Conversely, catching-up by use of price dynamics was statistically significant only in the years 2005-2007 and 2010. In these years, as well as in 2009, the two combined factors contributed to the fastest convergence of GVC Income in the dataset (β reaching even -0.05 in 2009-2010). Secondly, the speed of catching-up decreased significantly by the end of the period, which supports previous observations relating to the challenges of upgrading after 2010.

The parameter γ was negative and significant in a pooled sample, meaning that rising prices harmed the dynamics of the volumes in the GVCs, although the absolute value of the elasticity between the two factors was very low. In other words, price competitiveness supported slightly the expansion of volumes supplied to GVCs, but it did not translate into gains in terms of GVC Income. What's more, annual values of γ were significantly different from 0 only in 2005-2006, while in 2012 the value was even positive (which is to say that lower prices were correlated with a decline in volumes).

It may be concluded from this analysis that building up one's non-price competitiveness, in search of higher prices of value added, was a viable way to increase the corresponding GVC Income.

6 Concluding remarks

Measuring international competitiveness is a highly contested issue in contemporary economics. The emergence of global value chains limits the accuracy of traditional export-based measures and calls for the employment of techniques capable of accounting for value added input of individual economies into global production and trade. In this paper, I aimed to contribute to the global value chains literature by developing a framework both

for distinguishing diverse modes of competitiveness and for the identification of successful cases of upgrading.

Building on works of Kaplinsky and Readman (2005); Kaplinsky (2006), I adapted an established method of export price comparisons to the context of global value chains and constructed a bi-dimensional technique based on the dynamics of the volumes and prices of GVC Income. As it concerns the technical side of the paper, I took advantage of an input-output analysis in order to disentangle the value-added-based measure of GVC Income (Timmer et al., 2013). After this, I decomposed its dynamics into the contributions of both the prices and volumes of value added. The employment of industry-level price indices allowed me to control for sectoral heterogeneity, which is itself hidden in aggregate CPI or PPI measures. For most of the analysed countries, the indices are calculated on a chained basis which accounts for annual changes of the qualitative structure in industries. Finally, an additive decomposition of U-P. Reich (2016) allowed me to distinguish components of aggregate growth which were furthermore comparable in time and space.

Arguably, the proposed technique has its limitations. Industry disaggregation on the 2-digit level can be perceived as lacking enough detail to capture the actual heterogeneity of economic activity. The diverse quality of national data sources might lead to biased assessments in certain cases. I argue, however, that the advantages of the value added-based measures outweigh the disadvantages. The only alternative, namely using gross trade data in narrow industries, is difficult to reconcile with the increasingly complex input-output structures of national economies. Nonetheless, further work should certainly be devoted to the structural aspects of upgrading in GVCs.

The conducted analysis led to three important observations which may contribute to the debate on the performance of national economies in global value chains. First, countries differed significantly not only in terms of total GVC income dynamics, but also in terms of the modes chosen to build their competitive position in GVCs. These modes could be associated with the countries' development level and regional positioning. In particular, upgrading throughout the period was achieved only by a few Central, Eastern European and emerging countries. The deterioration of the market shares of most high-income European economies could be associated with their loss of price competitiveness, while the

USA and Japan were subject to downgrading. Countries specializing in financial services or in natural resources were able to benefit from a monopoly position. Korea, Taiwan and Turkey were the only countries that managed to achieve the combination of a growing real share in GVCs with declining relative prices of their value added.

Second, the inclusion of the time dimension expanded the view and demonstrated how the chances of successfully upgrading change with the stage of the global business cycle and the balance between global demand and supply. Before 2009 factors such as manufacturing decline in the USA, deflation in Japan, and the price-competitiveness strategy of China, accompanied by strong global demand, opened up space for many economies to upgrade. This was a period of a true shift in the structure of GVCs. The crisis of 2009 reversed the picture, however. Upgrading became extremely difficult and many countries started either to lose price competitiveness or to downgrade. The CEE economies, conversely, attempted to defend their market shares by means of price competitiveness. The key reason, next to weak demand, that stands behind these developments is the impressive expansion of China, which has been on an upgrading path since 2005.

Third, in the analysed sample, β-convergence by upgrading took place by means of both price and volumes growth. However, catching-up possibilities decreased significantly by the end of the analysed period. On the basis of growth based upon a low price elasticity of demand for volumes, it may also be argued that building non-price competitiveness in search of higher prices of value added was a viable way to increase GVC Income.

On a more general level, it might be concluded that the significant differences in the dynamics of prices and volumes of GVC Income reflect the evolution of the international distribution of power. They also indicate that the creation of value in production is a distinct process from generating the incomes, with profound consequences for the way in which international inequalities are analysed. Therefore, the improvement of the price relations (next to maintaining real market shares) becomes a critical factor for capturing the attainable gains in global competition and for pursuing economic development more generally, as was already highlighted by classical international political economy.

The presented results, which were mostly of an exploratory nature, open up avenues for further research. In particular, they might well be linked with explicit measures of techno-

logical capabilities in order to explain the diverse modes of international competitiveness across countries. Adopting a chain approach could allow for the investigation both of the dynamics of vertically integrated prices, as well as of the specific mechanisms of capturing the gains, i.e. of the distribution of income between members of particular value chains. Furthermore, the inclusion of wage and employment data could be a way to explain how prices of value added are determined and how income is distributed functionally within industries and chains.

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