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International Trade by Production Stage: What's Real?

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Highlights

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- This indicator is however affected by price effects, which were particularly strong during the recent inflation episode of the early 2020s.
- To neutralize these price effects, we compute price deflators by production stages, obtaining series of trade in volume.
- The deflated series reveal that the share of intermediate goods in world trade is relatively stable since the early 2000s.

RESEARCH AND EXPERTISE ON THE WORLD ECONOMY

Abstract

The intensity of global value chains can be proxied by the share of intermediate goods in world trade. This indicator is however affected by price effects, which were particularly strong during the recent inflation episode of the early 2020s. To neutralize these price effects, we compute price deflators by production stage, obtaining series of trade in volume. The deflated series reveal that the share of intermediate goods in world trade is relatively stable since the early 2000s. If anything, trade in parts and components, a key feature of global value chains, seems slightly more dynamic than other production stages. Our results further show that parts and components, as well as capital goods, experienced the fastest trend growth between 2000 and 2023, while primary goods lagged behind. Finally, trade volumes appear strongly procyclical overall, except for primary goods, which display no significant correlation with the global output gap.

Keywords

Globalization, Global value chains, International trade in volume, Intermediate goods, Production stages, Parts and components.

JEL

F14, F15, L60.

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International Trade by Production Stage: What's Real?*

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1 Introduction

Global value chains (GVCs) are central to the global economy but remain difficult to measure empirically. Identifying GVCs in the mosaic of international production processes and tracing their evolution over time is a complex task, but one of increasing importance, particularly in a context of multiple crises and rising geopolitical tensions. Reliable and timely data on GVCs are essential for evaluating the transmission of shocks as well as the robustness and resilience of trade networks.[1] Capturing GVC dynamics raises several problems, as it requires tracking value added through supply and use linkages, both between sectors and across borders.

The aim of this paper is to help understanding the evolution of goods-related GVCs at the global level. A number of indicators have been put forward to measure GVCs and assess their evolution over time and across space. In this paper, we propose a complementary indicator of GVC in volume based on disaggregated trade data by production stage.

The development of GVCs has led to massive trade flows of intermediate goods (and services), both intra- and inter-firm. To analyze the international segmentation of production at the world level, we therefore examine the evolution of the share of intermediate goods in global trade, distinguishing parts and components (P&C) from semi-finished products. We account for price

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[1] Following Miroudot (2020), robustness is defined as the capacity to maintain operations during a crisis, whereas resilience refers to the ability to restore operations to their pre-crisis state afterward.

effects through the construction of deflators by production stage, based on disaggregated bilateral trade unit-values. Controlling for price effects is essential to study GVC dynamics, as changes in GVC indicators may reflect price movements rather than real shifts. Relying on non-deflated gross or value-added trade flows can thus lead to distorted GVC inferences. Recent episodes of pronounced price fluctuations further reinforce the importance of taking price effects into account (notably the war in Ukraine and periods of inflation in energy or agricultural goods).

This paper extends and updates the approach developed by Gaulier et al. (2020), incorporating more recent data and refining the empirical methodology. It constructs a global measure of GVCs based on the relative real growth of manufacturing trade by production stage. To better isolate structural trends from cyclical fluctuations, the analysis also adjusts for global business cycle effects. The proposed indicators offer a timely and parsimonious alternative to measures derived from International Input-Output (IIO) tables and allow for more robust deflation by exploiting detailed price information at a disaggregated level.

The resulting dataset, Trade-Volume, providing time series of trade in value and in volume by production stage, as well as the price deflators we used to construct series in volume, is freely available on the CEPII website.

The rest of the paper proceeds as follows. Section 2 provides a comprehensive review of the literature on GVC measurement, showing that accounting for price effects is challenging for the established indicators, and that attempts made in this direction suggest that the price dimension indeed substantially affects the indicators. Section 3 outlines our method to compute deflators by production stage, and the data used in this analysis. Section 4 presents our results, providing some descriptive statistics and using an econometric estimation to recover structural trends in trade growth by production stage.

2 Literature review

Trends observed in GVC indicators may, to some extent, reflect changes in prices and exchange rates. The production of goods - particularly intermediate goods - can involve a large share of commodities (notably oil), making it highly sensitive to variations in energy prices or broader inflationary shocks. Excluding the energy sector from the analysis is not sufficient to eliminate the influence of commodity price fluctuations. As a result, conclusions regarding the evolution of GVCs can be significantly affected by whether and how price effects are accounted for. The treatment of price movements, and the specific methodology used to control for them, are crucial for accurately interpreting GVC dynamics. This concern has become especially salient in the current macroeconomic environment, which marks a transition away from a prolonged period of subdued and stable inflation. The recent resurgence of inflationary pressures reinforces the necessity of distinguishing nominal changes from real transformations in GVC structures. Nevertheless, only a limited number of empirical studies on GVC developments explicitly address the role of price variations.

Among the first contributions, Haugh et al. (2016), Borin and Mancini (2015), Borin and Mancini

(2017) as well as Timmer et al. (2021) have emphasized the importance of relying on trade and production data expressed in constant prices to analyze trends in international production segmentation. These papers rely on a broad set of GVC indicators - drawn from either trade statistics or input-output tables - and they also shed light on the methodological challenges associated with deflation procedures.

Haugh et al. (2016) (p. 17) compute an indicator of "backward participation in GVCs", defined as the ratio of intermediate goods imports to final domestic demand expressed in nominal terms.[2] To control for the influence of commodity price fluctuations and cyclical variations, the authors apply a deflation procedure to this indicator and then regress the resulting volume-based series on an output gap measure. The deflation methodology uses two different deflators with no disaggregated dimension: the price of total imports of goods and services to deflate imports of intermediate goods, and the deflator for total domestic expenditure concerning final domestic demand (neither of these deflators has a sectoral dimension).

Over the 1991–2015 period, the resulting "GVC structural index" (Haugh et al., 2016, pp. 17–18) displays a steady rise apart from a slight decline beginning in 2013. This trend contrasts with the sharp decline observed in the unadjusted GVC indicator from 2011 onward (Haugh et al., 2016, Figure 10, p. 18), underscoring the major influence of commodity prices and business cycle.

Using a distinct empirical strategy, Borin and Mancini (2015) and Borin and Mancini (2017) estimate an IIO-based indicator of GVC participation drawing on the 2013 release of the World Input-Output Database (WIOD).[3] This dataset provides input–output tables in constant prices for the 1995–2011 period, compiled through a double deflation method (Los et al., 2014) to allow for analyses based on changes in volumes alongside values.

At the global level, the Borin and Mancini indicator aggregates cross-country value-added linkages to measure the overall extent of multi-stage production fragmentation in the world economy. Specifically, it computes the share of gross exports that involve value-added flows crossing at least two international borders, summing both backward and forward linkages across all countries.[4] Forward GVC participation refers to the share in total exports of domestic value-added sent to the importer then reexported and eventually absorbed abroad or back by the exporter,

[2] The denominator of this GVC index, i.e., final domestic demand, changes with the country's GDP (including demand for non-tradable goods). Therefore, an economic shock unrelated to GVCs (e.g., trade liberalisation measures at world level) is likely to influence this indicator. This does not apply to relative growth rates of manufacturing trade by production stage, which are independent of any shocks that affect trade flows by production stage and total trade in a similar way. For this reason, relative growth rates of trade in intermediate goods might more accurately capture GVC dynamics. In Haugh et al. (2016), data for each country's import value of intermediate goods and each country's value of its final domestic demand are extracted from the OECD STAN Bilateral Trade Database by industry and end-use category and the OECD Economic Outlook 99 Database, respectively.

[3] Covering 40 countries, and a model for the rest of the world for 35 sectors (ISIC Rev. 3). The WIOD project is developed by the Groningen Growth and Development Centre at the University of Groningen in the Netherlands.

[4] The index of GVC participation measures "production processes that require at least two international shipments of goods (including both intermediate inputs and final products)" (Borin and Mancini, 2017, p. 23). The Borin and Mancini measure "excludes the fraction of domestic value added that is exported only once and directly absorbed by the destination country. The remaining part of exports is considered part of global value chains processes and is divided by total trade of a country or region to obtain the GVC participation index." (ECB, 2016, p. 25).

backward GVC participation to the share of foreign value-added and the pure double counting[5]. In contrast to other indicators, which may include value added embedded in intermediate exports even when it is absorbed by the first importing country, this measure restricts participation to value-added flows that are re-exported after further processing. This approach aims to capture what the authors define as "genuine" GVC activity, while avoiding potential double counting of single-border value-added transfers.

In addition, this index is adjusted for commodity price effects by setting to zero valued added in energy sectors and the changes in demand composition are "neutralized" (Borin and Mancini, 2017, p.25). As with Haugh et al. (2016), comparing adjusted and unadjusted GVC shares of total trade reveals the role of price variations, the unadjusted measure being much more volatile. In particular, nearly half of the contraction in the unadjusted index during the 2009 downturn is attributed to changes in commodity prices and demand composition.

While Borin and Mancini (2017) base their analysis on the 2013 release of the WIOD, Timmer et al. (2021) rely on the more recent 2016 version. Notably, the methodology for constructing input–output tables at constant prices evolved between the two releases, highlighting the challenges in deriving volume measures for IIO-based indicators of GVCs.[6] Timmer et al. (2021) also argue in favor of ensuring consistency with macroeconomic data - particularly those from national accounts - over relying on deflators constructed with detailed product-level price proxies, such as unit values derived from bilateral trade data. Although such deflators, based on several thousand goods, may be well suited to capturing price variation in trade flows, they do not necessarily align with broader price series for consumption, value added, and gross output that are essential for the input-output framework. Moreover, these trade-based deflators primarily cover goods and do not provide coverage of services. Timmer et al. (2021) thus emphasize the importance of maintaining coherence across all sectors of the economy and present their approach as a compromise in favor of consistency required with other macroeconomic price indicators.

Timmer et al. (2021) investigate trends in supply chain fragmentation over the period 2000–2014 using the "Supply Chain Fragmentation ratio" (SCF). This measure is defined as the ratio of the sum of the volume of imports by all countries that participate in a particular supply chain (imports of the country in which the product is finalised as well as imports by other countries in upstream stages of production) divided by the output value of the final good. The analysis reveals a continued - albeit slower - fragmentation of supply chains following the great trade collapse of 2008–2009. While the volume-based SCF ratio still indicates an increase in fragmentation after 2009, the use of the non-deflated (nominal) measure would have suggested a decline, potentially leading to the misleading conclusion of de-fragmentation after 2010.

More recently, the Asian Development Bank (ADB) constructed a set of multiregional input-output tables (MRIOTs), extending the WIOD framework to cover 29 Asian economies (ADB, 2023a,

[5]Pure double counting corresponds to value-added items that are recorded more than once in a gross trade flow resulting from the back-and-forth transactions involved in cross-border production processes.

[6]As the double deflation method led to unsatisfactory results for value added figures, it was replaced by an alternative approach since December 2014, the "exogenous value added in an RAS-approach deflation" method. For a presentation of this method see Los et al. (2014) and Timmer et al. (2021)

pp 13-14). These MRIOTs are available in both nominal and real terms for the years 2000 and 2007–2022.[7] Since all values are expressed in US dollars, the differences between GVC indicators measured in nominal and real terms reflect the combined influence of price and exchange rate fluctuations, referred to as the "dollar price wedge" (ADB, 2023b, p. 228).

The ADB report documents the evolution of overall GVC participation rates from 2007 to 2022. Following Borin and Mancini (2019) framework, the overall GVC participation rate is the sum of backward and forward GVC participation rates. Inflationary pressures are particularly evident in 2022, when the difference between nominal and real participation rates reached 0.9 percentage points - the highest observed over the period - compared to 0.6-point gaps in both 2020 and 2007, the two other peak years of divergence. The Global Value Chain Development Report 2023 further disaggregates this analysis by distinguishing between forward and backward GVC participation. It compares both dimensions of GVC integration in nominal and real terms over the 2007–2022 period, using the ADB's MRIOTs.[8] The report reveals divergence between nominal and real estimates of forward and backward indicators, with the largest discrepancies again recorded in 2007, 2020, and 2022. While global-level differences remain relatively limited, with low overall variances, the country-level estimates reported in the study reveal substantially greater variation.

Lastly, Jaax et al. (2023) and OECD (2024) examine the evolution of GVCs using the same indicator as Timmer et al. (2021), referred to here as the import intensity of production (defined again as the value of all trade in intermediate inputs along the value chain as a share of gross output (Jaax et al., 2023, p. 6)). Their study, however, relies on a different data source: the OECD Inter-Country Input-Output (ICIO) tables, which are available in both current and previous year's prices and cover the period 1995–2020.[9] The methodology used to construct the ICIO tables in previous year's prices aligns with the approach adopted by the WIOD project since 2014 (Guilhoto et al., 2022).[10] The ICIO tables are deflated using country-sector level deflators. The entire matrix is adjusted using deflated totals for rows and columns, derived from various sources such as national accounts, KLEMS, and STAN, with imputations applied when data are missing for certain countries[11] or sectors. The RAS iterative procedure ensures that the internal structure of the matrix remains consistent with the specified margins. Notably, no bilateral product-level price data are used in this process.

Jaax et al. (2023) reaffirm the importance of disentangling price effects from changes in trade

[7]ADB has been publishing nominal MRIOTs since 2015, and the real MRIOTs since 2020, with 35-industry and 5-final demand category disaggregation for 62 economies and the rest of the world. Nominal MRIOTs are compiled using the same methodology employed by the WIOD. Real MRIOTs are expressed in 2010 prices. In October 2024, the MRIOTs for 2023 were released; however, no analysis on GVC indicators in real terms was provided alongside the data.

[8]The Global Value Chain Development Report 2023 examines the effects of global shocks between 1995 and 2022 on GVC participation. For 1995–2006, data stems from the World Input-Output Database (2013 Release) while for 2007–2022, the Asian Development Bank Multiregional Input-Output Database is used. The analysis in real terms is limited to the 2007–2022 period.

[9]The tables are available for 67 countries including 'Rest of the world' and 45 broad industries, including services.

[10]See Guilhoto et al. (2022) for a presentation of the methodology which follows the main steps presented in Los et al. (2014)

[11]The deflators for the 'Rest of the World' are constructed as weighted averages of the ten largest economies in terms of output per sector using data from the UN National Accounts.

volumes to accurately assess the structural evolution of GVCs. Their study adopts a long-term perspective, comparing the import intensity of production at the global level in both current and constant prices over the period 1965-2020. The analysis draws on OECD ICIO tables from 1995 onward, as well as on the long-run version of the WIOD database covering 1965–2000.[12] This extended time horizon underscores the relevance of accounting for price movements when interpreting GVC dynamics - both in recent decades and in earlier periods such as the 1970s and 1980s. As expected, during the two oil crises, the import intensity of production measured in current prices exceeded the constant-price version of the indicator, reflecting the inflationary impact of energy prices. In more recent years, the apparent deglobalization observed between 2011 and 2019, as measured by the nominal indicator, appears to have been driven primarily by falling prices of intermediate inputs (especially raw materials) during the 2011-2016 period. In contrast, the constant-price series indicates that the import intensity of production remained relatively stable over the same period, with the 2019 level closely aligned with that of 2011.

This review highlights a trade-off between the sophistication of GVC measurement and the reliability of deflation techniques. IIO-based indicators can yield detailed insights into the GVC structures, particularly at the regional or country level. However, they are considerably more complex to deflate with accuracy. By contrast, trade-based indicators, though more elementary, enable for more robust deflation procedures by relying on disaggregated price data information. The approach pursued in this study seeks to balance these dimensions by emphasizing deflation quality while preserving the capacity to capture key features of GVC dynamics at the global level. In addition, IIO tables are released irregularly[13] and involve substantial data requirements as well as strong assumptions. Trade-based indicators, by contrast, can be updated more regularly with observed, disaggregated data. The framework proposed here contributes to the analysis of both longer-term trends and recent developments, making it particularly valuable for tracking global trade patterns under heightened economic uncertainty.

3 Methodology

3.1 Computing price deflators

We construct series of trade in volume by production stage. This requires deflating series of trade in value, and for this purpose, we compute price indices by production stage. These price indices are based on trade unit values at a very disaggregated level.

[12]A long-run time series of WIOTS has been constructed for the period 1965–2000, covering 25 countries and 23 sectors (classified according to ISIC Rev. 3), using the deflation methodology employed in the 2016 WIOD release. For a presentation of the specific implementation difficulties faced for the construction of the Long-run WIOD in pyp, see Woltjer et al. (2021). A comparison of overlapping years (1995–2000) across the long-run series of WIOD and the OECD ICIO tables reveals noteworthy discrepancies in indicator levels, both for current and constant prices, reflecting differences in underlying data sources and construction methods of IO tables.

[13]IIO-based measures are released with a significant lag – often two or three years. However, recent empirical strategies have combined econometric models with machine learning to produce nowcasts of IIO-based indicators (Mourougane et al., 2023). The quality of the nowcasts depends on the model performance, which appears to be unequal across countries. Moreover, these approaches provide no information on measures in volume.

Products are identified using the 6-digit Harmonized System (HS).

Logarithmic changes in unit-value (value in USD divided by quantity in tons) are computed for each elementary trade flow (i.e. an exporter i, an importer j, a product k and a year t):

$$dlog(UV_{i,j,k,t}) = log(UV_{i,j,k,t}) - log(UV_{i,j,k,t-1})$$

To exclude outliers, the top and bottom 5% of value-weighted logarithmic changes (dlog) are dropped for each product and each year. That is, at each point in time and for each product, trade flows are ranked by their growth rates, and the extreme values representing up to 5% of total trade value on both the upper and lower tails of the distribution are excluded from the analysis.[14]

These logarithmic changes in unit-value (dlog) are aggregated from the elementary level (exporter-importer-product) using a Tornqvist price-index formula. Noting K for the aggregation level (stage of production, or total world trade), the log variation of the Tornqvist price index ($dlogT_{K,t}$) is obtained as follows:

$$dlogT_{K,t} = \sum_{i,j,k \in K} weight_{i,j,k,t} \; dlog(UV_{i,j,k,t})$$

where the weight is a simple average of the elementary trade flow shares in the aggregation group considered (K) at time t and $t-1$:

$$weight_{i,j,k,t} = \frac{1}{2}\left(\frac{value_{i,j,k,t}}{\sum_{i,j,k \in K} value_{i,j,k,t}} + \frac{value_{i,j,k,t-1}}{\sum_{i,j,k \in K} value_{i,j,k,t-1}}\right)$$

Trade price series ($T_{K,t}$) are computed from $dlogT_{K,t}$ with 2000 as the base year ($T_{K,2000} = 100$). Trade in volume is then computed as follows:

$$Trade\_volume_{K,t} = Trade\_value_{K,t}/T_{k,t}$$

3.2 Data sources and nomenclatures

Unit values are obtained from the CEPII WTFC dataset[15] (before 2019) and from the CEPII BACI dataset[16] (after 2019). WTFC provides more reliable unit values but data is not available after 2019, hence the switch to BACI after this date. In other words, the growth rates of price indices obtained from BACI are used to deflate the series after 2019, while before 2019 price deflators are derived from WTFC.

Correspondence between HS 6-digit codes and production stage is established through the BEC

[14]In this operation, the weight for each elementary trade flow corresponds to:

$$weight_{i,j,k,t} = \frac{1}{2}\left(\frac{value_{i,j,k,t}}{\sum_{i,j} value_{i,j,k,t}} + \frac{value_{i,j,k,t-1}}{\sum_{i,j} value_{i,j,k,t-1}}\right)$$

[15]See Emlinger and Piton (2014) for the methodology used to construct the WTFC dataset.

[16]See Gaulier and Zignago (2010) for the methodology used to construct the BACI dataset.

classification[17]. We distinguish five production stages: primary goods, semi-finished goods, parts and components, capital goods and consumption goods. Additionally, refined petroleum products, identified from the ISIC nomenclature, are added to the primary goods sector given their parallel price dynamics with energy-related primary products.

To ensure consistency over time, the 1996 revision of the Harmonized System (HS) is used throughout this study. However, this choice may inadequately capture product changes, such as the emergence of electric vehicles, which were only incorporated in the 2017 HS revision. It may also lead to increased measurement errors as we move further from the 1996 classification, with new products emerging or existing ones evolving. In this version of the paper, we do not propose a comprehensive solution to the issue of nomenclature changes. Instead, to mitigate their impact, we exclude unit value variations of products affected by HS code changes from the calculation of price indices. Specifically, in years when revisions to the HS classification occur (2002, 2007, 2012, 2017, and 2022), we remove all products affected by these nomenclature changes, regardless of the revision date, from the dataset before constructing the price deflator. Future work should explore ways to better account for the introduction of new products in more recent HS revisions.

4 Main results

4.1 Descriptive statistics

Our trade deflators match well with trade price indices computed by other institutions (CPB and UNCTAD, see Figure 1). It is also noteworthy that trade deflators are more volatile than GDP deflators, highlighting the relevance of using trade specific price indices when deflating trade series.

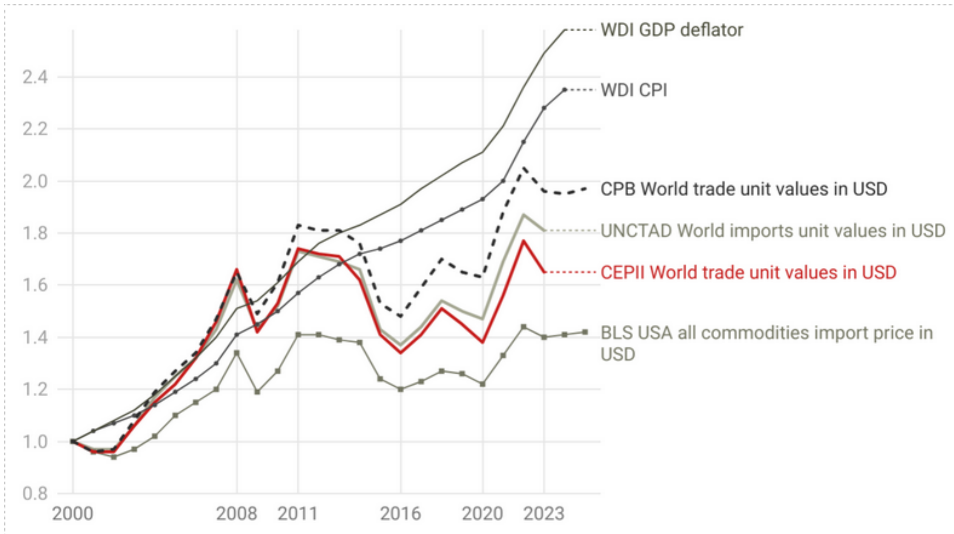
Deflating total world trade (Figure 2) using our price index, we find a smoother growth of trade over time, with a strong divergence between the deflated and nominal series for the latest years, illustrating the need to properly account for price effects during this period of strong inflation.

In Figure 3, we plot our price deflators for each production stage. As expected, primary goods exhibit the largest price variations, with a magnitude in line with the one depicted by other institutions (Figure 4). Semi-finished goods also have large price variations which mirror the ones of primary goods, as their prices are more directly influenced by commodity price developments than those of goods at more downstream stages of production. Parts and components have a relatively low magnitude of price variations but their movements are also tied to the ones of primary goods, unlike capital and consumption goods whose price index has much smoother variations, less related to price movements of primary goods.

Trade price procyclicality is evident across all stages of production (notably during the downturns of 2009 and 2020), but it is most pronounced for goods that are further upstream. Price series denominated in U.S. dollars are naturally influenced by fluctuations in the strength of the

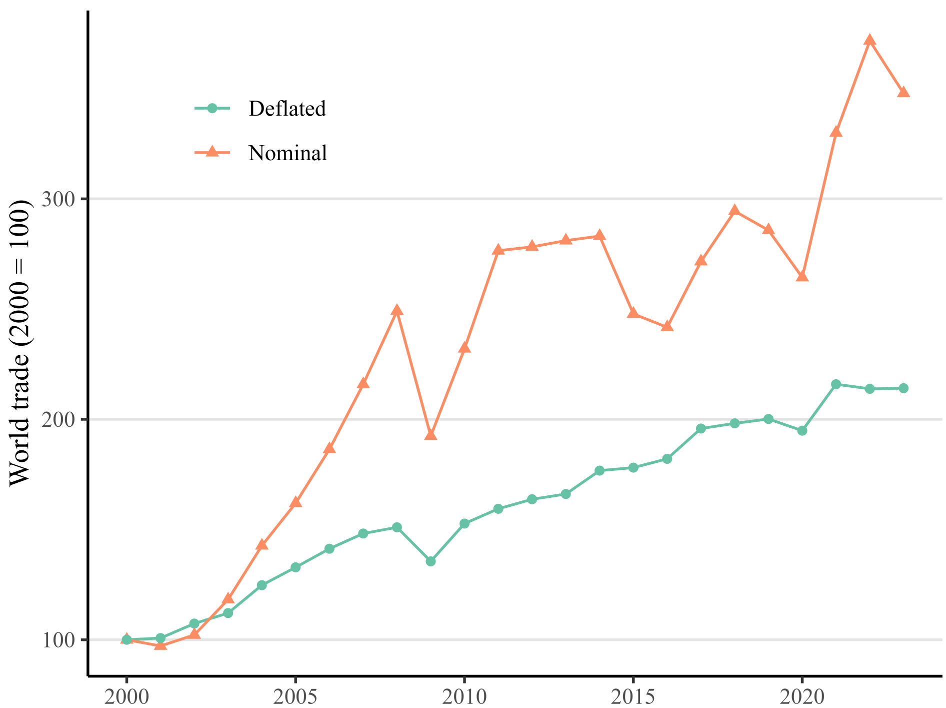
[17]Concordance tables between the HS nomenclature and the BEC nomenclature are obtained from the UN Statistical Division

Figure 1: Price deflators from different sources (2000 = 1).



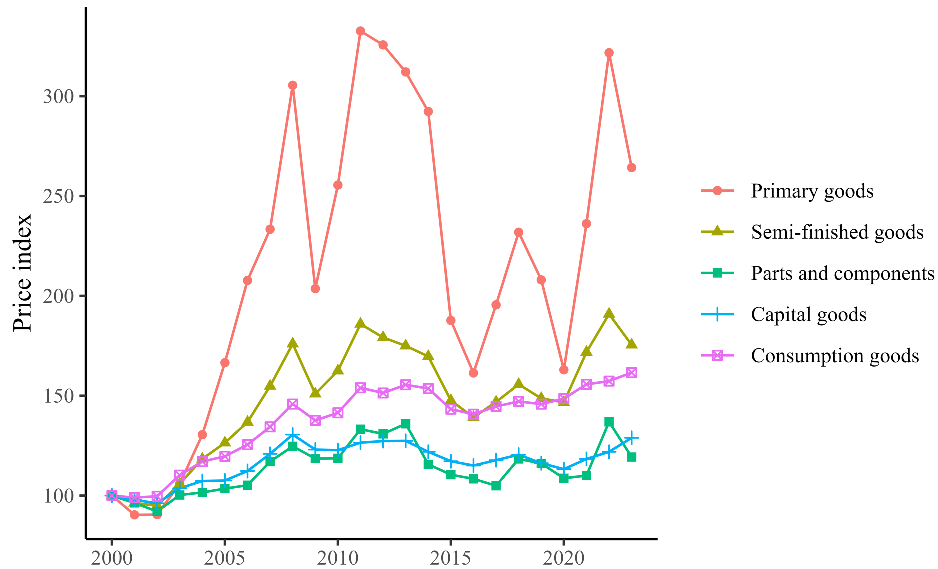
Sources: Trade-Volume dataset (annual, last data 2023); CPB-World Trade Monitor (monthly, last data April 2025); FRED-BLS USA (End Use) Import Index (monthly, last data May 2025); UNCTAD (annual, last data 2023); World Bank-WDI database (GDP deflator and CPI, annual, last data 2024).

Figure 2: Evolution of world trade, in value and in volume (2000 = 100)



currency. For example, the decline observed in 2015 can be attributed to a significant appreciation of the dollar, while the high inflation recorded in the 2000s (2002–2008) is partly a consequence of a depreciating dollar. This effect is particularly marked for primary goods, many of which are commodities priced in dollars.

Figure 3: Price index (deflator) by production stage



In Figure 5, we plot the evolution over time of trade in value and in volume for each production stage. The difference between the nominal and real series corresponds to our price deflator. For most production stages, deflating trade results in a smoother growth (with the exception of parts and components whose growth in volume remains rather irregular, with jumps and drops).

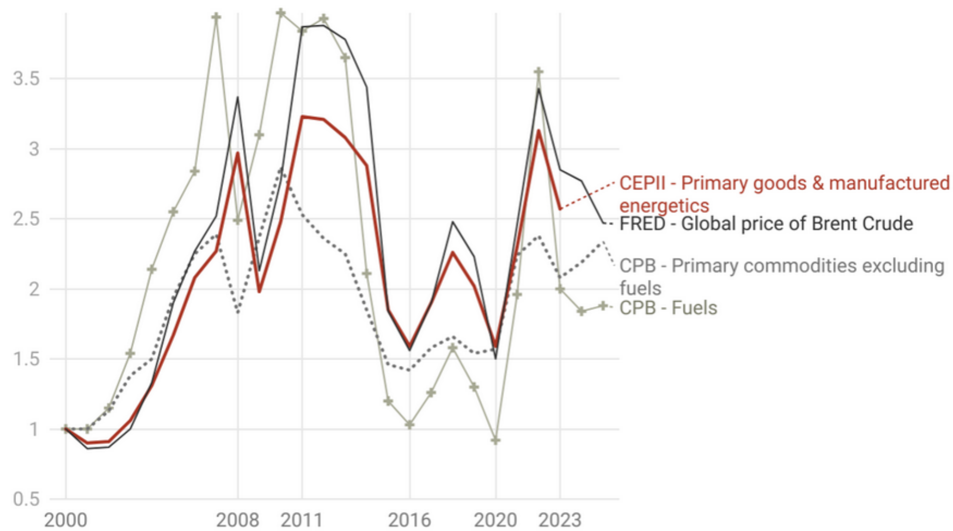
In Figure 6, we compare the evolution of trade in volume for primary goods, intermediate goods and final goods. Intermediate goods gather semi-finished products and parts and components, while final goods gather capital goods and consumption goods. Primary goods experience overall lower growth rates over the period, their trade in volume is less dynamic than trade in intermediate goods and in final goods, which grow at a similar rate.

Finally, Figure 7 plots our indicator of GVC intensity (the share of intermediate goods in world trade, excluding primary goods). This figure reveals that the share of intermediate goods in world trade is rather stable once price effects are accounted for, most of the variation arising from changes in prices. In the appendix, we propose different versions of this indicator, corresponding to different methodological choices (Figure 9). We find that the deflated share of intermediate goods in trade follows a very similar pattern with all methodologies.

4.2 Estimation of the trend in growth rates

Given the considerable volatility observed in volume indices, reflecting, in part, measurement errors (including in the construction of deflators), we estimate the underlying trend growth rate

Figure 4: Primary goods' price deflators from different sources



Sources: CEPII Trade-Volume dataset (annual, last data 2023); CPB-World Trade Monitor (CPB takes commodity price indexes from Hamburg World Economic Institute, monthly, last data April 2025); FRED- Global price of Brent crude (U.S. dollars per barrel, not seasonally adjusted, monthly, last data May 2025).

Figure 5: Trade by production stage, in value and in volume.

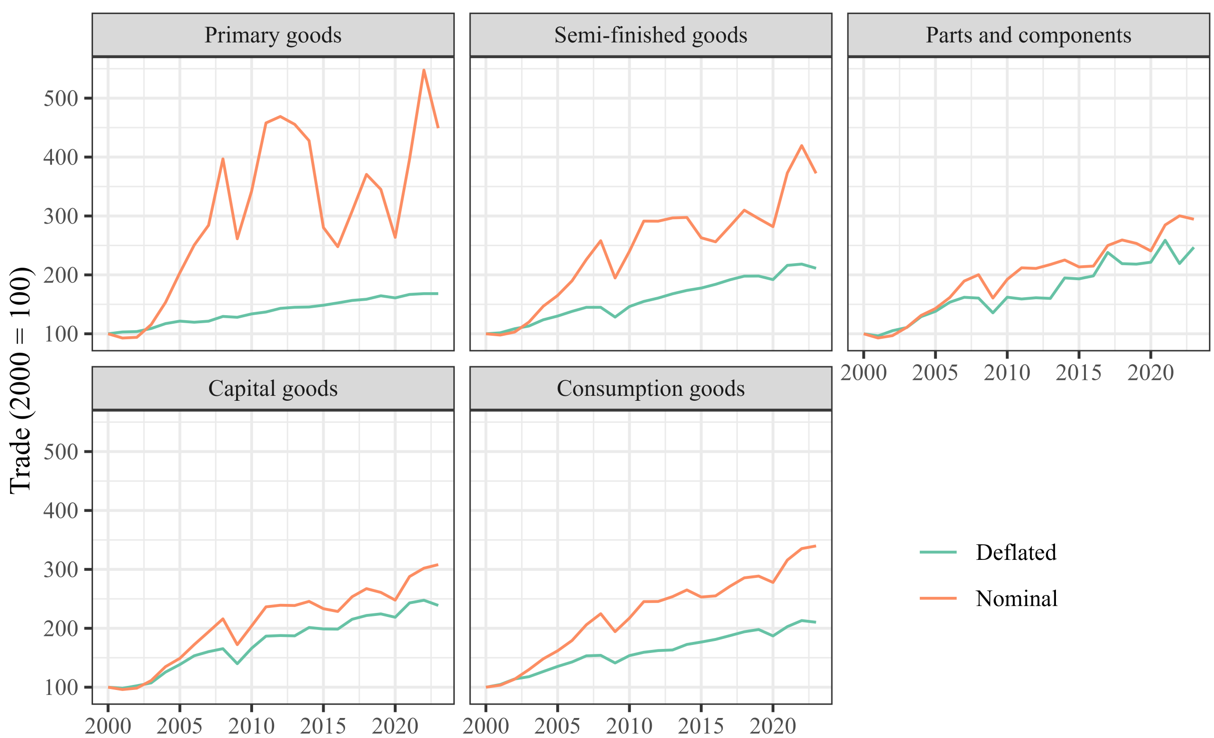


Figure 6: Evolution of trade in volume by production stage (2000 = 100)

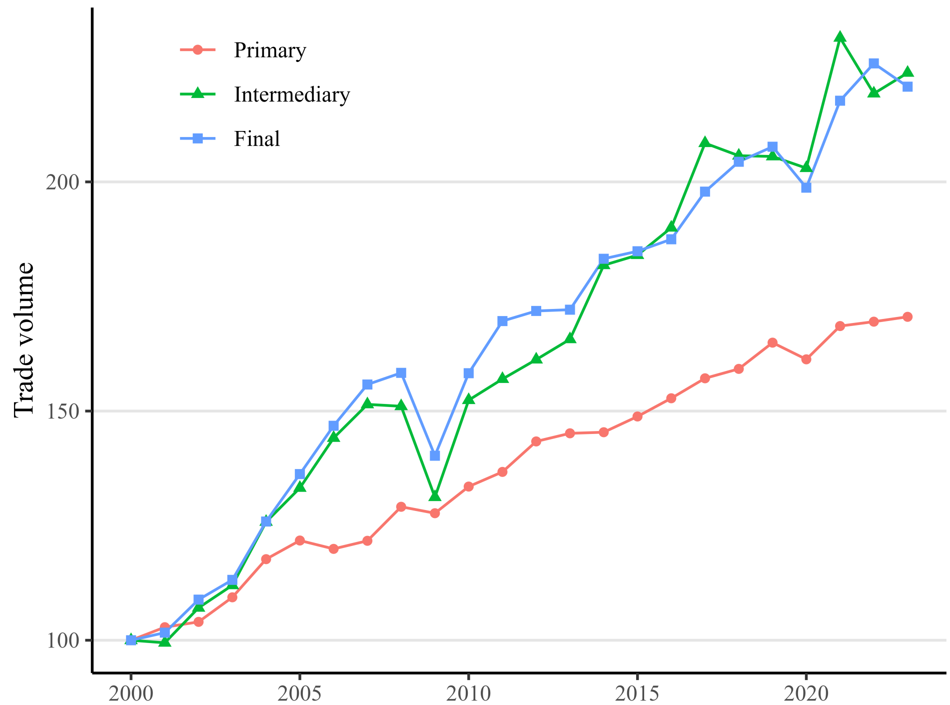
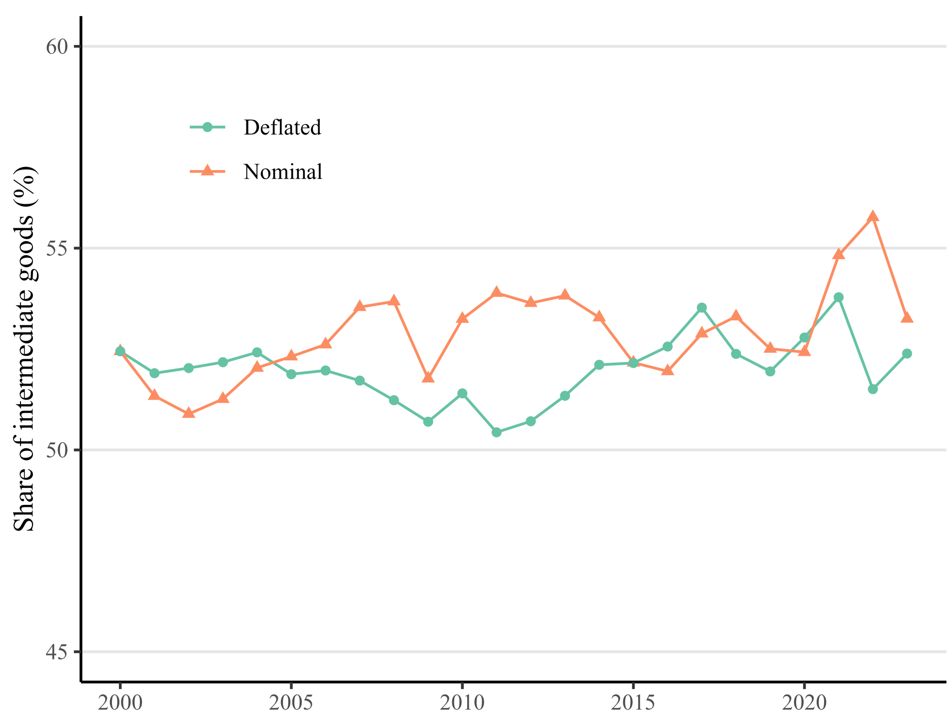


Figure 7: Share of intermediate goods in world trade



Notes: Intermediate goods correspond to semi-finished goods and parts and components. Primary goods are excluded.

using a regression approach. This method also allows us to control for the global business cycle: the estimated growth rate over the full period (2000–2023) is thus purged of cyclical fluctuations, and we can assess the degree of procyclicality of world trade by stage of production.

We regress the deflated trade index (in logs), or the deflated share in total trade for each production stage, on a constant, a linear time trend (capturing the average annual growth rate, i.e., the log-difference), and a global output gap measure (from the IMF) to assess procyclicality.

Table 1 reports the results. The second column presents the estimated growth rate for each production stage; the next two columns show the corresponding standard error and t-statistic. The final three columns display the coefficient, standard error, and t-statistic for the output gap.

It appears that trend growth was highest for parts and components and for capital goods, averaging +4.4% per year for parts and components, whereas, as expected, energy and other primary goods lagged behind, with an average growth rate of +2.4% per year. Panel B, which uses the share in total trade as the dependent variable, allows us to assess the statistical significance of differences across production stages. For instance, consumption goods exhibit a significantly lower growth rate than total world trade in volume terms.

Regarding cyclicality, we find, as anticipated, that world trade volumes are procyclical: a one percentage point increase in the global output gap is associated with trade volumes approximately 2% above their trend level. In contrast, trade in primary goods does not exhibit statistically significant procyclicality. Parts and components are significantly more procyclical than total trade.

5 Conclusion

Using a very simple indicator of GVC intensity (the share of intermediate goods in world trade), and properly accounting for price effects, we find that GVC intensity remained relatively constant during the last two decades.

By applying a regression approach to deflated trade indices, we isolate the underlying trend growth of world trade while accounting for global business cycle fluctuations. Our results show that parts and components, as well as capital goods, experienced the fastest trend growth between 2000 and 2023, while primary goods lagged behind. Trade volumes are found to be strongly procyclical overall, except for primary goods, which show no significant correlation with the global output gap.

The growing share of parts and components - as well as capital goods - in volume terms appears to be one of the most robust results. This holds despite the fact that our methodology does not account for quality improvements, which are likely more prevalent for these sophisticated and differentiated production goods. As such, the true growth of these categories may be even higher than reported.

Our indicator allows for frequent updates and will be used to track the latest developments of GVC.

Table 1: Trend growth rate and cyclicality

	PANEL A - Dependent variable: deflated trade index (log)					
	Trend			Output gap		
	Coef	Stder	T-stat	Coef	Stder	T-stat
Total	0.034	0.0014	25.06	2.10	0.78	2.69
Intermediate goods	0.038	0.0013	28.35	2.88	0.76	3.79
Final goods	0.034	0.0017	19.70	2.23	1.00	2.23
Primary goods	0.024	0.0008	29.76	0.09	0.46	0.21
Semi-finished	0.034	0.0013	25.54	2.07	0.76	2.72
Parts and components	0.044	0.0019	23.16	4.34	1.10	3.96
Capital	0.041	0.0024	17.15	2.70	1.36	1.99
Consumption	0.030	0.0015	20.81	1.87	0.84	2.24
	PANEL B - Dependent variable: share in total trade (log)					
	Trend			Output gap		
	Coef	Stder	T-stat	Coef	Stder	T-stat
Intermediate goods	0.0034	0.0005	6.45	0.78	0.30	2.56
Final goods	0.0003	0.0005	0.54	0.13	0.29	0.44
Primary goods	-0.0105	0.0009	-12.12	-2.01	0.50	-4.03
Semi-finished	-0.0004	0.0006	-0.64	-0.04	0.34	-0.11
Parts and components	0.0101	0.0016	6.44	2.24	0.90	2.50
Capital	0.0065	0.0012	5.39	0.59	0.69	0.87
Consumption	-0.0038	0.0005	-7.38	-0.23	0.30	-0.77

Notes : In each estimation, the dependent variable is regressed on a linear time trend and a measure of global output gap. The dependent variable is either the log of trade in volume (panel A) or the share in total trade (panel B).

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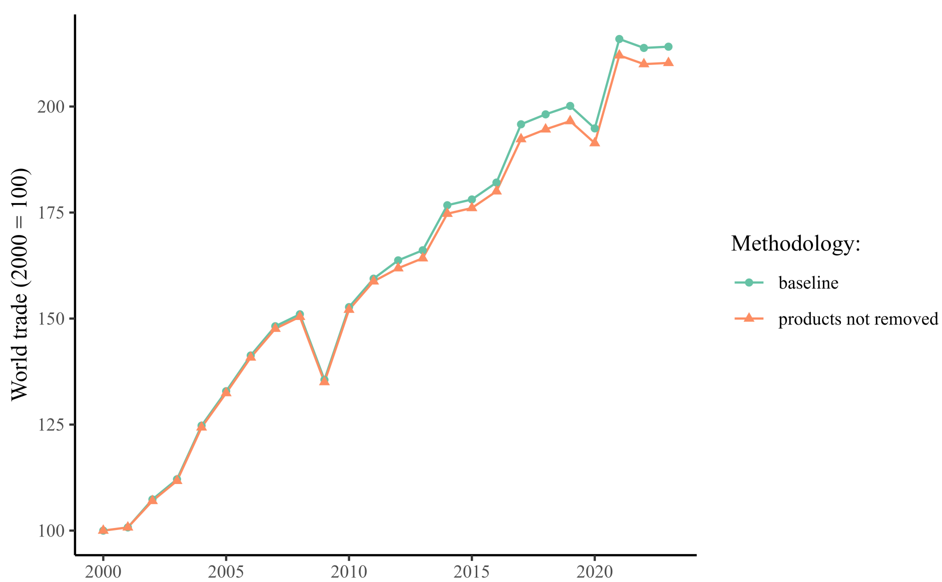
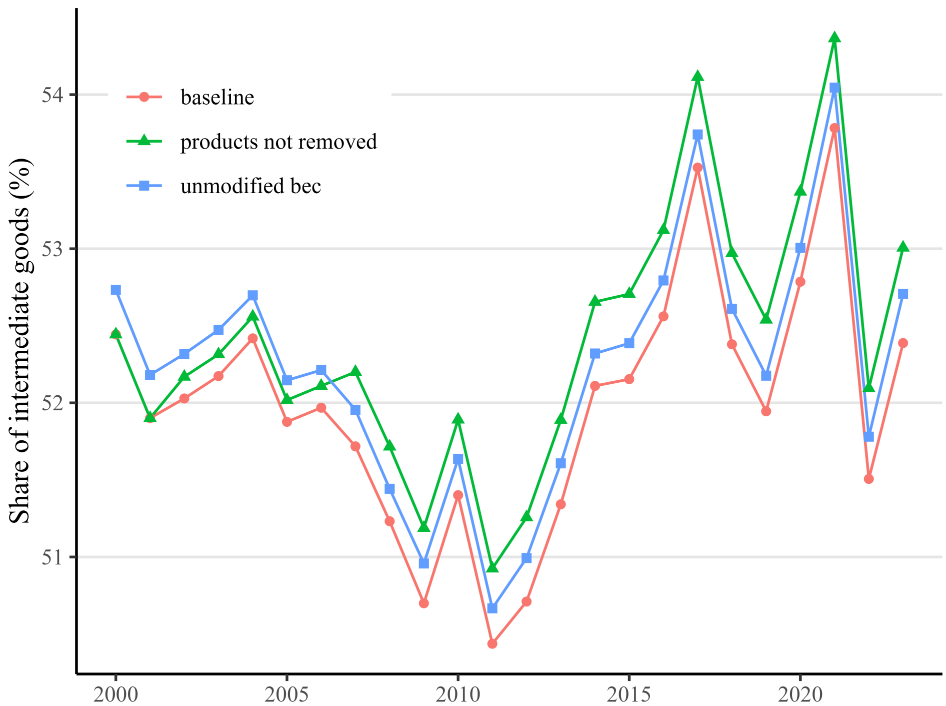
7 Appendix

Figure 8: Evolution of world trade in volume, comparing methodologies



Notes: Each line plots the evolution of world trade in volume, with different methodologies. In the baseline methodology, products affected by a revision of the HS nomenclature are removed in years where the revision takes place when computing price indices. "products not removed'' corresponds to a situation in which those products are not removed

Figure 9: Share of intermediate goods in world trade, comparing methodologies.



Notes: Intermediate goods correspond to semi-finished goods and parts and components. Primary goods are excluded. In the baseline methodology, products affected by a revision of the HS nomenclature are removed in years where the revision takes place when computing price indices, and products belonging to the division 23 of the ISIC Rev3.1 nomenclature ("Manufacture of coke, refined petroleum products and nuclear fuel") are added to the primary goods identified from the BEC. "products not removed" corresponds to a situation in which those products are not removed. "unmodified bec" corresponds to a situation in which the division 23 of the ISIC nomenclature is not added to primary goods identified from the BEC.