ISSN 1684-0364

SERIES

STUDIES AND PERSPECTIVES 192

ECLAC SUBREGIONAL HEADQUARTERS IN MEXICO

Revisiting constant market share analysis: an exercise applied to NAFTA

Hubert Escaith

UNITED NATIONS

ECLAC

Thank you for your interest in this ECLAC publication

Please register if you would like to receive information on our editorial products and activities. When you register, you may specify your particular areas of interest and you will gain access to our products in other formats.

Register

UNITED NATIONS

ECLAC

www.cepal.org/en/publications

facebook.com/publicacionesdelacepal

www.cepal.org/apps

SERIES

STUDIES AND PERSPECTIVES | **192**

ECLAC SUBREGIONAL HEADQUARTERS IN MEXICO

Revisiting constant market share analysis: an exercise applied to NAFTA

Hubert Escaith

UNITED NATIONS

ECLAC

This document was prepared by Hubert Escaith, formerly Chief Statistician at the World Trade Organization (WTO) and Chief of the Statistics and Economic Projections Division of the Economic Commission for Latin America and the Caribbean (ECLAC) and currently Associate Researcher at Aix-Marseille School of Economics (France) and Visiting Researcher at Bournemouth University Faculty of Management (United Kingdom), under the supervision of Jorge Mario Martínez Piva, Chief of the International Trade and Industry Unit of the ECLAC subregional headquarters in Mexico.

The author is grateful for the collaboration of Jorge Mario Martinez Piva, Sébastien Miroudot and Jennifer Alvarado, who provided insightful comments on previous drafts.

United Nations publication
ISSN: 1684-0364 (electronic version)
ISSN: 1680-8800 (printed version)
LC/TS.2021/94
LC/MEX/TS.2021/16
Distribution: L

Printed at United Nations, Santiago
S.21-00428

This publication should be cited as: H. Escaith, "Revisiting constant market share analysis: an exercise applied to NAFTA", *Studies and Perspectives series*, No. 192 (LC/TS.2021/94; LC/MEX/TS.2021/16), Mexico City, Economic Commission for Latin America and the Caribbean (ECLAC), 2021.

Contents

Tables

Figures

Box

Abstract

This article proposes a new formulation of constant market share (CMS) trade analysis inspired by the statistical principles supporting revealed comparative advantages (RCA). This novel approach is methodologically consistent and rooted in information theory. It also avoids the discrete-form residuals that plague traditional CMS analysis, while remaining simple to compute. The new "comparative market share analysis decomposition" (CMSD) is applied to the changes in the structure and origin of United States imports after the implementation of the North American Free Trade Agreement (NAFTA). It is shown in this exercise that both CMSD and RCA can be paired together in order to shed light on the dynamics of competitiveness and comparative advantages in international trade.

Introduction

Constant market share trade analysis (CMS) is commonly used in empirical investigation of international trade. It aims at identifying the strength and weaknesses of national exports relative to other competitors on a given import market. It is therefore closely related, at least in its broad objective, to revealed comparative advantages (RCA) indices, another tool widely used in applied trade analysis. As a matter of fact, Hernández and Romero (2012) introduce ECLAC CMS model MAGIC as being based on the general principles of comparative advantages, comparing changes in the composition of a country's exports with the market structure.

CMS decomposition intends to separate the effects of export structure (the specialisation of a country according to its revealed comparative advantages) and the evolution of demand by importing countries. When applied to data corresponding to distinct "points in time", identifying what is the share of variation due to structure and what is due to demand faces an accounting problem. A new "residual" or "interaction term" is required to achieve the required identity (Milana, 1988; Richardson, 1971). Several researchers have tried to decompose the residual term into meaningful sub-components (Fagerberg and Sollie, 1987). Yet, as the present author believes, there is little justification in finding sophisticated explanations to residuals that, in theory, should not exist. This paper shows that building CMS indicators from a solid statistical approach, rooted in probabilities and inference theory, leads to residual-free indicators that are both theoretically and statistically consistent.

The paper builds on the methodological similarities between CMS and RCA. While RCA indices intend to identify the product specialization of a country and its competitiveness based on the composition of its exports, CMS analysis is more interested in evaluating if this specialization is adequate considering the evolution of demand emanating from importers. Besides these differences, they share many methodological features even if the economic foundations for developing RCAs and CMSs indicators are different.

RCAs try to express in numbers a concept initially defined by D. Ricardo (1772–1823). The statistical issue is therefore to measure something that is not directly observable. New developments in trade theory, based on the heterogeneity of firms, led to proposing micro-foundations to RCAs (Eaton and Kortum, 2002). CMS analysis, on the contrary, deals only with observable phenomena: market shares and their evolution. Business economists will recognise the well-known Boston Consulting Group matrix of analysing markets in terms of mature products, rising stars, dogs, etc. In other words, RCAs belong to the universe of economics while CMS relates to the tools of strategic business management. Yet, it will be shown that their statistical foundations are similar.

Besides this introduction, the present article is organised as follows. A first part introduces the concept behind constant market share analysis. It reviews various approaches that have been proposed in the literature before presenting a new decomposition based on a probabilistic approach. It shows that this new "comparative market share analysis" solves some of the issues previously found in the literature and opens the way for a theoretically consistent parallel with one-way trade comparative advantages indices. The second part applies the new methodology to the analysis of United States imports between 1990 and 2020, highlighting the competition between regional and international exporters on the biggest single-nation world market. The period of investigation covers the implementation and the recent renegotiation of the former North American Free Trade Agreement (NAFTA) between Canada, Mexico, and the United States of America, now called the United States-Mexico-Canada Agreement (USMCA).[1] The empirical results obtained confirm previous results and shed new light on the impact of NAFTA on regional and extra-regional trade. The main results are synthetised in concluding remarks.

[1] United States-Mexico-Canada Agreement (USMCA) entered into force on 1st July 2020. In this article the acronym NAFTA also covers the trade movements made under the USMCA.

I. The dynamics of export competitiveness and constant market share analysis

The intuition behind the CMS approach is that the aggregate growth performance of national exports relative to other competing exporters is the result of product specialization (exporting country's productive structure), the strength of demand on the importing markets or/and the growth rate of commodity exports. But, even on a low demand market niche, the country can expend its exports if it is able to displace its competitors. If the average growth rate of national exports is lower than the total growth of demand for imports, the analyst wants to investigate the extent to which this underperformance is due to a mismatch of the productive structure (the exporter has competitive advantages in products that are in low international demand), on the one hand, and to the effect of the individual product performance on the other hand. To quote ECLAC (2006) in the presentation of its own CMS model (MAGIC, see box 1): "One country's competitive situation, taken over a particular period, in selected international markets and in chosen sectors of international trade, is determined by relative international market share and by the country's capacity to detect the highest growth sectors and specialize in them".

As Piezas-Jerbi and Nee (2009) explain, the key assumption when applying CMS analysis is that, if a country's export competitiveness does not change and all other factors influencing its exports (product composition or geographical distribution of world demand for imports) are held constant, this country's share in world trade should remain constant over time as well. Alternatively, any change in the country's exports that cannot be accounted for by observable explanatory factors such as the global trade growth or the structural composition of external demand (be it the total demand for imports from trading partners or the product composition of world trade) can be interpreted as a change in competitiveness.

These authors add a series of important remarks. First, CMS results reflect changes and cannot be used to compare the relative positions of countries in terms of competitiveness (p. 16). With the rise of the South-North and South-South trade during the 1990s and 2000s, it would be logical to expect some emerging countries showing a greater positive contribution of their competitiveness indicator

(Escaith and Miroudot, 2015). Another shortcoming of the method would be that it is based on competition for market shares, projecting a mercantilist vision of world trade (i.e., a "zero-sum" game where the one's gains are somebody else's losses).[2]

Box 1
Module for the Analysis of Growth in International Commerce (MAGIC)

ECLAC MAGIC (Module for the Analysis of Growth in International Commerce) initiated in 1995 with a dedicated software called MUSIC (Module for United States Import Consultation) aimed at monitoring and analysing the evolution of market share in the United States. In its new developments, it integrates the analysis on several other markets (Central America, the European Union and Mexico). The information provided goes much beyond market share analysis, and include data on revealed comparative advantages, product specialization, and trade costs at detailed product classification (from HS 2 to HS6 as well as tariff-line level for the United States).

The market share analysis for particular exports is presented according to the Boston Consulting Group Matrix[a] typology (rising stars vs. stagnant sectors) as well as the typology used for Constant Market Share Analysis. The CMS analysis is based on the formulation proposed by Milana (1988). It also includes a price competitiveness effect derived from changes in real effective exchange rate and a decomposition of the residual. In this traditional presentation, the residual (called structural interaction effect) shows a positive sign when country j gains share in a dynamic product or when it loses share in a stagnant product.

The information is relevant for exporting firms, as it provides important information on the evolution of demand for particular products and main competitors. It is also relevant for public authorities as it offers a synthetic snapshot of the competitive position of the national exports on multiple markets. It gives also interesting information to governments on the tariffs faced by its exporters compared to main competitors on some markets (e.g., the United States). This knowledge is of great value in trade negotiation and trade monitoring.

Source: Prepared by the author, on the basis of M. Cordero, *Nuevo MAGIC: Módulo para Analizar el Crecimiento del Comercio Internacional* (LC/MEX/TS.2021/9), Economic Commission for Latin America and the Caribbean (ECLAC), 2021 and R. A. Hernandez and I. Romero, "Module for the analysis of growth in international commerce (MAGIC Plus) User guide (updated)", *Series Manuales* No. 79, Economic Commission for Latin America and the Caribbean (ECLAC), 2012.
[a] The BCG Matrix was created in 1969 and is also known as share/growth matrix. It is a 2×2 table where one dimension of the matrix represents the market growth for a product and other one represents the business unit's market share of the product.

A. The theoretical continuous time decomposition and its discrete time equivalent

Let us have first a look in a very simplified formulation at the mathematical specification of CMS analysis in continuous time. Assume we are looking at the behaviour of total exports from a home country perspective. Ignoring for the time being the disaggregation by commodity, let (V^{i}_{w}) be the total value of home exports to World and ($V^{\cdot}_{w}$) the total value of world trade (home plus foreign exports). The share of exports of the home country *i* in world trade at time *t* is given by:

$$\mathrm{S}_t^i = V_{w,t}^i \big/ V_{w,t}^{\cdot} \quad [1]$$

The basic identity of the CMS can therefore be represented by:

$$\frac{dV_{w,t}^i}{dt} = \mathrm{S}_t^i \left(\frac{dV_{w,t}^{\cdot}}{dt}\right) + V_{w,t}^{\cdot} \left(\frac{d\mathrm{S}_t^i}{dt}\right) \quad [2]$$

[2] The authors mention that it would be incorrect to conclude that industrialized countries are losing in productivity and welfare just because their performance indicator appears to be negative.

As we see, given ($V^{\cdot}_{w}$), the (exogenous) demand for imports emanating from the international community, the structure of a country's exports (S*ti*) indicating for example the relative weight of all traded commodities actually exported by country "*i*" affects its potential for export growth.[3] So far, so good. But Richardson (1971), among others, points out a practical problem with writing the CMS identity in the form of Equation [2] because it refers to an infinitesimally short time period (the continuous case) whereas CMS analysis is usually performed over discrete time periods (annual at best, but usually pluri-annual changes).

This gives rise to what is often referred to as the "index number problem" in CMS analysis. In discrete time, when only data corresponding to the beginning and the end of a period are available, the equation [2] is rewritten as:

$$\Delta V^{i}_{w,1} \equiv S^{i}_{0}\Delta V^{\cdot}_{w,1} + V^{\cdot}_{w,1}\, \Delta S^{i}_{1} \qquad [3]$$

Where 0 and 1 stand for the first and last year of the period. ΔV^1 and ΔS^1 indicate the changes between 0 and 1 in national or world export values and in export share, respectively.

$S^{i}_{0}\Delta V^{\cdot}_{w,1}$ is often referred as the global scale effect, indicating the average growth in exports if market shares remained constant. $V^{\cdot}_{w,1}\, \Delta S^{i}_{1}$ is the ex-post composition effect (sometimes also referred as the "competitive" effect) indicating the average growth due to changes in the product mixed (weighted by imports at final time 1). But it can also be written as:

$$\Delta V^{i}_{w,1} \equiv S^{i}_{1}\Delta V^{\cdot}_{w,1} + +V^{\cdot}_{w,0}\, \Delta S^{i}_{1} \qquad [4]$$

The previous identities require only two decomposition factors, like in the continuous case [2]. This is achieved by mixing two types of weighting, one based on the initial year (Laspeyres indices) and one on the final year (Paasche indices), or contrariwise. This is the approach used, *inter alia*, by Leamer and Stern (1970).

But if it does the trick, mixing Laspeyres and Paasche weights lacks theoretical justifications. Numerous authors have attempted to provide better discrete time CMS decomposition to account for the growth and competitiveness effects. Among the precursors, we may cite Tyszynski (1951), Svennilson (1954) and Baldwin (1958).

It was commonly accepted that the CMS method would gain in theoretical consistency and in empirical applicability if only initial years' weights (Laspeyres indices) were employed throughout the calculation. These efforts however create an additional problem, because a new residual term is produced as a side-effect of these decompositions (Milana, 1988, Richardson, 1971):

$$\Delta V^{i}_{w,1} \equiv S^{0}_{i}\Delta V^{\cdot}_{w,1} + V^{0}_{w,0}\, \Delta S^{i}_{1} + \Delta V^{\cdot}_{w,1}\, \Delta S^{i}_{1} \qquad [5]$$

The residual term ($\Delta V^{\cdot}_{w,1} \cdot \Delta S_1^{i}$) is interpreted as the interaction between world trade volume and export structure.

All three above mentioned expressions are identities that differ only for the weights applied to the changes in world exports and in the country's exports shares. The additional interaction effect is a bone of contention amongst analysts. Some argue (as this author) that this residual is just a product of inaccuracies in the market share decomposition; others believe that it is a source of important

---

[3] For example, if a country specializes in especially high-growth commodities, or it exports to especially high-growth geographical markets.

explanatory information that is worth analysing.[4] For these authors, the residual effect can be interpreted as the degree of success of the country in adapting the market composition of its exports to the changes in the composition of demand for world imports.

Nothing opposes further discrete-time decomposition of equation [2]. Fagerberg and Sollie (1987), for example, calculate five levels of decomposition by distinguishing three sub-level effects (regional, product and interactions) in each one of the "scales" and "composition" parts. The five effects are meant, according to the authors, to measure the influence of market shares, market distribution, commodity composition, commodity adaptation and market adaptation effects. Ahmadi-Esfahani (2006) adopts a similar decomposition.

Widodo (2020) asserts that the approaches in Leamer and Stern (1970) and in Fagerberg and Sollie (1987) are complementary. The latter one tries to shed light on changes in country's competitiveness while the former focuses on explaining changes in exports.

B. Index number theory: the ideal approach

While agreeing that the Leamer and Stern (1970) solution of mixing two types of weights is not satisfactory, many researchers remain uncomfortable with the addition of a residual term, which does not exist in the theoretical model. As mentioned, the interaction effect term exists only when the decomposition formula is calculated in discrete time. Milana (1988) refers to this issue as the "index number problem of CMS analysis". The author examines CMS from the index number theory and shows that neither a Laspeyres nor a Paasche approach can deliver a proper solution.

The problem stems from the fact that both a country and world exports are changing continuously in time while CMS identities are merely discrete time approximations. Using higher-frequency data, like annual or quarterly trade statistics, should reduce the issue. But Piezas-Jerbi and Nee (2009) observe that using high frequency data leads to instability in the interaction component, complicating its economic interpretation.

For Milana (1988), aggregating (weighting) the observations according to the Divisia index formulation, which is path-dependent, provides the best theoretical solution. In practice, the author proposes to use as approximation in discrete time, a superlative index number. Superlative indices are price or quantity indices that are approximatively 'exact' for a flexible aggregator (i.e., flexible weighting coefficients, in our case). The class of superlative indices includes the Fisher index, the Törnqvist index and the Walsh index.

A simpler alternative is to use a full chained index approach, which would require frequent rebasing, based on annual observations. Nuddin and others (2018) follow Milana (1988) but use a simplified chained approach averaging Laspeyre or Paasche indices. Their geometric approach allows them solving the inconsistency in CMS analysis.

To conclude this review of the methodological literature, another approach (stochastic regression) is also possible when high frequency observations are available. Such an alternative approach, first discussed in the late 1970's but implemented only years later, is the so-called dynamic regression shift-share analysis. Fritz and Streicher (2005) provide an example of application to regional employment.

---

[4] Actually, a similar issue is found in growth accounting and comparative static analysis: separating volume from qualitative effects in continuous mathematical terms is easy, but it runs into lots of practical issues when applied to discrete time statistics. More formally, the analysis of reconciliating continuous with discrete time observations is known in descriptive statistics as the "Index Number Theory".

II. Comparative market share analysis: a probabilistic reinterpretation of CMS

Tyszynki (1951) referred (p. 288) to the changes in market shares due to structural changes in world trade as the difference between the hypothetical market share and the initial share. It was this comment that opened the way to the present reinterpretation of the CMS measurement through the lens of information theory. Indeed, the reference to a "hypothetical situation" at the root of the CMS analysis called our attention because it is closely related to the probabilistic interpretation of RCAs in Escaith (2020).

According to this paper, most of the RCA indicators that are proposed in the applied trade analysis literature are explicitly or implicitly rooted in a probabilistic approach, following the pioneering paper of Kunimoto (1977). They can also be interpreted from an information theory perspective because they provide information by comparing the observed situation with a hypothetical state of maximum entropy. Comparative advantages, which are not observable directly, are inferred from the deviation of actual trade flows with their expected (maximum entropy) value. This "expected" trade pattern is based on an uninformed "prior" (the best rational assessment of the probability of an outcome before collecting new information).[5]

Disregarding time for the moment, the expected value of exports on *k* product by country *i* in the "neutral situation" when no specific information is available, is given by:

$$E\left(X_k^i\right) = \left(\frac{X^i}{X^w}\right) \cdot X_k^w \qquad [6]$$

[5] This maximum entropy situation differs radically from the hypothetic case mentioned by Tyszynki (1951), who referred to it as maintaining unchanged the previous market shares.

Most applied RCA indices available in the literature derive from the following rule: if the observed exports (X_k^i) are higher than $E(X_k^i)$, which is what is expected in a neutral situation, then we conclude that country *i* has special characteristics, other than its sheer economic size, that bestow it with special advantages in exporting the product *k*. The usual way of calculating the difference is by calculating the ratio between the observed and the neutral situations:

$$RCA_k^i = X_k^i \;/\; E\left(X_k^i\right) \;;\; \forall\, X^i \neq 0 \; and \; X_k^w \neq 0 \qquad [7]$$

The pioneering Balassa's RCA index (Balassa, 1965), for example, belongs to this class of indices. It remains very popular today for analysing comparative advantages in "one-way" trade (considering only exports or imports, but not two-way trade simultaneously). Bela Balassa, who is credited with formulating one of the first RCA indices, also used CMS in 1979 when estimating United States export performance.

Comparative advantages are "revealed" when compared to the export performance of other countries. Similarly, CMS analysis is best understood when comparing the evolution of total exports of country "*i*" with the dynamics of total exports (or total imports from the reference country if we take a market-share approach). Yet, even after including this comparative dimension, it is still not possible to apply to CMS the same probabilistic RCA decomposition.

In Escaith (2020), the uninformed prior for RCAs is the marginal distribution of bilateral trade: the weight of a country in total exports and the weight of a given commodity in this total trade. But this weight (*1*) changes with time and is subject to the above-mentioned index-number issue, and (*2*) is already part of the initial equation [1] and cannot be considered as an uninformed prior benchmark.

To avoid using a path-dependent aggregator as neutral benchmark in CMS analysis, we need to use a different "uniformed prior". In absence of any prior information on the actual market share of an exporter, the uninformed prior, following a common practice in Bayesian statistics, is given by a uniform distribution of exports amid the total number of traded products. This number corresponds to all the products imported by the market used as reference for conducting the CMS analysis (a country, a region, or the world total). Under this uninformed prior, the expected share of commodity *k* in exports of country *i* at time *t* is:

$$E(S_{k,t}^i) = 1/C \qquad [8]$$

With *k* = 1, ..., C. C, the total number of traded commodities, can be larger than the number of commodities exported by country "*i*".

From [8] it flows that the neutral import structure of the reference region, being the average of neutral exports from all countries (*i* = 1 to N) is given by, for each commodity *k*:

$$E(S_{k,t}^w) = \frac{1}{N}\sum_{i=1}^{N} E(S_{k,t}^i) = 1/C \qquad [9]$$

Reinterpreting Tyszynki's intuition, CMS is calculated as the difference between the hypothetical (maximum entropy) market share and the observed share. The difference in national export growth rate between the observed and the expected exports is:

$$x_t^i - E\left(x_t^i\right) = \sum_{k=1}^{C} x_{k,t}^i \left(S_{k,t-1}^i - E(S_{k,t-1}^i)\right) \qquad [10]$$

With $x^i_t = (X^i_t - X^i_{t-1})/(X^i_{t-1})$, the total export growth rate of country *i* in year *t* expressed in arithmetic form, and $E(x^i_t)$ its expected value.[6] Similarly, the difference in total imports growth rate between the observed and the expected import structure is:

$$m^w_t - E(m^w_t) = \sum_{k=1}^{C} m^w_{k,t}\,(S^w_{k,t-1} - E(S^w_{k,t-1})) \qquad [11]$$

With $m^w_t = (M^w_t - M^w_{t-1})/(M^w_{t-1})$.

These differences between the national growth rate of exports and the reference market in the actual situation can be expressed as a combination of the differences between the actual and neutral situations. If the number of traded commodities does not change between the first and the final period, and after rearranging the terms (see Annex), we arrive at the following decomposition of growth rate of country "*i*" exports:

$$x^i_t = m^w_t + \left[\sum_{k=1}^{C} x^i_{k,t}\left(S^i_{k,t-1} - \frac{1}{C}\right) - \sum_{k=1}^{C} m^w_{k,t}\left(S^w_{k,t-1} - 1/C\right)\right] + \frac{1}{C}\sum_{k=1}^{C}\left(x^i_{k,t} - m^w_{k,t}\right) \qquad [12]$$

The first term is the rate of growth of the reference market (a global effect felt by all exporters), the second term between brackets is the composition effect and the last one is the individual product competitiveness. Because the market share decomposition in [12] is based on the same theoretical understanding of revealed comparative advantages, it is called the Comparative Market Share Decomposition (CMSD) in this document.

The second term of CMSD compares the actual growth rate (relative to a neutral distribution) weighted by the structure of national exports, with the actual growth rate (relative to a neutral distribution) of weighted imports. It measures, therefore, the impact of the exporting country's specialisation in fast or slow growing market segments, relative to a neutral situation without comparative advantages. If high performing national exports take place principally in marginal products, the second term in [12] will be negative.

The third term results from averaging the growth differential product by product between the exporter and the whole market. It is an indicator of "speed" in the competition more than an indicator of "structure".

Besides being well rooted in information theory, an important property of this decomposition is that it also solves the index number issue: it is entirely expressed in terms of a Laspeyre index but does not produce a residual when calculated in discrete time. So, it answers the problem mentioned by Milana (1988) by providing a theoretical consistent CMS method decomposition based only on initial years' (Laspeyres) weights. Yet, it is done without recurring to an additional interaction term to "explain" the residual. Because there is no residual term product of applying the formula in discrete time, the results are consistent independently of the length of time between the first and final years.

Quite interestingly, this CMSD is very similar to the results previously obtained by Artige and Neuss (2014). These authors reach an analogous conclusion despite adopting a different decomposition approach, working also on a different subject matter (a shift-share analysis of regional employment). This close similarity between their pioneering "New Shift Share Method" and the probabilistic approach to market-share analysis in [12] adds two important properties to our CMSD: firstly, it is plausible: the

[6] The decomposition requires arithmetic growth rates, taking the difference in logarithm ($\ln(x^i_t) - \ln(x^i_{t-1})$ will not result in an exact decomposition.

same end-results [12] are obtained despite starting from different hypothetical perspectives. Secondly, it allows to "import" from Artige and Neuss (2014) the series of interesting properties they demonstrate in their paper. They show that this new decomposition solves additional consistency flaws the authors have identified in the previous literature (see annex to this document for more details).

To conclude the methodological presentation, It should be noted that this analysis is based on a single import market. But countries export to several markets, and an additional factor plays a role in explaining the individual exporters performance: the geographical distribution of their exports.

Traditional CMS analysis also considers this geographical component as in Piezas-Jerbi and Nee (2009) or in the MAGIC software. Let us just mention that the probabilistic CMSD decomposition can be formally extended to the geographical dimension by referring to the statistical interpretation of the gravity model, another workhorse of the trade analyst. In the statistical interpretation of gravity models, the "neutral" situation corresponds to the absence of any trade friction, leading to a situation of maximum entropy. Goods and services have the same price everywhere and consumers in countries *a* and in *b* are expected to buy products in the same proportion based on their share of world income (Escaith and Miroudot, 2015). By comparing the actual bilateral trade flows with this neutral distribution, we obtain the gravity equation with a probabilistic understanding similar to RCAs and, with the abovementioned adjustment, to CMSD.

Having done so, the CMSD can be expressed in a multi-market context by adding the geographical effect using the same approach than in equation [12]. As shown in Annex, the same approach can be used for disaggregating the relative export growth rate according to the distribution of products can be used to look at the impact of the geographical distribution of exports.

III. Empirical application: NAFTA and the United States imports

With 222 billion dollars, the United States was the largest world importer of merchandises in 2020, followed by China (204 bn) and the European Union (177 bn, extra-regional imports only) according to World Trade Organization (WTO, 2021). Competition for this huge market is fierce. Canada signed a free-trade agreement with the United States in 1988, and Mexico joined both when signing the North American Free Trade Agreement (NAFTA), in 1994. This regional trade agreement (RTA) was not an isolated event: the European Union was established in 1993 under the Maastricht Treaty, and the ASEAN Free Trade Area (AFTA) started in 1992 through the Common Effective Preferential Tariff (CEPT). Thanks to preferential trade creation, the establishment of these RTAs was expected to change the geography of trade flows, with intra-regional trade taking place in larger proportions.

But RTAs could also entail trade diversion and displace exports from third parties. Actually, the first attempt at designing a CMS analytical tool at ECLAC (MUSIC, the predecessor of MAGIC, see box 1) responded to the concerns about possible trade distortions which might result from the North American Free Trade Agreement (NAFTA) between Mexico, Canada, and the United States for other countries, especially the Central American and Caribbean subregions.

Widodo (2010) concludes from a CMS analysis of the Asian, European and North American RTAs that that the change in trade patterns only happened at the beginning of economic integration (1990-1995 in the case of the European Union, the North East Asia, and the ASEAN and 1995-2001 in the case of the NAFTA). The present section intends to provide further light on the latter case, without pretending to undergo an in-depth analysis which would require a dedicated volume. And commands also a carefully drafted one, because NAFTA has been and remains a very contentious issue, both in Mexico and the United States (Canada being more at ease with the idea) that must be treated cautiously.[7] As Moreno-Brid, Rivas-Valdivia and Santamaría (2005) diplomatically mention, NAFTA has been neither the panacea claimed by its supporters, nor the disaster predicted by its opponents.

Let us have first a look at the evolution of United States trade by origin and destination between 1990 and 2020. Data are taken from the United States International Trade Commission (USITC) website, they exclude reexports (see table 1).

Table 1
United States: structure of trade by origin and destination, 1990–2020
(Percentages)

Trade partners	Imports, CIF from partner countries						
	1990	1995	2000	2005	2010	2015	2020
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Canada	18.1	19.2	18.5	16.9	14.2	13.2	11.6
Mexico	6.0	8.1	10.9	10.0	11.8	13.1	13.9
China, incl. Hong Kong and Macao	5.2	7.8	9.6	15.6	19.7	21.8	19.0
Western Hemisphere (n.e.s)	7.0	5.9	6.1	7.5	6.9	5.2	3.9
Advanced economies (n.e.s)	53.7	48.4	42.8	35.3	31.2	33.7	36.7
Emerging and developing economies (n.e.s)	9.9	10.5	12.0	14.7	16.2	13.0	15.0
	Exports, FOB to partner countries						
	1990	1995	2000	2005	2010	2015	2020
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Canada	21.1	21.6	22.6	23.4	19.4	18.6	17.8
Mexico	7.2	7.9	14.1	13.3	12.8	15.7	14.9
China, incl. Hong Kong and Macao	1.2	2.0	2.1	4.6	7.2	7.7	8.7
Western Hemisphere (n.e.s)	6.4	8.5	7.6	7.9	10.8	10.1	9.0
Advanced Economies (n.e.s)	54.1	49.6	45.0	40.7	37.3	35.5	37.6
Emerging and Developing Economies (n.e.s)	9.9	10.3	8.6	10.1	12.5	12.4	12.0

Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
Notes: On the basis of trade data in current dollars.
(n.e.s): not elsewhere specified in the table.

Imports from the two other NAFTA partners, Canada and Mexico, are relatively stable, and represent between 24% and 29% of total United States imports. The main change is in the distribution between Canada and Mexico, with Mexico's exports gradually overtaking Canadian ones. China's progression is even more impressive, as it almost quadruplicates its share of United States imports between 1990 and 2020. This progression reduces the weight of Advanced Economies, n.e.s (other than Canada) and Western Hemisphere, n.e.s (mainly Latin America and the Caribbean countries, less Mexico).

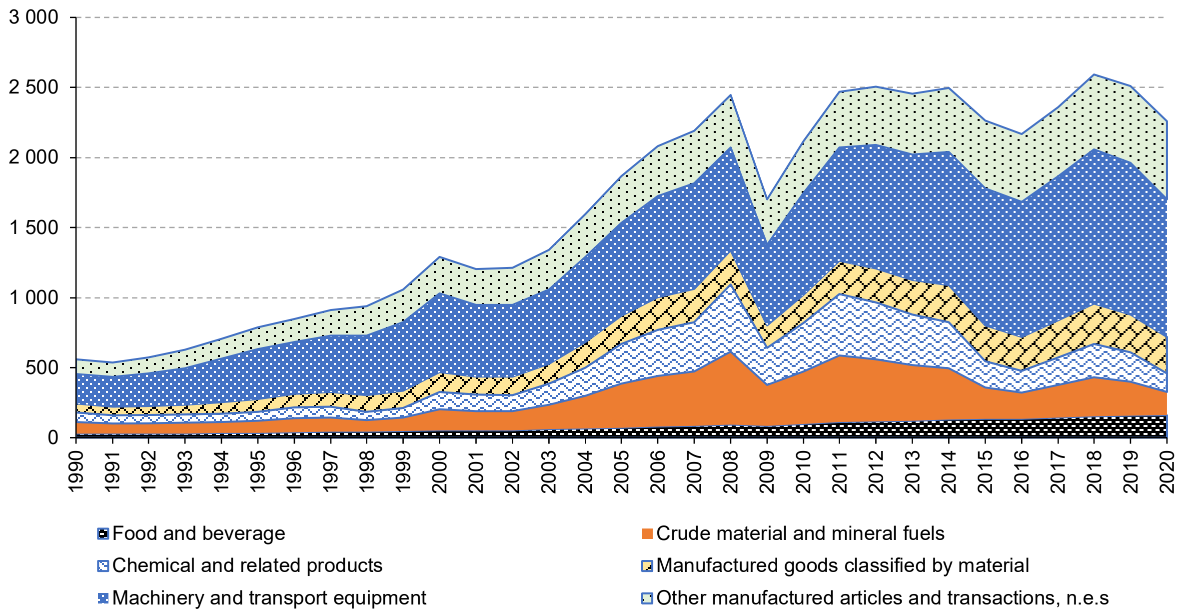
Different tendencies are observed for exports, except for "trade with other advanced economies, n.e.s" which follows the same trend. Within NAFTA partners, Canada retains its leading position as an important market for United States products, even if Mexico's weight increases significantly. The rest of Latin America and the Caribbean attracts more United States exports, as well as the others emerging and developing countries. The source of discrepancies between United States imports and exports is the relatively small weight of China as an export market for United States products. China absorbs less American merchandises than the sum of Latin American (excluding Mexico) and Caribbean countries.

---

7 NAFTA was a perennial target in the broader debate over free trade. It was criticized in the United States for contributing to job losses and the outsourcing of manufacturing. Meanwhile, many economists in Mexico have been considering it as a bad and politically motivated choice compared to more inward oriented protectionist policies that delivered high growth rates in the 1970s.

The changes in the geographical structure of United States trade have been accompanied by changes in the relative importance of products. We will focus on United States imports (see figure 1).

Figure 1
United States: evolution of imports by broad categories, 1990–2020
(Billion dollars)



Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
Note: Imports, excluding re-exports, valued CIF. Downloaded 16 March 2021.

As it can be seen from figure 1, there are important differences at product level in both growth rates and shares. The latter can be explained in part by changes in relative prices, and the graph would probably look different if expressed in constant price. But, from a market share perspective, if higher prices may reflect stronger demand, there is little sense of performing CMSD at constant price.

In terms of overall growth of total imports, there are at least two main periods, separated by an interlude. From 1990 to 2008, imports grew at 8.3% annual average rate. This trend was broken by the 2009-2010 global crisis. Afterwards, imports remained fluctuating, following a horizontal canal with ups and downs but without a clearly defined trend (the 2011-2020 average annual growth rate is ten time smaller, at 0.8%). Being positioned on exporting a product which demand is fast growing or being positioned on a high-volume sector does not always mean that it will always lead to high overall export growth. This is where the CMSD analysis brings additional information.

For the present application, CMSD analysis is applied on the imports of commodities classified at 2 digits of the SITC classification for manufactures, and 1 digit for other commodities. Imports are identified by origin for the main developed and developing countries (identified as the G20 members) plus an aggregate for all other Latin American and Caribbean countries and territories.

Comparing growth rates over the 1991–2020 period with the resulting shares in 2020, table 2 shows that there is little correspondence between being in the top performers and being the largest markets. Only four products belong to the category of large and fast-growing market. This said, the broad category of chemical (SITC 5) tops both lists, having registered the fastest annual growth over the period (8.7%) and weighting almost 12% of total imports in 2020.

Table 2
United States: top 10 products based on their growth or their market shares in the import market, 1990–2020

	Top 10 by 1991–2020 growth rate				Top 10 by share in 2020 imports		
SITC	Description	1991–2020	2020	SITC	Description	1991–2020	2020
50	Chemicals and related products	8.7	11.7	50	Chemicals and related products	8.7	11.7
87	Professional and scientific instruments	8.1	2.6	78	Road vehicles	4.0	10.5
82	Furniture and parts thereof	8.0	2.2	77	Electrical machinery and appliances	5.8	7.6
81	Prefabricated buildings and fittings	8.0	0.5	89	Miscellaneous manufactured	6.2	6.5
40	Animal and vegetable oils	7.4	0.3	76	Telecommunications equipment	6.6	6.1
90	Other commodities and transactions	7.4	5.8	75	Office and data processing machines	5.6	5.9
74	Industrial machinery and equipment	6.7	4.2	90	Other commodities and transactions	7.4	5.8
76	Telecommunications equipment	6.6	6.1	30	Mineral fuels	2.2	5.4
65	Textile and related products	6.6	1.9	00	Food and live animals	5.7	5.2
69	Manufactures of metals, n.e.s.	6.4	2.4	74	Industrial machinery and equipment	6.7	4.2

Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
Notes: SITC codes ending with "0" correspond to the one-digit classification, all other products are at two digits; growth rates are average annual variations over the period based on nominal United States dollars; products in bold appear in both top-10 panels. The average growth rate of total imports was 5.3% over the period. Import values include insurance and freight costs (CIF valuation).

Table 3 presents the evolution of the respective market share for different periods of the 1990-2020 period; 1990–1994 corresponds to the years preceding the implementation of NAFTA; 1995-2000 precede the integration of China to WTO, 2001–2007 correspond to the years of hyper-globalisation, before the Global Crisis of 2008–2009. Period 2011–2016 capture the trends in the post-crisis period, before the change in United States trade policy initiated by the Donald Trump administration (2017–2020).

Table 3
United States: evolution of market shares in the import market, 1990–2020

Country/region	1990–1994	1995–2000	2001–2007	2008–2010	2011–2016	2017–2020	1990–2020
Argentina	0.26	0.26	0.26	0.25	0.20	0.20	-0.1
Australia	0.72	0.52	0.50	0.49	0.45	0.47	-0.3
Brazil	1.47	1.16	1.42	1.34	1.29	1.19	-0.6
Canada	18.71	19.15	17.18	14.79	14.00	12.36	-6.7
China	4.76	7.52	13.56	18.47	20.21	20.26	15.8
France	2.62	2.38	2.22	2.06	1.96	2.07	-0.7
Germany	5.13	5.09	5.04	4.41	4.96	4.95	-0.8
India	0.75	0.86	1.09	1.40	1.91	2.23	1.6
Indonesia	0.87	1.01	0.80	0.83	0.87	0.86	0.2
Italy	2.37	2.23	1.96	1.64	1.78	2.16	-0.5
Japan	18.14	13.78	9.04	6.37	6.01	5.58	-12.9
Mexico	6.44	9.77	10.67	11.04	12.43	13.52	7.8
Others LAC	4.65	4.55	5.02	5.61	4.89	3.21	-2.1
Republic of Korea	3.26	2.95	2.80	2.43	2.90	3.05	-0.5
Russian Federation	0.18	0.56	0.81	1.25	1.07	0.81	0.8
Saudi Arabia	1.84	1.08	1.46	1.89	1.69	0.67	-1.7
South Africa	0.33	0.32	0.40	0.43	0.37	0.36	0.1
Turkey	0.24	0.25	0.30	0.23	0.31	0.44	0.2
United Kingdom	3.76	3.66	3.19	2.78	2.39	2.31	-1.9
World others	23.51	22.89	22.28	22.27	20.31	23.30	2.4
Grand Total	100.00	100.00	100.00	100.00	100.00	100.00	0.0

Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
Note: In percentage based on a simple average of yearly percentages, except the last column: percentage points based on the difference between 1990 and 2020 values.

China appears as the big winner, having gained almost 16 percentage point of market share between 1990 and 2020. The big loser on the face of the data is Japan, with a drop of 13 percentage points during the same period. This said, it is important to put these numbers in perspective, because the 1990–2007 period has been marked by the rise of global value chains, and it is probable that a significant share of Chinese manufacture include Japanese components. Controlling for the effect of the fragmentation of production would require using trade in value-added data, something which goes beyond the purpose of this essay.

With NAFTA, Canadian market share in the United States dropped 7 percentage points while Mexican's participation went up by 8 points. In the rest of the Americas, Argentina and Brazil maintained their market shares while the rest of Latin America and the Caribbean lost about two percentage points. This evolution results from a combination of changes in the composition of the United States demand, which tends to favour the countries presenting comparative advantages in the export of those products that are in high demand. It results also, as discussed previously, from the relative competitiveness of each exporter.

An intuitive way to look at individual exporter's performance is to see if they were able to increase their own exports in sectors where demand was particularly high and, conversely, retract from exporting products that were in low demand. Table 4 presents for the most dynamic products identified in table 2 the corresponding variation in the weight of these products in the basket of national exports. It also shows the overall correlation coefficient between the changes in national export structure and the change in import structure (as the growth rate difference m_k^w - $m_{.}^w$).

Table 4
United States: correlation between the evolution of the import structure and national export basket, 1990–2020

	US import market		Argentina	Brazil	Canada	China	Japan	Mexico	Other LAC	Republic of Korea
Change in product share 1990-2020[a]	1991-2020	Growth difference[b]	1990–2020	1990–2020	1990–2020	1990–2020	1990–2020	1990–2020	1990–2020	1990–2020
Chemicals and related products	8.7	3.4	5.1	4.6	4.2	1.9	6.9	0.2	0.5	7.6
Professional & scientific instruments	8.1	2.8	0.0	0.1	0.5	1.5	1.7	2.2	4.0	0.6
Furniture & parts thereof	8.0	2.7	-0.5	0.8	-0.1	3.2	-0.1	0.4	0.0	0.0
Prefabricated buildings & fittings	8.0	2.7	-0.3	-0.1	0.3	0.9	0.0	0.4	-0.1	-0.2
Animal & vegetable oils	7.4	2.1	1.0	-0.3	0.6	0.0	0.0	0.0	0.2	0.0
Other commodities & transactions	7.4	2.1	12.4	7.0	2.8	1.2	1.9	-0.9	5.3	1.2
Industrial machinery & equipment	6.7	1.4	0.4	-1.2	1.3	3.0	2.8	3.2	0.2	2.6
Telecommunications equipment	6.6	1.3	0.0	-0.8	-0.4	9.2	-8.1	-1.0	0.1	-5.4
Textile & related products	6.6	1.3	-0.9	-1.6	-0.1	1.2	-0.3	-0.3	0.3	-1.3
Manufactures of metals, n.e.s.	6.4	1.1	-0.4	-0.1	0.3	2.3	0.0	0.6	0.3	-0.8
Miscellaneous manufactured	6.2	0.9	-1.2	0.6	1.1	-9.3	-2.2	-0.5	0.5	-1.1
Electrical machinery & appliances	5.8	0.5	0.0	-1.0	-2.0	5.1	-0.7	-3.0	2.5	-1.1
Food & live animals	5.7	0.4	0.8	-6.4	4.5	-2.5	0.3	-1.1	10.6	0.2
Office & data processing machines	5.6	0.3	-0.3	-0.5	-1.8	13.0	-9.0	6.2	0.0	1.1
Road vehicles	4.0	-1.3	-1.4	-4.4	-13.7	2.6	0.2	11.5	0.0	19.4
Mineral fuels	2.2	-3.1	-7.1	4.3	11.7	-4.5	0.2	-14.7	-32.7	2.9
Correlation national growth rate and United States market share variation:			0.50	0.15	0.15	0.33	0.14	0.24	0.34	0.15

Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
[a] Change in the relative weight of the product in the United States import or the country's exports to the United States, in percentage points.
[b] Difference between the average annual growth of product imports and the average growth of total imports, in percentage points.
[c] Correlation coefficient between import growth rate differential and changes in national composition of exports calculated over all 33 product categories.

A high coefficient of correlation does not mean that the country was successful in gaining market share, it also corresponds to withdrawal from low-demand market segments. For example, the high correlation observed for Argentina corresponds to a correlative 11 percentage points drop in the weight of its exports of leather products to the United States (SITC 61), which is the category of imports that registered the lowest growth rate on the United States market between 1990 and 2020 (1.8% average annual growth, or 3.5 percentage points lower than the total average). Yet, Argentina could not increase its presence in most of the high-growth market segments, besides Chemicals and other products. The group other Latin American and Caribbean countries is in a similar situation, the relatively high correlation coefficient corresponding to a major drop in the weight of their exports of mineral fuels, which registered a weak demand from the United States (the increase in imports was 3.1 percentage points below the total average).

On the contrary, China's correlation corresponds more to products that where in high demand. If we distinguish the two subperiods defined by the implementation of NAFTA and the global financial crisis of 2008–2009, we see interesting differences in the dynamic of market shares.

To have a synthetic picture of the situation, figure 2 presents the main results of a Principal Component Analysis (PCA) on the exports of American and Caribbean countries (Argentina, Brazil, Canada, Mexico, Other Latin American and Caribbean countries) plus China. The CPA was conducted on all 198 duplets (6 exporters, 33 products), but only the most significant cases are shown on the graph.

The positive part of the horizontal axis (66% of total variance) shows the duplets "Country-Product" that increased their share of the United States market during the 1995–2007 period. The positive part of the vertical axis (34% of total variance) displays the duplets that increased their share during the 2011–2020 period. The two factorial axes define four quadrants, indicating different share evolution. Points situated in the upper-right North-East (N-E) quadrant experienced increase of their market share in the United States market for both the 1995–2007 and 2011–2020 period. Similarly, lower-right (S-E) quadrant denotes increase in 1995–2007 but decrease in 2011–2020; lower-left (S-W) shows decrease in both 1995–2007 and 2011–2020 and upper-left (N-W) indicates country-product duplets that decreased in 1995–2007 but increased in 2011–2020.

The first information that we gain from this PCA is that most of the variance occurred during the 1995–2007 period. This cycle corresponds to a deep reshuffling of the market-share positions on the United States market. This reshuffling was general, the results are comparable when conducting the same analysis also including all G-20 countries and rest of world region (660 duplets, not shown here): the pre-crisis period represents 64% of the changes and the post-crisis years explains the remaining 36%.

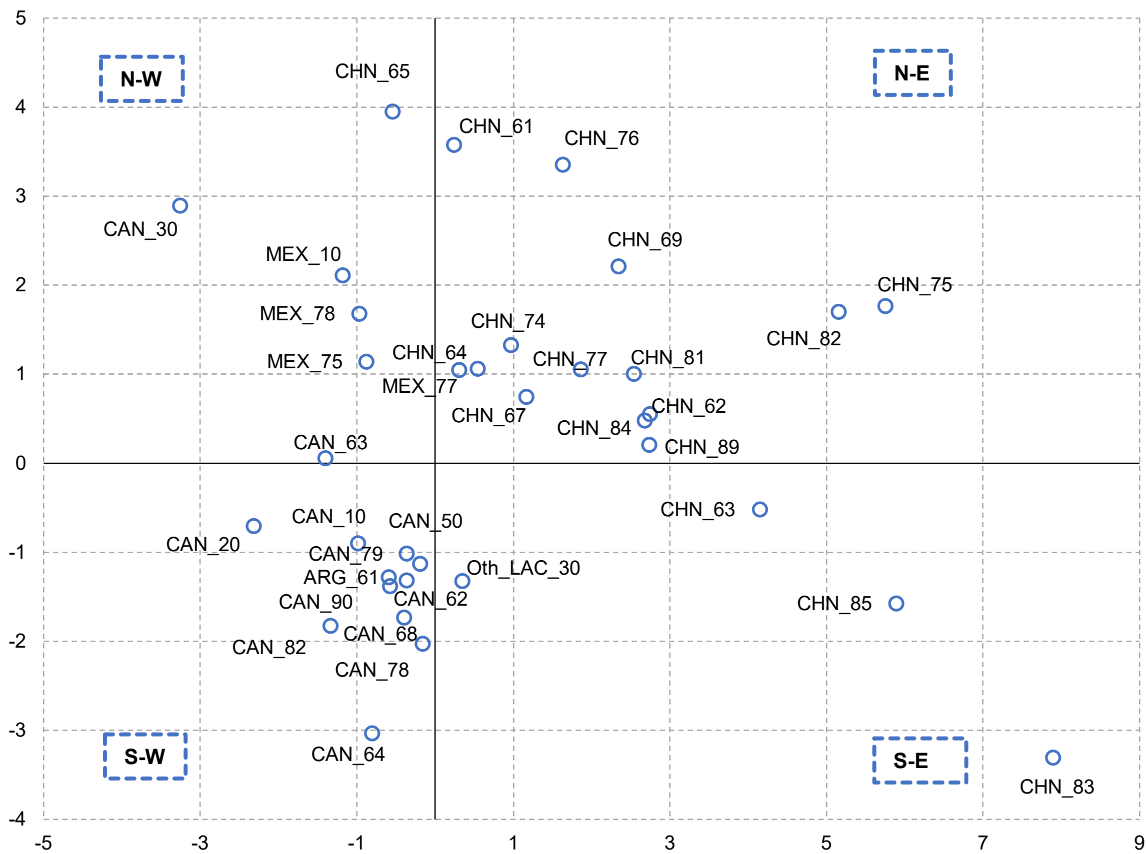
The reshuffling took principally place between Canada, China and Mexico. Brazil does not appear on the graph (the changes in market share were marginal and did not contribute much in "explaining" the reshuffling), Argentina is noted for its loss of market share in Leather products (SITC 61) and the other Latin American and Caribbean countries for a small gain in Mineral fuels (SITC 30) during the first period, followed by a decline in the post-crisis era.

China, on the contrary, is widely represented and is present mostly in the positive quadrants of the graph. Its main gains took place during the pre-crisis period, when it moved from a relatively small provider of imported merchandises to taking a major position on the United States market. The exception is for Textile and apparel (SITC 65) that lost relevance during the first period but regained some ground after the crisis. In contrast, Wood manufactures, Travel goods & handbags and Footwear (SITC 63, 83 and 85) gained market share but retreated during the most recent period.

Canada is on the negative side (South-West quadrant) for most products during both periods. The main exception is for Mineral fuel (SITC 30) where it regained importance as a provider during the post-crisis 2011–2020 period.

Mexico shows a contrasting evolution for many products. Like other countries, it was displaced by China between 1995 and 2007, with the exception of Electrical equipment (SITC 77). The second subperiod shows significant progression for Beverages and tobacco (SITC 10); Office and data processing machines (SITC 75) and Road vehicles (SITC 78).

Figure 2
Selected countries: evolution of market shares, 1995-2007 and 2011-2020



Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
Notes: Principal component analysis on selected countries; underlying data are changes in product market shares in percentage points over all 33 product categories and all countries for the two periods (two observations for each duplet country-product).

N-E Increase in both 1995-2007 and 2011-2020.
S-E Increase in 1995-2007 and decrease in 2011-2020.
S-W Decrease in both 1995-2007 and 2011-2020.
N-W Decrease in 1995-2007 and increase in 2011-2020.

What kind of additional information, therefore, can we gain from analysing the CMSD indexes? In a fast-growing market like the United States between 1990 and 2008, it has to be expected that most of the driving force will come from the strength of the demand side itself. In other words, the high tide did probably lift all boats indistinctly. When the import market goes side-ways, as occurred after the 2008–2009 Global Crisis, the relative strength of the competitiveness (COMPET) and composition (COMPO) effects may become more discriminant.

To read table 5, one must recall that the sum of the two effects must be added to the average growth of total United States imports to obtain the performance of each individual exporter. In other words, table 5 indicates the sources of over or under export performance.

Table 5
United States: competitive and composition effects on the import market, 1990–2020

Effects	Composition (COMPO)						Competitiveness (COMPET)					
Exporters	1991–1994	1995–2000	2001–2007	2008–2010	2011–2016	2017–2020	1991–1994	1995–2000	2001–2007	2008–2010	2011–2016	2017–2020
Argentina	-0.20	-0.22	-0.13	0.05	-0.11	-0.18	0.16	0.23	0.11	-0.08	0.13	0.13
Australia	-0.23	-0.11	-0.02	-0.11	-0.03	0.04	0.09	0.11	-0.01	0.11	0.03	0.05
Brazil	-0.11	-0.05	-0.04	0.09	-0.01	-0.06	0.07	0.02	0.06	-0.09	0.01	0.03
Canada	-0.03	-0.01	0.02	0.01	0.01	0.00	0.05	0.01	-0.05	-0.04	-0.03	-0.02
China	-0.06	-0.04	-0.03	-0.01	0.00	0.02	0.25	0.11	0.14	0.05	0.01	-0.04
France	0.02	0.00	-0.01	0.00	0.00	0.01	-0.04	0.00	-0.01	-0.03	0.01	-0.03
Germany	-0.01	0.01	0.00	0.00	0.02	-0.03	-0.03	0.00	0.00	-0.05	0.01	0.02
India	-0.33	-0.55	-0.05	-0.05	0.00	-0.05	0.40	0.57	0.11	0.14	0.05	0.07
Indonesia	-0.80	-0.63	-0.27	-0.15	-0.34	-0.11	0.90	0.60	0.25	0.20	0.35	0.11
Italy	-0.01	-0.03	-0.02	-0.01	0.02	-0.01	-0.03	0.02	0.00	-0.06	0.03	0.02
Japan	0.03	-0.02	-0.03	-0.05	0.01	-0.03	-0.03	-0.05	-0.04	0.00	-0.02	-0.01
LAC n.e.s.	-0.10	-0.15	-0.01	-0.03	-0.08	-0.06	0.06	0.17	0.04	0.05	0.01	0.01
Mexico	0.00	-0.01	0.00	0.00	0.00	-0.01	0.06	0.09	0.00	0.03	0.02	0.02
Republic of Korea	-0.06	-0.02	-0.06	-0.02	-0.01	-0.04	0.00	0.05	0.01	0.04	0.05	0.03
Russian Federation	-0.41	-0.40	-0.08	0.00	-0.23	-0.10	1.21	0.46	0.17	0.14	0.14	0.14
Saudi Arabia	-1.47	-1.92	-1.46	-0.86	-1.04	-0.93	1.35	1.96	1.54	0.96	0.96	0.80
South Africa	-1.83	-0.32	-0.10	0.01	-0.12	-0.01	1.80	0.35	0.15	0.01	0.08	0.13
Turkey	-1.42	-0.44	-0.18	-0.16	-0.08	-0.13	1.46	0.46	0.17	0.12	0.17	0.20
United Kingdom	0.01	-0.01	0.03	-0.02	-0.01	-0.01	-0.03	0.00	-0.06	-0.04	0.00	-0.01
World n.e.s.	0.01	0.02	0.00	0.00	-0.02	0.00	-0.02	-0.02	0.00	-0.01	0.02	0.06
Average	-0.35	-0.25	-0.12	-0.07	-0.10	-0.09	0.38	0.26	0.13	0.07	0.10	0.08

Average growth rates	1991–1994	1995–2000	2001–2007	2008–2010	2011–2016	2017–2020	1991–2020
All commodities[a]	7.4%	10.5%	7.0%	0.4%	2.2%	1.9%	5.3%

Source: Prepared by the author, on the basis of United States International Trade Commission (US-ITC) data.
[a] The average annual growth rates of total United States imports (GLOBO effect).

Overall, not only Canada and Mexico do not appear to have benefited much from NAFTA over the 1995-2020 period, but Canada has even been on the losing side. This is also the conclusion of Pérez-Ludeña (2019), using ECLAC' MAGIC CMS decomposition software. Among other factors, it is quite possible that Canada, having signed a free trade agreement with the United States in 1988, saw some of its preferences eroded by Mexico after 1995. Mexico received a boost just after the signature of the NAFTA, with its COMPET indicator rising on average three percentage points over the 1995-2000 period. But this effect was not particularly higher than other countries and certainly less than some newcomers to the United States market, like the Russian Federation.

This said, the divergence between Canada and Mexico CMSD results remains important as it challenges the thesis defended by several authors (see Montenegro y Soloaga, 2006) on the ineffectiveness of NAFTA. According to their line of thoughts, NAFTA did not influence Mexico-United States bilateral trade, which would have increased naturally, following the prediction of the gravity model which considers economic size and proximity. Yet, "proximity" in the gravity model is not limited to geographical distance and should include also trade frictions. NAFTA reduced these trade frictions, increasing the relative competitiveness of Mexican products compared to other countries —a parameter known as multilateral resistance terms (MRT) in structural gravity modelling— in particular, reducing Canada's comparative advantages for some industries. The massive devaluation of the peso in 1995 added also to the competitiveness of Mexican exports. Actually, ECLAC MAGIC-PLUS analytical software includes real exchange rates variations in its menu of variables.[8]

The gravity model and its emphasis on the size of markets may also explain why foreign direct investment (FDI) is relatively more concentrated in Mexico on export-oriented manufactures (Pérez-Ludeña, 2019). FDI taking place in Canada and the United States looks also at producing for the local market, due to the larger weight of the domestic demand compared with Mexico's.

One of the main reasons for the mediocre outcome for Canada and Mexico market shares in the United States is that the 1990–2008 period saw the irruption of large developing countries on the international scene. These emerging countries have displaced (at least in terms of market share) the more established neighbours or the industrialised countries, including the so-called Asian Newly Industrialised Countries (NICs).

Among the G20 developing countries, India, Indonesia, Saudi Arabia, South Africa, and Turkey registered high growth on individual products (the COMPET indicator in table 5) but were disadvantaged by their structural composition effect. China, at the contrary, was able to sustain high competitivity during most of the period, while offering a product-mix (COMPO) which was relatively well in phase with what the United States market required. Indeed, many authors have highlighted the role of China as a spoiler for the non-US NAFTA participants. Readers may, among many dedicated investigations, look at Dussel-Peters and Gallagher (2013) and Pérez-Ludeña (2019) for a review at sectoral level, and at Ros (2012) for implications on Latin American export strategies.

Interestingly, the most recent period (2017–2020) marked a break in this trend, with China registering a drop in its competitive score that could not be compensated by better product assortment. Among the possible reasons, this may simply reflect that China is now a mature economy that has achieved most of its catching-up transition to become the "New Centre" (Ros, 2012). One may also see here the effect of the change in United States trade policy towards China. We leave the discussion to others, but the data tend to show that the United States decoupling from China did not particularly benefit its NAFTA partners Canada and Mexico, at least up to 2020. NAFTA was renegotiated during 2017 and drafted end–2018; the revised treaty became effective in 2020 as the United States-Mexico-Canada Agreement (USMCA).

---

8 This said, exchange rates may not fully influence exports when prices of internationally traded merchandises are fixed in United States dollar (commodities) or when trade takes place along global value chains and is governed by long-term contractual arrangements.

IV. Complementing CMSD with RCA

The new CMSD is theoretically consistent. But, as the quick review of the NAFTA evolution shows, it is better at pointing at trends than at explaining them. Some may even claim that, by dropping the combined inter-action effect between supply and demand, it is less informative than the old version. This is true, at least as long as this interactive effect is not a spurious one that results just from an accounting issue that exists only in discrete time. Because the chances are that this interaction effect is, indeed, spurious, it is possible to state that one remains on safer theoretical grounds by using CMSD. This said, following Einstein's famous quote the "in theory, theory and practice are the same; in practice, they are not", the information contained in the inter-action term should not be disregarded entirely, but just as a "memo item" and taking a few precautionary measures.[9]

Moreover, the theoretical convergence between RCAs and CMSD opens the door to further empirical investigations that can enrich the analysis while remaining on a safe theoretical ground. Let us consider Balassa index, probably the most intuitive one. This index is calculated as the ratio of product k's share in country "i" exports to its share in world trade. Formally, it reads as:

$$\mathrm{BRCA}_k^i = \left(\frac{X_k^i}{X^i}\right) \Big/ \left(\frac{X_k^w}{X^w}\right) \qquad [13]$$

Intuitively, the index compares country *i* export structure with the World trade situation. A value of the RCA above one in sector *k* for country *i* means that *i* has a revealed comparative advantage in that sector. From a statistical perspective, BRCA measures the ratio between the "observed" exports X_k^i and the "expected" trade flow $\boldsymbol{E}(X_k^i)$ that could be inferred from the relative size of the *i* total exports in

9 At least five to ten years periods. The main intuition behind my recommendation is related to the difference between firms, competing on absolute advantages, and countries competing on comparative advantages. The evolution of comparative advantages results from a Schumpeterian creative destruction process, firms exiting the export market in the face of an external shock, while new ones being created to satisfy new demand. Adjusting to new conditions takes time: production capacity is putty-clay, and once it has been created, it cannot be changed.

World trade. As mentioned previously, a similar statistical approach from the entropy perspective (comparing the actual trade flows with the outcome of a neutral distribution) leads to formulating the traditional bilateral trade gravity model (Escaith and Miroudot, 2015).

Most descriptive applications of RCAs are in comparative static, or for tracking the evolution of RCAs of a single economy through time. As French (2017) mentions, the initial impetus for using of RCA measures (Balassa, 1965) was for evaluating the effects of changes in trade barriers (especially tariffs) on a country's producers and exports. An interesting feature of the proposed CMSD is to complement the dynamic analysis of market shares with the information on comparative advantages. The present article shows that CMSD and RCAs share the same statistical logic, as do also gravity models. French (2017) concludes that "[gravity] and other similarly derived measures, should prove to be valuable tools to be employed in applied academic and policy-oriented international trade analyses".

Balassa's RCA for each country and each product can be calculated taking the United States imports as the trade reference: X_k^i are exports of product "*k*" by country "*i*" to the United States (X_k^w being the total exports of "k" from all countries to the United States, also equal to the total United States imports if we ignore the FOB/CIF difference).

The combined inter-action effect between supply and demand, which does not exist in CMSD methodology, can be estimated by calculating the correlation between the countries RCAs and the strength of product demand on the import market. For example, table 6 calculates the Pearson correlation between changes in product RCAs during the reference period and the relative strength of import demand for this product (calculated as the difference in growth rates between a specific product and the average import growth). Two sub-periods are considered: the entire 1990–2020 period, and the post-NAFTA 1995–2007 years corresponding to a situation high growth of imports in the United States market. If the correlation is positive, the exporter was able to adapt its offer (measured by RCA) to the changes in demand. If the correlation is negative, it means the exporting country probably missed some export opportunities.

Table 6
United States: correlation between variations in exporters' RCAs and import growth from the import market, various subperiods 1990–2020

Country	Simple		Weighted	
	1990–2020	1995–2007	(4)-(1)	(3)-(2)
Argentina	-2.3	0.4	0.9	0.9
Australia	0.0	0.3	0.6	0.6
Brazil	-1.3	0.0	0.0	0.1
Canada	0.5	0.1	0.0	0.3
China	-0.1	0.1	0.4	0.3
France	0.1	0.1	0.0	0.2
Germany	-0.1	-0.1	-0.2	-0.1
India	-0.3	0.0	0.1	-0.2
Indonesia	1.0	-0.1	-0.1	-0.3
Italy	0.3	-0.5	-0.6	-0.5
Japan	0.0	-0.3	-0.5	-0.5
LAC_nes	-1.2	0.1	0.4	0.0
Mexico	-0.5	-0.2	-0.2	-0.2
Republic of Korea	0.0	0.2	0.4	0.5
Russian Federation	-0.2	0.0	-1.0	-0.6
Saudi Arabia	0.0	-0.4	-1.0	-0.8
South Africa	0.1	-0.1	-0.4	-0.8
Turkey	-0.1	-0.1	-0.3	-0.6
United Kingdom	0.1	0.3	0.1	0.4
World_Others	-0.1	-0.1	-0.2	-0.2

Source: Author's calculations.

Notes: Correlation calculated a SITC product level between changes in countries RCA and import growth rate differential on the import market ($m_{k,t}$ - $m_{.t}$). Initial RCAs used as product weights are the 1990–1994 averages.

Perhaps not much was lost, if the product did not weight much in the initial export basket. To investigate this option, table 6 also provides the correlation coefficient weighted by the initial value of the individual product RCA. Missing opportunities on products that had little initial weight in the export structure of a country will weigh less than those that concern products where the country had some comparative advantages. One may expect a large country with a diversified production structure to be better able to adjust to changes in demand. In the short term, so-called "emerging economies" that adopt an export-led industrialization strategy are also expected to show a positive correlation with international demand. Once the industrialization process is mature, it becomes much more difficult to redeploy production capacities. Note that missed opportunities may be simply due to supply constraints. For example, a higher demand for oil cannot be met by a non-oil exporting country.

The difference between simple and weighted correlations is particularly illuminating in the case of Argentina. When all products are considered equally (simple correlation), Argentina missed lots of opportunities during the 1990–2020 period. But if one considers mainly the products where Argentina has some comparative advantages (weighted correlation, second panel of table 6), then the country was able to adjust its offer to changes in United States demand. Oil exporters like the Russian Federation and Saudi Arabia, at the contrary, were fully impacted by the lower United States dependency on imported oil and gas.

The rest of Latin America and the Caribbean region shows a mixt outcome. One may have expected to see commodity exporters in South America to benefit from the "super-cycle" in prices that coincided with China's rapid growth (Ros, 2012) but it must be considered that many countries in this region, especially in Central America and in the Caribbean, are not exporters of mineral products and rely on labour-intensive light manufacture. The situation of industrialized countries is heterogeneous, with Italy and Japan having difficulties in adapting their export structure to changes in demand, while Australia and the Republic of Korea show positive interactions.

The NAFTA partners of the United States did not particularly well in this regard. In particular, Mexico presents negative correlations that show the existence of missed opportunities. This is particularly puzzling, because one of the expected outcomes of NAFTA was to drive export-led industrialization in this country. Indeed, Moreno-Brid, Rivas Valdivia and Santamaría (2005) mention that for Mexico, the NAFTA-induced export drive meant a shift towards manufacture exports, away from traditional primary commodities. Yet it seems that the adaptation was not fully successful. Indeed, these authors mention that Mexico export-drive was highly concentrated in only a few sectors, in particular transport equipment. Table 3 indicates that this sector was not amongst the most dynamic on the United States import market.

On the contrary, China seems to have been able to produce what the United States market required, adapting its export basket to the changes in United States demand. Moreover, not only China leapfrogged over Mexico to become in 2005 the second largest trading partner of the United States but it competed directly with several Mexican products. According to Dussel-Peters and Gallagher (2013), 36% of Mexican products are under direct threat from Chinese exports on the United States market and 20% are under partial threat.

Obviously, a formal diagnostic would require analysing the situation product by product in order to know if the positive or negative outcomes are due to supply constraints, changes in relative prices or loss of market due to increased competition. This would require a separate study. The objective of this section was to show on this example that the CMSD and RCA trade indices are analytically complementary, in addition to pertaining to the same theoretical environment.

V. Conclusions

Devising well-behaved constant market share decomposition indices has been the pursuit of many researchers since the 1950s. The basic issue is simple, but tricky. One may remind A. Einstein's quote which mentioned that in theory, theory and practice must be the same, yet in practice, they often differ. In this case, the issue arose because in theory, decomposition is done in continuous time while in practice, it is done in discrete time. As we saw, in the practical (discrete) case, the analyst must cope with new components that do not exist in the theoretical (continuous) case.

This "residual" disturbed the Statisticians but called the attention of the Economists. While the former tried to solve the issue by removing the residuals, the latter believed that something could be learned from them. They interpreted these residuals as the joint influence of commodity adaptation and market adaptation effects.

This article adopts the Statistician's perspective and explains the discrete-time decomposition of market share analysis from the information theory perspective. Not only the resulting decomposition is free of residual noise, but it is also well rooted in the same theoretical background that sustains a family of widely used empirical trade models: Revealed Comparative Advantages and Gravity Model. In addition, the new index, called Comparative Market Share Decomposition (CMSD), is simple to compute on the basis of available trade data.

Economists may miss the additional pieces of information that the interaction terms in old-style approaches delivered. The article showed on the NAFTA example that this aspect is easily covered by associating the twin indices: CMSD and RCAs. Because both indices are based on the same probabilistic approach, this theoretical convergence provides a much firmer conceptual terrain for analysing interactions than the old-style growth-accounting residuals.

In its controversy with Porter (1990) on the competitiveness of nations, Krugman (1994) warns also against the use of careless arithmetic because competitiveness cannot be simply measured by trade flows and their changes. For Dunn (1994), the issue is even more complex today, as the distinction between foreign and home-based multinational corporations becomes irrelevant. The NAFTA example confirms the limits of these macro-approaches.

While it is possible to identify trends, it remains necessary to complement the market share diagnostic with more detailed sectoral analysis: CMSD provides useful information on the "What", but not on the "Why". This is particularly important when it comes to define| corrective measures, because some issues are due to structural factors that are difficult to change, others, at the contrary, may result from short-term nominal fluctuations in relative prices, that are expected to be only transitory.

CMSD is best understood as providing indicators that complement other approaches. The present article shows that Constant/Comparative Market Share analysis, Revealed Comparative Advantages and Bilateral Trade Gravity models share the same underlying statistical logic, yet provide complementary information. All three methodologies can now be understood from a unified perspective: measuring the information gained when comparing the observed situation with its correspondent in a hypothetical situation of maximum entropy. This theoretical convergence calls for using them in conjunction when conducting applied research for evidence-based trade policy making.

Bibliography

Ahmadi-E. and Z. Fredoun (2006), "Constant market shares analysis: uses, limitations and prospects", *Australian Journal of Agricultural and Resource Economics*, 50.

Artige, L. and L. van Neuss (2014), "A new shift-share method' growth and change", *Growth and Change, Forthcoming*, vol. 45(4).

Balassa, B. (1979), "Export composition and export performance in the industrial countries, 1953-1971", *The Review of Economics and Statistics*, vol. 61-4.

______(1965), "Trade liberalization and revealed comparative advantage", *The Manchester School*, 33(2).

Baldwin, R. E. (1958), "The commodity composition of world trade: selected industrial countries 1900-1954, *Review of Economics and Statistics*, 40.

Cordero, M. (2021), *Nuevo MAGIC: Módulo para Analizar el Crecimiento del Comercio Internacional* (LC/MEX/TS.2021/9), Economic Commission for Latin America and the Caribbean (ECLAC).

Dunn, M. H. (1994), "Do nations compete economically? A critical comment on Prof. Krugman's essay "competitiveness: A dangerous obsession", *Intereconomics*, vol. 29, issue 6, Baden-Baden.

Dussel Peters, E. and K.P. Gallagher (2013), "NAFTA's uninvited guest: China and the disintegration of North American trade", *CEPAL-Review*, No. 110, Economic Commission for Latin America and the Caribbean (ECLAC), August.

Eaton, J. and S. Kortum (2002), "Technology, geography, and trade", *Econometrica*, 70 (5).

ECLAC (Economic Commission for Latin America and the Caribbean) (2006), "Module for the analysis of growth of international commerce (MAGIC PLUS)", *Bulletin FAL*, No. 242, October.

Escaith, H. (2020), "Contrasting revealed comparative advantages when trade is (also) in intermediate products", *MPRA Paper*, No. 103666.

Escaith, H. and S. Miroudot (2015), "World trade and income remain exposed to gravity", *The Global Trade Slowdown: A New Normal?*, B. Hoekman (edit.), VoxEU.org eBook.

Fagerberg, J. and G. Sollie (1987), "The method of constant market share analysis reconsidered", *Applied Economics*, 19, 52.

French, S. (207), "Revealed comparative advantage: what is it good for?", *Journal of International Economics*, vol. 106.

Fritz, O. and G. Streicher (2005), "Measuring changes in regional competitiveness over time a shift-share regression exercise", *WIFO Working Papers*, 243.

Hernández, R .A. and I. Romero (2012), "Module for the analysis of growth in international commerce (MAGIC Plus) User guide (updated)", *Series Manuales*, No. 79, Economic Commission for Latin America and the Caribbean (ECLAC).

Krugman, P. (1994), "Competitiveness: a dangerous obsession", *Foreign Affairs*, March/April, vol. 73-2.

Kunimoto, K. (1977), "Typology of trade intensity indices", *Hitotsubashi Journal of Economics*, vol. 17.

Leamer, E. and R. Stern (1970), *Quantitative International Economics*, Boston, Allyn and Bacon Publishing Co.

Milana, C. (1988) "Constant-Market-Shares Analysis and Index Number Theory", *European Journal of Political Economy*, vol. 4-4.

Montenegro, C. and I. Soloaga (2006), "NAFTA's Trade Effects: New Evidence with a Gravity Model", *Estudios de economía*, vol. 33, Nº 1, Santiago.

Moreno-Brid, J. C., J. C. Rivas Valdivia and J. Santamaría (2005), *Mexico: Economic Growth, Exports and Industrial Performance after NAFTA* (LC/MEX/L.700), Mexico, Economic Commission for Latin America and the Caribbean (ECLAC).

Nuddin, A. and others (2018), "A new constant market share competitiveness index", *Malaysian Journal of Mathematical Sciences*, 12(1).

Pérez-Ludeña, M. (2019), *Vínculos productivos en América del Norte* (LC/MEX/TS.2019/5), Mexico, Economic Commission for Latin America and the Caribbean (ECLAC).

Piezas-Jerbi, N. and C. Nee (2009), "Market shares in the post-Uruguay Round Era: a closer look using shift-share analysis", *WTO Working Paper* ERSD-2009-14, Geneva.

Porter, M. (1990), *The Competitive Advantage of Nations*, New York, Free Press.

Richardson, J. D. (1971), "Constant-market-shares analysis of export growth", *Journal of International Economics*, vol. 1 (2).

Ros, J. (2012), "Latin America's trade and growth patterns, the China factor, and Prebisch's nightmare", *Journal of Globalization and Development*, vol. 3-2.

Svennilson, I. (1954), *Growth and Stagnation in the European Economy*, United Nations ECE, Geneva.

Tyszynski, H. (1951), "World trade in manufactured commodities, 1899-1950", *The Manchester School*, vol. 19-3.

Widodo, T. (2010), "Market dynamics in the EU, NAFTA, North East Asia and ASEAN: the method of constant market shares (CMS) analysis", *Journal of Economic Integration*, 25(3), September.

WTO (World Trade Organization) (2021), *Monthly Trade Trends, March 2021*, Geneva, Press Release.

Annex

As occurred for the re-interpretation of RCAs from a probabilistic perspective, the starting point for the CMSD decomposition is the difference between actual and expected export growth for country "*i*" exports as well as for total imports by the reference market "*w*":

$$x_t^i - E(x_t^i) = \sum_{k=1}^{C} x_{k,t}^i \,(\mathrm{S}_{k,t-1}^i - E(\mathrm{S}_{k,t-1}^i)) \;= \sum_{k=1}^{C} x_{k,t}^i \,(\mathrm{S}_{k,t-1}^i - \; 1/C) \qquad [14]$$

$$m_t^w - E(m_t^w) = \sum_{k=1}^{C} m_{k,t}^w \,(\mathrm{S}_{k,t-1}^w - E(\mathrm{S}_{k,t-1}^w)) \;= \sum_{k=1}^{C} m_{k,t}^w \,(\mathrm{S}_{k,t-1}^w - \; 1/C) \qquad [15]$$

Rearranging these equations, we can express the actual growth rates in terms of their expected value.

$$x_t^i \;= \sum_{k=1}^{C} x_{k,t}^i \,(\mathrm{S}_{k,t-1}^i - \; 1/C) \quad + \sum_{k=1}^{C} \frac{1}{C} x_{k,t}^i \qquad [16]$$

$$m_t^w \;= \sum_{k=1}^{C} m_{k,t}^w \,(\mathrm{S}_{k,t-1}^w - \; 1/C) \quad + \sum_{k=1}^{C} \frac{1}{C} m_{k,t}^w \qquad [17]$$

Taking the difference between the growth rate of the national exports and of the total imports, then recombining these equations leads to the following expression:

$$x_t^i - \; m_t^w = \sum_{k=1}^{C} x_{k,t}^i \left(\mathrm{S}_{k,t-1}^i - \; 1/C\right) - \sum_{k=1}^{C} m_{k,t}^w \left(\mathrm{S}_{k,t-1}^w - \; 1/C\right) + \frac{1}{C} \sum_{k=1}^{C} \left(x_{k,t}^i - \; m_{k,t}^w\right) \qquad [18]$$

The first two summation elements on the right-hand side of equation [18] represent the effect of export shares (composition) while the third one is the impact of competitiveness on individual products. Moving m_t^w to the right-hand side of equation [18] gives the CMSD equation [12].

Table A.1 presents the details of the decomposition in discrete time on a small three countries, three products, three periods example. The shaded area at the South-East corner of the table shows the direct comparison ($x^i_t - m^w_t$) as in equation [18], while the other shaded areas under the respective total for countries A, B and C result from the decomposition into the composition and the competitive CMSD components. It is easy to verify that the decomposition into a net composition factor and a competitive one reproduces exactly the difference in growth rates.

Table A.1
CMSD on a Toy Model of three products, three exporters and one importer

Country	Product	Values			Growth Rate		COMPO1		COMPO2		COMPET		COMPO(1+2) + COMPET	
		T1	T2	T3	T2	T3	T2	T3	T2	T3	T2	T3	T2	T3
A	1	20.0	22.0	24.2	10.0	10.0	-1.33	-1.40	0.00	-0.04	-0.2	-0.3	-1.50	-1.65
A	2	30.0	31.5	33.1	5.0	5.0	-0.17	-0.28	0.00	-0.04	-1.8	-1.9	-2.00	-2.16
A	3	50.0	60.0	72.0	20.0	20.0	3.33	3.91	0.00	0.10	2.0	1.9	5.33	5.69
A	**Total**	**100.0**	**113.5**	**129.3**	**13.5**	**13.9**	**1.83**	**2.23**	**0.00**	**0.02**	**0.00**	**-0.32**	**1.83**	**1.88**
B	1	30.0	36.0	43.2	20.0	20.0	-0.67	-0.24	0.00	-0.04	3.2	3.0	2.50	2.84
B	2	50.0	55.0	60.5	10.0	10.0	1.67	1.58	0.00	-0.04	-0.2	-0.2	1.50	1.37
B	3	20.0	21.0	22.1	5.0	5.0	-0.67	-0.73	0.00	0.10	-3.0	-3.1	-3.67	-3.94
B	**Total**	**100.0**	**112.0**	**125.8**	**12.0**	**12.3**	**0.33**	**0.61**	**0.00**	**0.02**	**0.00**	**-0.32**	**0.33**	**0.26**
C	1	50.0	52.5	55.1	5.0	5.0	0.83	0.73	0.00	-0.04	-1.8	-2.0	-1.00	-1.19
C	2	20.0	24.0	28.8	20.0	20.0	-2.67	-2.28	0.00	-0.04	3.2	3.1	0.50	0.84
C	3	30.0	33.0	36.3	10.0	10.0	-0.33	-0.32	0.00	0.10	-1.3	-1.4	-1.67	-1.87
C	**Total**	**100.0**	**109.5**	**120.2**	**9.5**	**9.8**	**-2.17**	**-1.87**	**0.00**	**0.02**	**0.00**	**-0.32**	**-2.17**	**-2.22**
Importer	1	100.0	110.5	122.5	10.5	10.9						Direct calculation (x^i-m)		
Importer	2	100.0	110.5	122.4	10.5	10.7						x^A - m	1.83	1.88
Importer	3	100.0	114.0	130.4	14.0	14.3						x^B - m	0.33	0.26
Total	**All**	**300.0**	**335.0**	**375.3**	**11.7**	**12.0**						x^C - m	-2.17	-2.22

Source*:* Prepared by the author, on the basis of simulated data.
Notes*:* Growth rates, COMPO and COMPET are in percentage.
COMPO1= $\sum_{k=1}^{C} x^i_{k,t}\,(S^i_{k,t-1} - 1/C)$; COMPO2= $\sum_{k=1}^{C} m^w_{k,t}\,(S^w_{k,t-1} - 1/C)$; COMPET= $\frac{1}{C}\sum_{k=1}^{C}(x^i_{k,t} - m^w_{k,t})$.

The review of literature revealed that Artige and Neuss (2014) had arrived at the same results when analysing employment in Belgium using the closely related method of shift-share analysis. Despite depriving me from the pleasure of being the first to find this solution, their paper sheds additional light on this procedure that improve its value.

First, they arrived at the same hilltop taking a different path. Instead of analysing the issue at hand from the information theory perspective, they try to compensate the absence of ordering in the shift-share analysis. While it is possible to rank growth rates from high to low, there is no ordinal ordering of economic structure: there is no good and bad sectoral specialization, a priori. It is only ex-post, (using the final year Paashe indices) that one can conclude that it was a good or a bad one. In order to disentangle the effect of specialization from the effect of sectoral growth rates, they associate a uniform distribution of sectors to the sectoral growth rates. It happens that the CMSD probabilistic approach ends-up in practice doing exactly the same thing: the expected sectoral distribution $E(S^i_{k,t-1})$ does not depend on the actual shares and plays the role of the uniform distribution used by Artige and van Neuss (2013).

Another advantage of finding a convergence between this CMSD and Artige and van Neuss (2013) new shift-share index is that it reveals additional properties for this new decomposition. Their paper (p. 14) shows that previous decompositions used in the literature may lead to biased conclusions, indicating spurious composition and competitive effects while none is present by construction. Their (and, therefore, the CMSD) decomposition leads to accurate results.

To conclude, equation [18] considers only one market (the United States or the entire world). But it is possible to further disaggregate total exports by countries and see if a given exporter has done better or worse due to its geographical specialisation. Because there is no a priori reason to believe that one geographical distribution is better than another, the multiple markets decomposition would follow the same principle than for multiple products composition.

$$x_t^i - E(x_t^i) = \sum_{j=1}^{N} x_{j,t}^i \, (S_{j,t-1}^i - E(S_{j,t-1}^i)) \; = \sum_{j=1}^{N} x_{j,t}^i \, (S_{j,t-1}^i - \; 1/N) \qquad [19]$$

$$m_t^{\cdot} - E(m_t^{\cdot}) = \sum_{w=1}^{N} m_t^w \, (S_{w,t-1}^{\cdot} - E(S_{w,t-1}^{\cdot})) \; = \sum_{w=1}^{N} m_t^w \, (S_{w,t-1}^{\cdot} - \; 1/N) \qquad [20]$$

With, as before $x^i_t = (X^i_t - X^i_{t-1})/(X^i_{t-1})$, the export growth rate of country "i" in year "t"; m^w_t and $m^{\cdot}_t$ the import growth rate of country "w" and total world trade in year "t" , respectively. S^i_j the geographical distribution of exports of country "i" by country of destination and $S^{\cdot}_w$ the geographical distribution of World imports by country of origin. N is the total number of countries. Rearranging and taking the difference as before leads to a new expression, similar to equation [18], but in the space of the N countries instead of in the space of the C products. This allows to calculate separately the influence of the commodity composition of exports and the influence of their geographic distribution.

UNITED NATIONS

ECLAC

Series

Studies and Perspectives-Mexico

Issues published

A complete list as well as pdf files are available at
www.eclac.org/publicaciones

192. Revisiting constant market share analysis: an exercise applied to NAFTA, Hubert Escaith (LC/TS.2021/94; LC/MEX/TS.2021/16), 2021.
191. El régimen de bienestar mexicano: inercias, transformaciones y desafíos, Carlos Barba (LC/TS.2021/70; LC/MEX/TS.2021/12), 2021.
190. El régimen de acumulación en México: caracterización, tendencias y propuestas para su transformación, Arturo Guillén (LC/TS.2021/42; LC/MEX/TS.2021/7), 2021.
189. Primeras lecciones y desafíos de la pandemia de COVID-19 para los países del SICA, Alberto Enríquez y Carlos Sáenz (LC/TS.2021/38; LC/MEX/TS.2021/5), 2021.
188. Estrategia de desarrollo con redistribución del ingreso: salario mínimo y frentes de expansión en México, Ricardo Bielschowsky, Miguel del Castillo, Gabriel Squeff, Roberto Orozco y Hugo E. Beteta (LC/TS.2021/35; LC/MEX/TS.2021/4), 2021.
187. Absolute convergence in manufacturing labor productivity in Mexico, 1993–2018: A spatial econometrics analysis at the state and municipal level, René Cabral, Jesús Antonio López Cabrera y Ramón Padilla Pérez (LC/TS.2020/158; LC/MEX/TS.2020/42), 2020.
186. Los intermediarios en cadenas de valor agropecuarias: un análisis de la apropiación y generación de valor agregado, Yannick Gaudin y Ramón Padilla Pérez (LC/TS.2020/77; LC/MEX/TS.2020/15), 2020.
185. Los motores de la degradación ambiental: el modelo macroeconómico y la explotación de los recursos naturales en América Latina, Alejandro Nadal y Francisco Aguayo (LC/TS.2020/69; LC/MEX/TS.2020/14), 2020.
184. Barreras sistémicas y discriminación en el acceso a financiamiento para la mujer: el caso de la cadena del turismo rural en Sacatepéquez (Guatemala), Sara Hess (LC/TS.2020/49; LC/MEX/TS.2020/12), 2020.
183. Medición de la pobreza de México: análisis crítico comparativo de los diferentes métodos aplicados. Recomendaciones de buenas prácticas para la medición de la pobreza en México y América Latina, Julio Boltvinik y Araceli Damián (LC/TS.2020/43; LC/MEX/TS.2020/11), 2020.

STUDIES AND PERSPECTIVES

Issues published:

ECLAC

Economic Commission for Latin America and the Caribbean (ECLAC)
Comisión Económica para América Latina y el Caribe (CEPAL)
www.eclac.org