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Developing Countries' Increasing Weight in World Trade, Openness, and Convergence

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Abstract

Over approximately the last two decades, developing countries have substantially increased their weight in global markets. This process is a defining feature of the recent economic globalization and has significantly affected output and employment across countries. To measure and analyze this process from a long-run perspective, we introduce the exporters' relative average income indicator and show how this indicator can be broken down into an openness-income correlation component and a cross-country income inequality component. We use this indicator to study the timing, intensity, and proximate determinants of the changes in the relative weight of richer and poorer countries in international trade over the 1961-2014 period. We also assess the extent to which the recent changes are due to the extraordinary growth of China and how its measurement is affected by the difference between PPP and national account values and by the increasing gap between value-added and gross exports.

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1 Introduction

Over approximately the last two decades, developing countries have substantially increased their weight in global markets. This process is a defining feature of the recent economic globalization and has significantly affected output and employment across countries (for the specific impact on the US, see Acemoglu et al. 2016, Pierce and Schott 2016, and Hummels et al. 2018). Although the increasing weight of developing economies in international trade is by now an important and familiar phenomenon, there is not an obvious macroeconomic measure that can help analyze its timing, causes, and consequences. Typically, this phenomenon is measured by defining two or more groups of countries according to their income level (e.g., developed and developing countries) and calculating the share of each group in world trade at different time periods (e.g., WTO 2013). However, this approach has important limitations: the grouping of countries is arbitrary (both in terms of the number of groups and their boundaries), the measure is insensitive to changes in country incomes within groups (whereas it jumps when a country changes groups, which occurs rather frequently), and it is unclear how this measure could be broken down into components that would help investigate the proximate determinants of its changes.

This paper introduces the *exporters' relative average income* to measure the relative weight of richer and poorer countries in world exports and uses this measure to analyze the timing, intensity, and proximate determinants of the changes in this relative weight over the 1961-2014 period. The initial analysis of the timing and intensity of the changes is carried out in Section 2. In Section 3, we show that this measure can be broken down into an *openness-income correlation* component and a *cross-country income inequality* component. This break down provides a first look into the proximate determinants of the relative weight of developed and developing countries in international trade by connecting our measure to the dynamics of cross-country income convergence. Then, in Section 4, we analyze a series of factors that could influence the measure's path. Specifically, we analyze how this path has been affected over the period by: (*i*) changes in the wedge between PPP and national accounts values, which we call the Balassa-Samuelson effect; (*ii*) the difference between value-added and gross exports, which has become more important as a result of offshoring and the emergence of global value chains; and (*iii*) the impact of China's extraordinary growth. In Section 5, we conclude.

2 The exporters' relative average income

Consider the following notation: C is the number of countries indexed by c, $GDPpc_c$ is country c's per capita GDP, X_c is this country's exports, and s_c is its share in global trade. World variables are denoted by a W subscript (i.e., $s_c = X_c/X_W$, where $X_W = \sum_{c=1}^{C} X_c$). We define the *exporters' average income* as $AVEX = \sum_{c=1}^{C} s_c GDPpc_c$. Note that if we randomly pick up a product in international markets, the $AVEX$ also represents the expected income of the product's country of origin (strictly speaking, it is the source country's expected income of any exported dollar). If the $AVEX$ increases, the expected income of the competitors in international markets increases.

The $AVEX$ rises over time if the richer countries gain market share in the global market and as the world's $GDPpc$ increases. Because we are interested in whether richer or

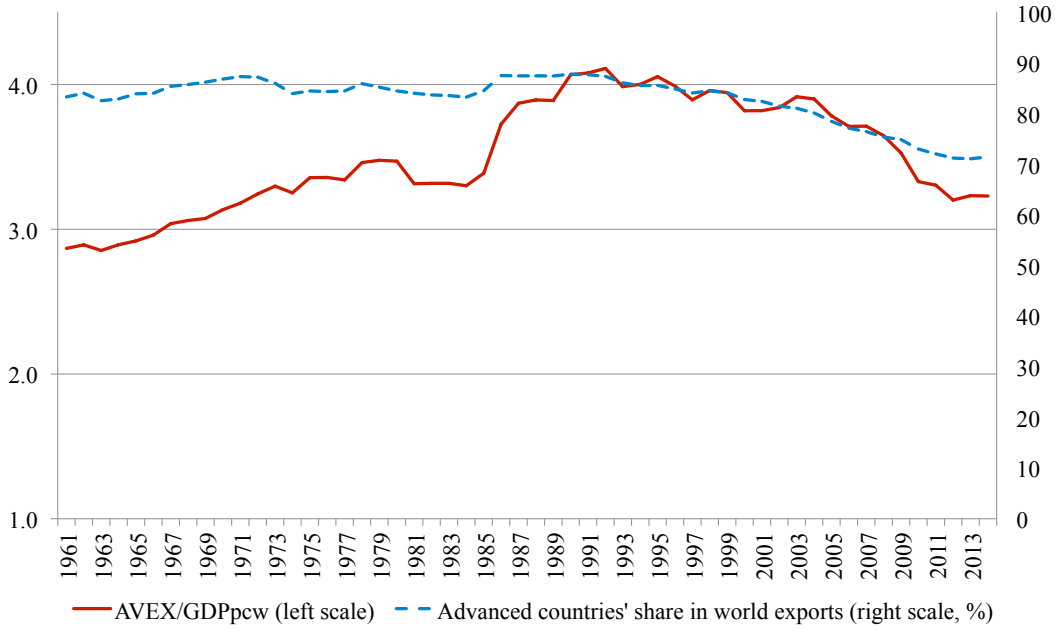

Figure 1: Exporters' relative average income ($AVEX/GDPpc_W$) and advanced countries' share in world trade. National accounts data in exchange rate US$.

poorer countries gain market share, we define the *exporters' relative average income* as the ratio $AVEX/GDPpc_W$, where $GDPpc_W$ is the world's per capita GDP (i.e., $GDPpc_W = GDP_W/world\ population$). The $AVEX/GDPpc_W$ ratio measures the relative weight of richer and poorer countries in world trade. It would be equal to 1 if all the countries had the same weight in global exports than in the world population (i.e., if $s_c = p_c$, where p_c is country $c's$ share in world population) and increases as richer countries increase their share in global exports over their share in the world's population.

All the variables in this paper are calculated using data from the Penn World Table version 9 (PWT9; Feenstra et al. 2015) except for the exports in valued added terms, which are considered in Subsection 3.2. Because we are interested in comparing the dynamics of several global indicators along different periods, it is crucial to calculate them with a constant sample of countries; otherwise, changes in the sample would influence the observed dynamics of the indicators. For 1961, the common sample of the national accounts and PPP data in PWT9 includes 112 countries. This is the sample we use throughout the paper except in Subsection 3.2. Although the number of countries included in PWT9 raises to 211 at the end of the dataset (2014), our constant sample of 112 countries still represents 88% of the total population of those 211 countries in 2014, 86% of their total exports, and 91% of their total GDP.

Figure 1 shows the path followed by the $AVEX/GDPpc_W$ ratio over the 1961-2014 period, using GDP and export data at national account prices (in exchange rate US$) provided by PWT9. The exporters' average income has moved within a range of approximately 3 to 4 times the world's average income. The exporters' relative income shows an upward trend between 1961 and 1992, except for a short period around the first half of the 1980s. Then, in 1992, it initiated a decreasing trend that accelerated sharply around 2003 and ended in

2012. Notwithstanding, the exporters' relative income in 2014 was still above its level in the 1960s. The strong downward trend observed between 2003 and 2012 corresponds to the transformations in the global economy to which we referred in the Introduction.

In comparison, the advanced countries' share in world trade (also drawn in Figure 1 using the same sample of countries and data, and the World Bank's definition of advanced countries, updated for 2014) barely exhibits any upward trend during the 1960s, 1970s, and 1980s, or a downward acceleration after the beginning of the Great Recession in 2008. This indicator overestimates the share of developed countries in the early years of the period being analyzed, as it uses the 2014 definition of developed countries (which includes countries that were relatively poor in the 1960s). Conversely, if we used a definition of developed countries for an earlier year, then the indicator would underestimate the developed countries' share in world exports as we move to the end of the period being analyzed. Also, this standard indicator exhibits a less rich and informative path because it does not capture the changes in export shares within the groups of developing and of developed countries.

3 The openness correlation and inequality components

Now, denoting $r_c = GDP_c/GDP_W$, we can analyze the proximate determinants of the exporters' relative income dynamics using the following decomposition:

$$\begin{aligned}\frac{AVEX}{GDPpc_W} &= 1 + \sum_{c=1}^{C}(s_c - r_c)\frac{GDPpc_c}{GDPpc_W} + \sum_{c=1}^{C}(r_c - p_c)\frac{GDPpc_c}{GDPpc_W} \\ &= 1 + OI + IN. \end{aligned} \tag{1}$$

Note that OI is a measure of the correlation between export openness (openness for short) and per capita GDP, weighted by the countries' GDP. In fact, taking into account that $\sum_{c=1}^{C}(s_c - r_c) = 0$ and because $s_c/r_c = \frac{X_c/GDP_c}{X_W/GDP_W} \equiv \frac{openness_c}{openness_W}$, this term is equal to the following:

$$OI = \text{cov}\left(s_c - r_c, \frac{GDPpc_c}{GDPpc_W}\right) = \sum_{c=1}^{C} r_c \left(\frac{openness_c}{openness_W} - 1\right)\left(\frac{GDPpc_c}{GDPpc_W} - 1\right). \tag{2}$$

This OI component would be zero if all countries had either identical openness or identical $GDPpc$, and it increases if richer countries tend to be more open than poorer countries (with more weight assigned to larger countries). We refer to OI as the *openness-income correlation* component. In turn, IN is a measure of cross-country income inequality. In fact, because $r_c/p_c = \frac{GDPpc_c}{GDPpc_W}$, this term can be rewritten as follows:

$$IN = \text{cov}\left(s_c - r_c, \frac{GDPpc_c}{GDPpc_W}\right) = \sum_{c=1}^{C} p_c \left(\frac{GDPpc_c}{GDPpc_W} - 1\right)^2. \tag{3}$$

This expression is similar to the σ measure used in the analysis of cross-country income convergence (Sala-i-Martín 1996).[1] We refer to IN as the cross-country *income inequality*

[1] A difference is that income deviations with respect to the world average are not weighted by the countries' population in Sala-i-Martín (1996). In Appendix A, we recalculate our indicators without weighting by country size and compare their paths with the weighted indicators used in this main text.

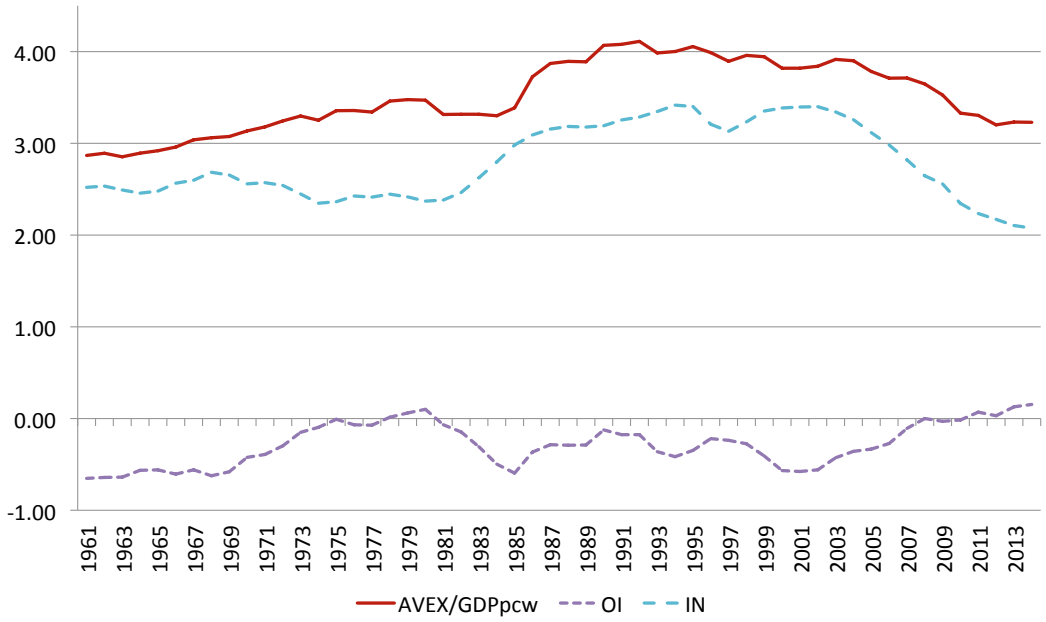

Figure 2: Exporters' relative income ($AVEX/GDPpc_W$) and its openness-income correlation (OI) and inequality (IN) components. National accounts data in exchange rate US$.

component of the $AVEX/GDPpc_W$ ratio. Thus, the exporters' relative average income increases with the openness-$GDPpc$ correlation and with cross-country income divergence.

Figure 2 shows the path followed by these two components. The OI is negative most of the time, i.e., poorer countries tend to be more open. The possibility of this counter-intuitive relationship is discussed in Alcalá and Ciccone (2004), who show in a formal model that as an economy's productivity rises, measured openness can decrease even if the country's increase in international trade is the source of the productivity rise. The reason is the Balassa-Samuelson effect: when productivity grows, the nominal increase in GDP can be larger than the nominal increase in exports due to the rise in the relative price of nontradables, which raises measured GDP but not exports. Hence, national accounts openness can decrease as a result of increased productivity even if this increase is due to larger international exchanges.[2] In fact, as we show in the next section, if openness is measured in PPP values, then the correlation between openness and income is positive every year between 1963 and 2014.

The correlation between $AVEX/GDPpc_W$, on the one hand, and OI and IN, on the other, was 0.92 and -0.33, respectively, between 1961 and 1984. This correlation changed to -0.45 and 0.90, respectively, during the period 1984-2014. Thus, the path followed by $AVEX/GDPpc_W$ from 1961 to the beginning of the 1980s was mostly shaped by the path of the increasing correlation between openness and income. Only richer countries were becoming more open. However, over the last three decades, the key determinant of the

[2]In general, when comparing macro magnitudes across countries, national accounts (in exchange rate US$) underestimate the developing countries' relative GDP and, therefore, overestimate these countries' relative openness ratio. This is the case because exports and imports do not include nontradables and, therefore, they are not affected by their relative price increase.

$AVEX/GDPpc_W$'s path has been cross-country income convergence and divergence.[3] In particular, there has been a strong trend towards convergence since 2002 (see Ravallion 2018 for a discussion and references on the relationship between globalization and inequality and its recent trends).

4 Other factors affecting measured exporters' income

4.1 The Balassa-Samuelson effect

From the perspective of international competition, real values in PPP are not the most important but wage levels and prices in exchange rate US$. Thus, in the previous sections, we used national account prices in exchange rate US$ to calculate the$AVEX$so that it coincides with the actual competing firms' expected income of origin (which is also a proxy for the wage level in the source country). However, from the point of view of cross-country income convergence and productive capacity comparisons, it is more appropriate to use PPP magnitudes. Thus, in this subsection, we recalculate our indicators using PPP values and compare their paths with the national account values examined in the previous sections.

We use output-side real GDP and the share of exports in real GDP at current PPP from PWT9 ($CGDP^o$ and csh_x in this dataset's notation), and define real openness as $ropenness_c = X_c^{PPP}/CGDPpc_c$, where $X_c^{PPP} = csh_{xc} * CGDP_c^o$ and $CGDPpc_c = CGDP_c^o/$ $/population_c$. Then, the exporters' relative average income in PPP terms is given by $AVEX^{PPP}/GDPpc_W^{PPP} = 1 + OI^{PPP} + IN^{PPP}$, where

$$OI^{PPP} = \sum_{c=1}^{C} r_c \left(\frac{ropenness_c}{ropenness_W} - 1\right)\left(\frac{CGDPpc_c}{CGDPpc_W} - 1\right),\ IN^{PPP} = \sum_{c=1}^{C} p_c \left(\frac{CGDPpc_c}{CGDPpc_W} - 1\right)^2.$$

Figures 3 and 4 represent these variables' paths along the 1961-2014 period. Figure 3 shows that the PPP exporters' relative income has a smoother path than the national-account measure, although both display similar turning points. Only, the sharp decline in the exporters' relative income that took place this century starts three years earlier when we use the PPP measure: in 2000 instead of in 2003.

Both PPP components show smoother time profiles than their national account counterparts as they are not affected by the volatility of the exchange rate (Figure 4). In contrast to OI, OI^{PPP} was always positive since the end of the 1960s and shows an almost monotonically (though modest) increasing trend. Therefore, the sharp decline of the exporters' relative income since 2000 that we observed in Figure 3 is due, only, to the IN^{PPP} component, which shows a sharp trend towards cross-country income convergence since 2000.

Surely, the developing countries' GDP growth has been accompanied by export growth. In fact, the world's average openness has increased substantially: from 10.9% in 1961 to 28.6% in 2014 using national accounts at exchange rate US$ and from 9.2% in 1961 to

[3]Because OI and IN are the additive components of $AVEX/GDPpc_W$, their contribution to the changes in this ratio increases with their variability, which can be measured using their standard deviations. The standard deviations of OI and IN between 1961 and 1982 were 0.27 and 0.09, respectively, whereas between 1982 and 2014 they were 0.20 and 0.43.

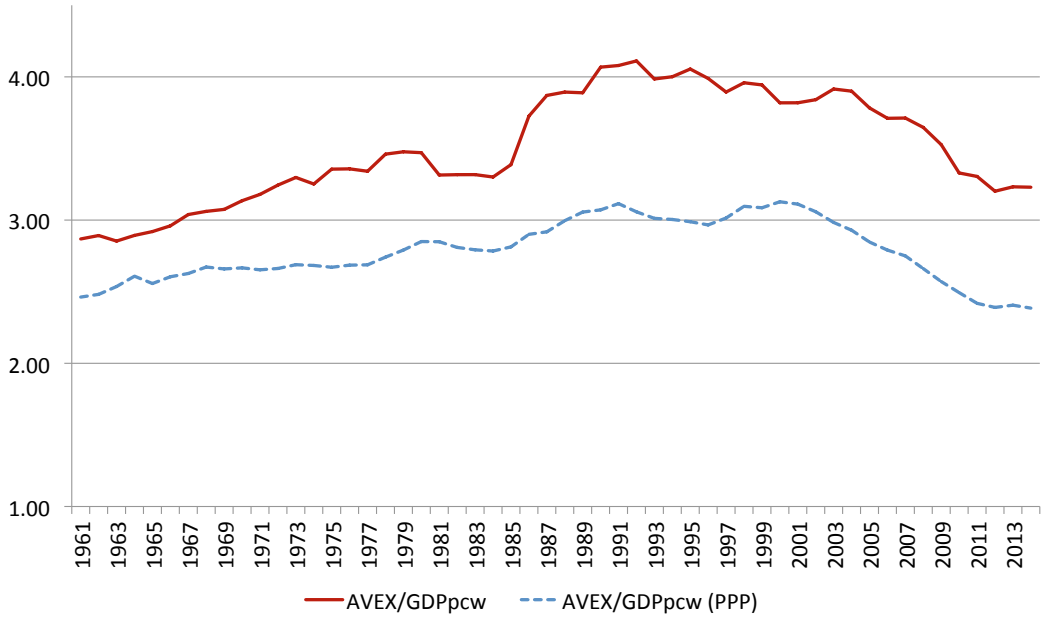

Figure 3: Exporters' relative average income calculated using, alternatively, national accounts data in exchange rate US$ ($AVEX/GDPpc_W$) and PPP values ($AVEX/GDPpc_W(PPP)$).

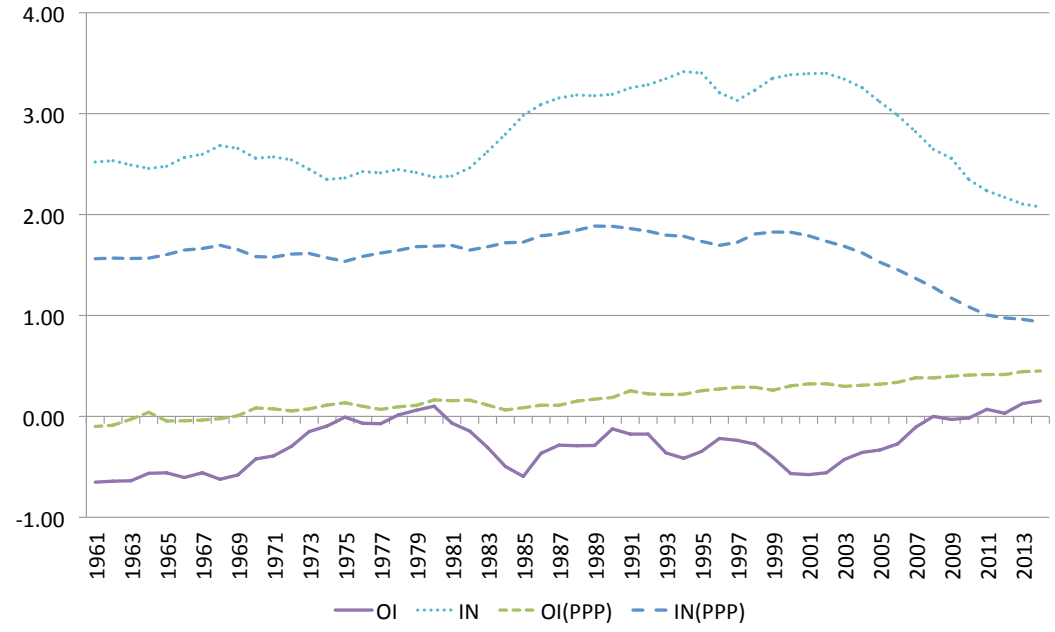

Figure 4: Openness-income correlation (OI) and cross-country inequality (IN) components of the exporters' relative income. National accounts in exchange rate US$ and PPP values.

24.1% in 2014 in PPP terms (see Figure 9 in the Appendix). However, developing countries have not increased their openness more than developed countries. In fact, it is rather the opposite, as the openness-income correlation has been increasing since the beginning of the 21st century, both in PPP and exchange rate dollars. The reason why developing countries now have a much larger weight in global markets is this century's income convergence trend. This fact casts some doubts on the characterization of the recent emerging economies' growth as following an export-oriented strategy at the expense of developed countries with large trade deficits, such as the US.[4]

4.2 Value-added versus gross trade flows

Production fragmentation, offshoring, and global value chains have affected output and employment across the world and reduced the percentage of domestic value added that is embodied in (gross) exports (Feenstra 1998, Johnson and Noguera 2012, Timmer et al. 2013, Johnson 2014, Hummels et al. 2018). To which extent does the increasing gap between gross and value-added exports affect or distort the $AVEX/GDPpc_W$, OI, and IN paths found in sections 2 and 3?

Researchers have developed several approaches to estimate trade in value added terms (e.g., Johnson and Noguera, 2012; Koopman et al. 2014; Los et al. 2016). Unfortunately, the statistics needed to conduct this estimation (i.e., international input-output tables) are available only for a limited number of countries and periods. We use the data provided by the World Input Output Database (WIOD, Release 2016; Timmer et al. 2015), which covers 43 countries over the 2000-2014 period, to recalculate our indicators in terms of value added. These recalculations affect export and openness variables but not GDP and, thus, they affect the OI but not the IN component. We denote the new indicators based on exports in value-added terms with a VA superscript:

$$\frac{AVEX^{VA}}{GDPpc_W} = 1 + OI^{VA} + IN, \text{ where } \mathrm{O}I^{VA} = \sum_{c=1}^{C} r_c \left(\frac{openness_c^{VA}}{openness_W^{VA}} - 1 \right) \left(\frac{GDPpc_c}{GDPpc_W} - 1 \right).$$

We also recalculate the previous gross exports' $AVEX$ and OI variables as well as $GDPpc_W$ using the same sample of 43 countries. We label these restricted-sample gross-trade variables with a "43s" indicator. Figure 5 shows the results. Rather surprisingly, the value-added indicators' path is almost identical to the gross-trade indicators' path. Hence, measurement issues resulting from production fragmentation and global value chains do not appear to have significantly influenced the observed changes in the developing countries' share in global markets.

4.3 The role played by China

Over the last decades, China's extraordinary growth coupled with its large size and gradual opening to the world economy appears to have had a notable impact worldwide

[4]For example, China's export openness, as of 2014, is below the world's average both in exchange rate US$ and PPP (see Figure 9 in Appendix B), notwithstanding the surge in nominal (exchange rate US$) openness in the mid 2000s.

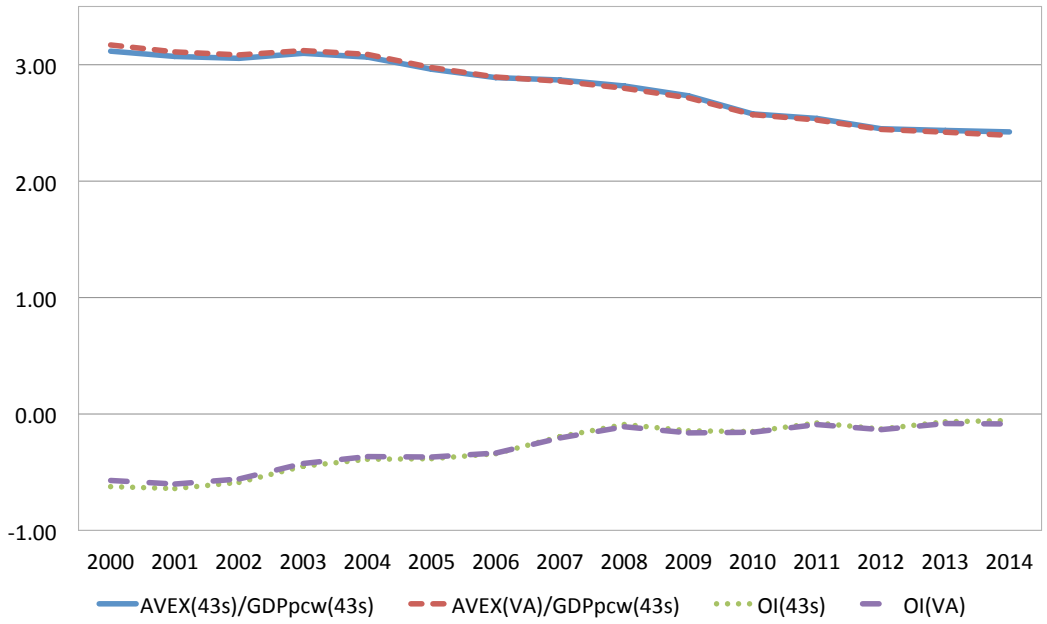

Figure 5: The exporters' relative average income using gross trade data ($AVEX(43s)/GDPpc_W(43s)$) and value added data ($AVEX^{VA}/GDPpc_W(43s)$) using a restricted sample of 43 countries. National accounts data in exchange rate US$.

on output, employment, and trade (e.g., see Autor et al. 2013 and 2016 for the impact in the US). Are the recent transformations in the world economy, in terms of the developing countries' presence in international trade and cross-country income convergence, exclusively due to this country's dynamics? We now recalculate our indicators excluding China from the sample of countries to investigate the role played by this country in the evolution of the exporters' relative income and its components. Figures 6 and 7 show the paths of the new indicators in comparison with the paths shown in sections 2 and 3 (the label "exCh" denotes the indicators excluding China).

The two $AVEX$ ratios in Figure 6 evolve almost in parallel until 1991. After that year, the ratio calculated using the whole sample takes a downward trend, while the one calculated excluding China keeps an almost monotone upward trend. The two measures eventually cross each other in 2012. Therefore, the role of China appears to have been crucial in the downward trend of the exporters' relative income that started in the early 2000s, which we documented in the previous sections. This downward trend disappears when China is excluded from the calculations.

However, the trend towards cross-country income convergence that began in 2002 still becomes apparent after excluding China, though much less pronounced (see Figure 7; the reduction between 2002 and 2014 in the IN measure that excludes China is 64% smaller than the reduction in the measure that includes China). In contrast, China does not appear to significantly influence the openness-income correlation component.

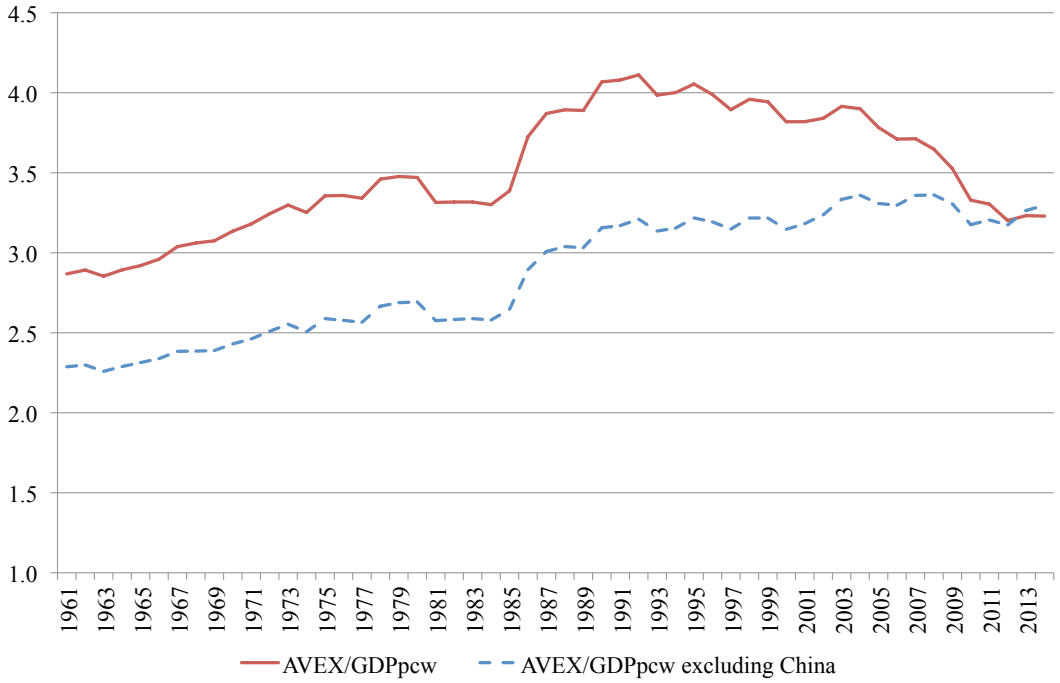

Figure 6: Exporters' relative average income calculated using either the full sample of countries or a sample that excludes China. National accounts data in exchange rate US$.

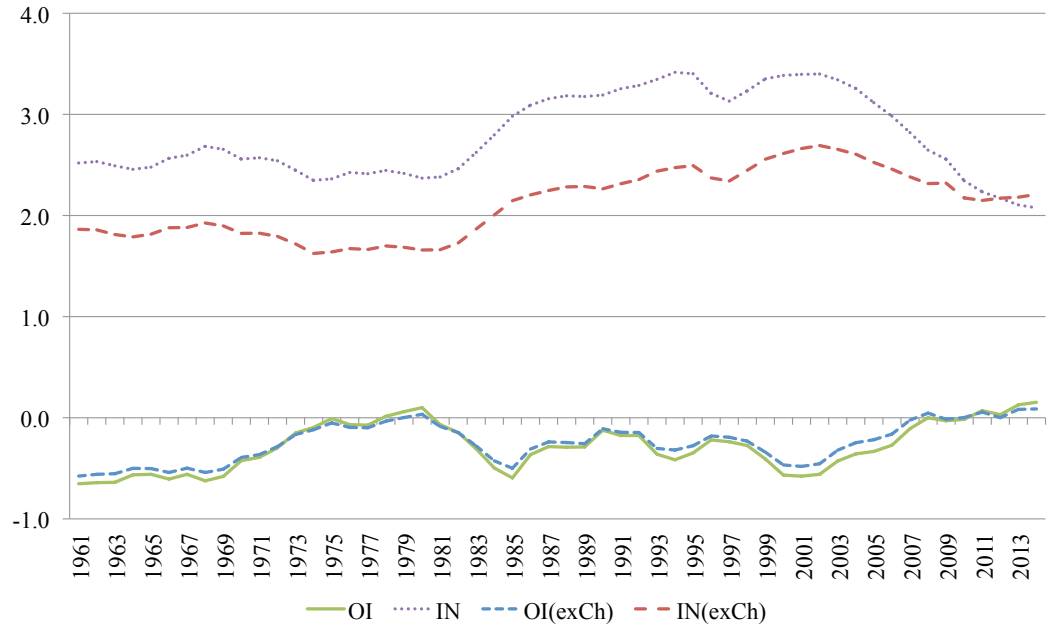

Figure 7: Openness-income correlation (OI) and cross-country inequality (IN) components calculated using either the full sample of countries or a sample that excludes China (labelled as "exCh"). National accounts data in exchange rate US$.

5 Conclusions

International competition has dramatically changed over the last decades as a consequence of the developing countries' extraordinary rise in global markets. In this paper, we have defined and used the exporters' relative average income to assess the timing and intensity of the changes in the relative weight of richer and poorer countries in international trade over the 1961-2014 period. The assessment can help frame more detailed analyses of particular aspects and consequences of this process.[5] The paper also showed that the exporters' relative income can be broken down into an openness-income correlation and a cross-country income inequality component, examined the dynamics of these two components over the cited period, and investigated how the corresponding trajectories have been affected by a series of factors such as measurement issues, production fragmentation, and the impact of China.

The exporters' relative income had an upward trend over three decades that changed to a downward trend in the early 90s. This downward trend brought the exporters' average income from being more than 4 times the world's $GDPpc$ in 1992, to being less than 3 times in 2014. It is shown that the increasing trend from 1961 to the beginning of the 80s was due to an increasing correlation between openness and income (developed countries were becoming relatively more open than developing countries). However, over the last three decades, the key determinant of the exporter's relative income has been, alternatively, cross-country income divergence and convergence. In particular, the recent rise in the developing countries' weight in global markets is due to the strong income convergence process that started around 2002. It was not caused, as one may conjecture, by a relative increase in the developing countries' export openness with respect to that of the developed countries. In fact, the correlation between export openness and $GDPpc$ has been increasing since the beginning of the 2000s, both in exchange rate US$ and in PPP.

We also used data on value-added trade to check that the observed changes in the developing countries' share in global markets are not driven by measuring issues that could result from production fragmentation and global value chains. In turn, the extraordinary development of China does appear to have played a crucial role in the reduction of the exporters' relative income that started in the early 2000s. However, the trend towards cross-country income convergence that began in 2002 still becomes apparent when China is excluded from the sample, though much less pronounced than when it is included.

The paper raises questions that invite further research. For instance, cross-country inequality and the openness-income correlation are only proximate determinants of the exporters' average income, whose changes over time need to be explained. The determinants of these changes and their interrelationships are important research issues that remain open.

[5]For example, in a related paper, Alcalá and Solaz (2018) estimate the cross-country growth consequences of the export relocation process between richer and poorer countries over the 1996 and 2014 period, using information on the exports of approximately 5.000 products by 100 countries.

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Appendix A: Using indicators that do not weight by country size

Frequently, measures of $\sigma-$convergence and average openness do not weight countries by their relative population or GDP. However, from the point of view of global inequality and competition, it is quite different if a very large country (like China or India) is growing very fast and becoming more open than if this is occurring in a small country. This is why in this paper, we used indicators that weight country data with country size. At any rate, it is interesting to calculate the unweighted indicators and compare their paths with the weighted indicators' paths used in the main text. We define the unweighted OI and IN as:

$$OI^U = \frac{1}{C}\sum_{c=1}^{C}\left(\frac{openness_c}{openness_W}-1\right)\left(\frac{GDPpc_c}{GDPpc_W}-1\right), \quad IN^U = \frac{1}{C}\sum_{c=1}^{C}\left(\frac{GDPpc_c}{GDPpc_W}-1\right)^2.$$

Figure 8 compares the weighted and unweighted indicators' paths. The unweighted income inequality indicator also exhibits a turning point in the 2000s, from income divergence to income convergence, but though five years later. Thus, we still find convergence in recent years but only after 2007 instead of in 2002. In turn, the openness-income correlation OI^U's is always positive and with a trend similar to that of OI^{PPP} in Figure 4. Thus, the common presumption that richer countries have consistently been more open is consistent with the use of unweighted , which is not apparent when using the weighted export openness measure, is only confirmed when using indicators that ignore cross-country size differences or when measuring export openness in PPP.

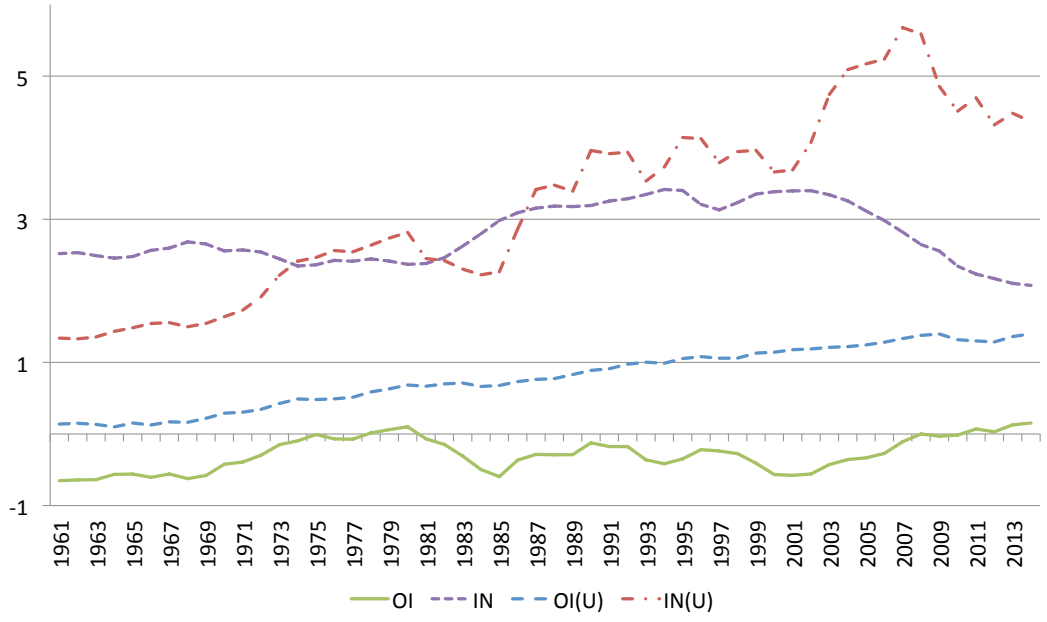

Figure 8: Openness-income correlation (OI) and cross-country inequality (IN) components of the exporters' relative income, weighted and unweighted (U) by country size. National accounts data in exchange rate US$.

Appendix B: The world's and China's openness and real openness

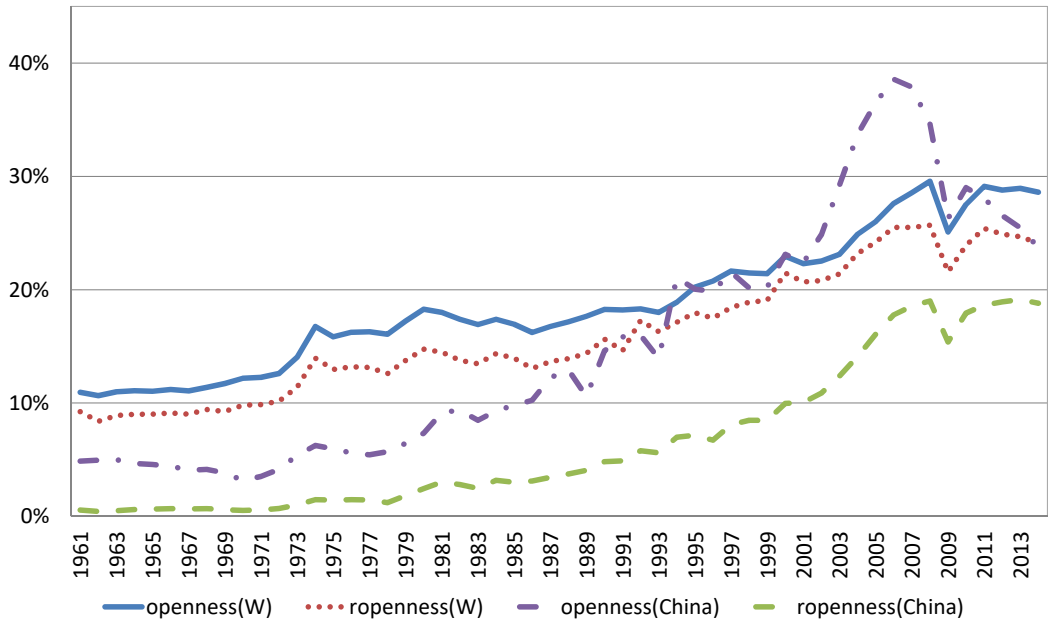

Figure 9: China's and world's (W) openness. National accounts in exchange rate US$ and PPP data (the latter are denoted as ropenness = real openness).