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Policy Brief

DIVERSIFICATION OR SPECIALIZATION: WHAT IS THE PATH TO GROWTH AND DEVELOPMENT?

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Abstract

This note revisits the debate on whether the path to development and growth can be explained by specialization or, on the contrary, by diversification of a country's export basket. I revisit the literature and find that measurement plays an important role in explaining the gap between these two different schools of thoughts. In particular, I revisit the seminal paper by Imbs and Warcziag (2003) using exports data, and find that once the analysis is performed using highly disaggregated data and when excluding natural resource rich countries from the sample, the re-specialization pattern typical of rich countries is much less pronounced.

Introduction

In general, international trade theories predict that once countries open up to trade outside their borders they will specialize in goods for which they have comparative advantage. Early theories of trade explained comparative advantage as being driven by relative productivity differences (as explained by David Ricardo) or by relative abundance of factors of production (as explained by Eli Heckscher and Bertil Ohlin). More recent theories incorporate monopolistic competition and firm level analysis in their models to allow countries (or firms within a country) to specialize in varieties of goods in order to explain what economists refer to as intra-industry trade—when two countries trade among themselves products within the same industry, such as cars, for example (Helpman and Krugman 1985, Melitz 2003). All in all, most trade theories would predict that a country transitioning out of autarky will respond to incentives to specialize in either goods or non-perfectly substitutable varieties of goods. This results from international competition driving less productive firms out of the market (and with them their products) and only those firms that are productive enough to compete in world markets surviving. Thus, countries that are more exposed to international trade would specialize further.

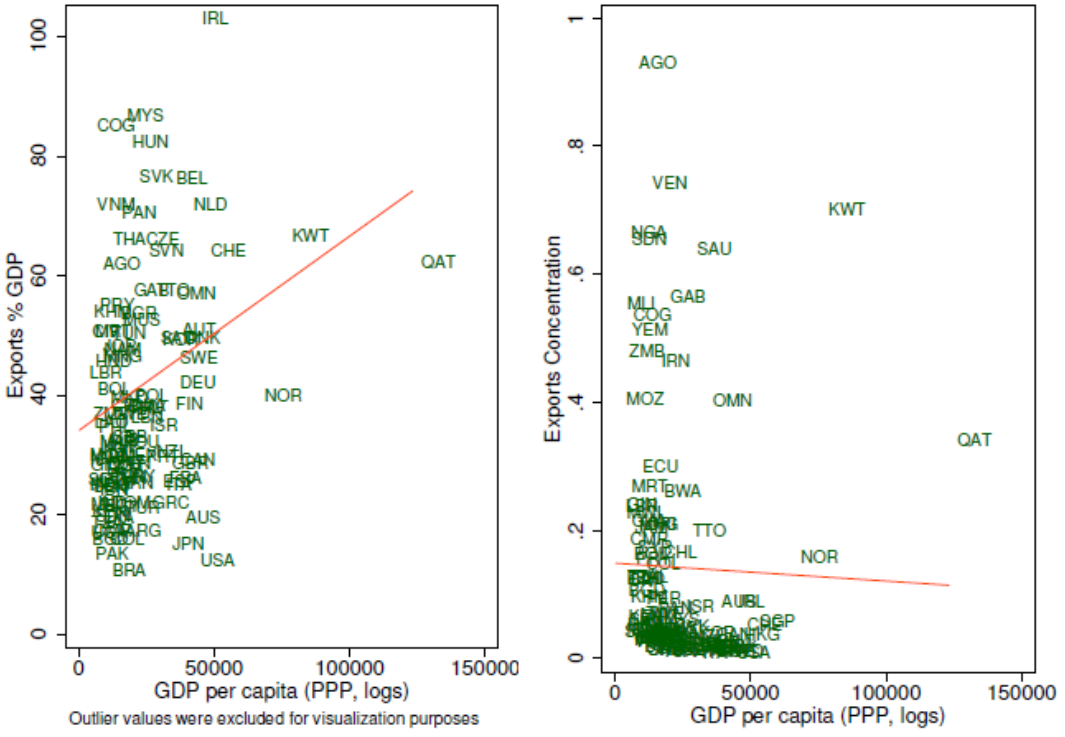
Yet, data shows a strong correlation between income levels and diversification of export baskets. The evidence is not always definitive. Figure 1 explores the relationship between both openness to trade and export concentration (i.e., specialization) and income per capita. The left panel uses data for the year 2010 to show that, on average, countries with higher openness to trade (measured as exports as a share of GDP) tend to be richer. The right panel shows that countries that are less concentrated—as measured by the Herfindahl-Hirschman Index of concentration using four-digit export categories—tend to be richer. Notice that a negative correlation between export concentration and income per capita holds in spite of severe outliers, such as natural resource rich countries like Venezuela, Libya, Kuwait, and Saudi Arabia, in the upper right part of the graph.

In light of this confounding evidence, what is it that explains the path to development? Is it diversification or specialization? This note explores this question by reviewing the existing literature and attempting to close the gap between the two contradictory sets of evidence.

The question on the role of diversification or specialization on economic growth and development has been widely explored in the economic literature. The seminal paper by Imbs and Warcziag (2003), referenced as IW here onward, presents a stylized fact that has become widely accepted in the literature. Using several datasets to measure the concentration of production across different countries and years, IW show that as countries grow, specialization is non-linear. In particular, they show that the specialization pattern follows a U-shaped curve: at low levels of income, countries are highly concentrated, then they diversify and at the higher levels they tend to concentrate again. One of the

strengths of their methodology is that their results can be interpreted as a within-country process. These results have been confirmed using export data by Cadot et al. (2011).

Figure 1: Exports and concentration



Note: The left panel shows a scatterplot of openess to trade (exports as share of GDP) against PPP-adjusted GDP per capita (in logs). The right panel shows a scatterplot of exports concentration—measured as the Herfindahl-Hirschman Index—against PPP-adjusted GDP per capita. Data sources come from the World Bank's World Development Indicators, Penn World Tables and trade data from U.N. Comtrade, with corrections by Hausmann et al. (2011).

Yet, the work summarized in Hausmann et al. (2011) shows that countries in the highest level of income and development, much on the contrary, tend to have highly diversified export baskets. That is, the results suggest that, in fact, there is no re-specialization pattern among countries in the highest levels of income.[1]

Thus, these opposing statements beg the question: what is the path to growth and development? Is it concentration or diversification of a country's export basket? Both paths could be explained by different theories. On one hand, even after countries diversify and grow, they become more integrated in the global economy, allowing them to reconcentrate in a particular set of goods fulfilling the gains from trade that come from comparative advantage. However, in a general equilibrium setting, global integration also implies diffusion of knowledge and this could also result in productivity gains that are

[1] *See also Hidalgo et al. (2007), Hausmann and Hidalgo (2009), Hausmann and Klinger (2006).*

reflected in diversification, not concentration (see Bahar et al., 2014; Bahar and Rapoport, forthcoming). Yet, how come there could be such discrepancy in the data?

It might be due to measurement peculiarities. In particular, I focus on two aspects of measurement of the data. The first has to do with outliers in the concentration versus income relationship which might be driving the results of re-specialization for richer countries. In particular, the presence in the sample of natural resource rich countries, which tend to have high incomes and also very highly concentrated in their export baskets.

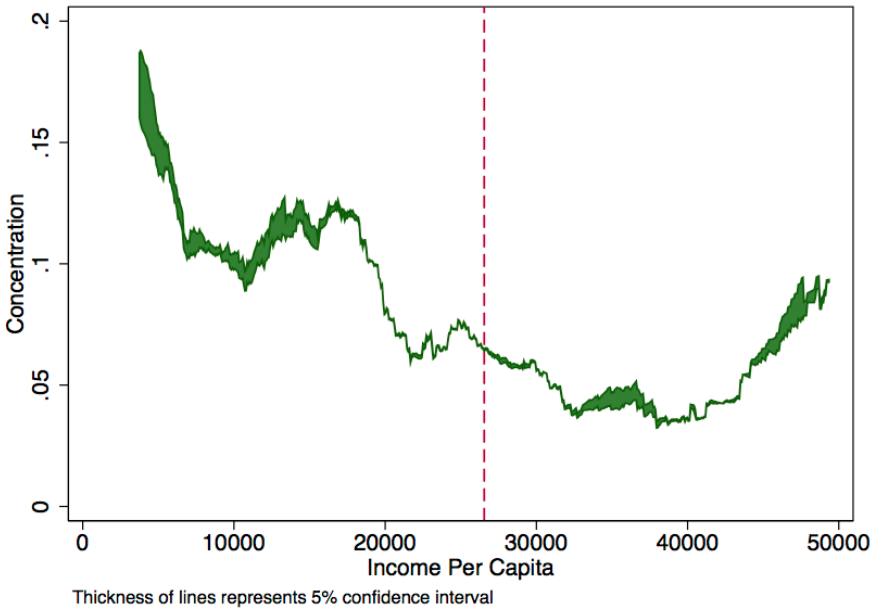
The second regards the disaggregation level used in the data. It might well be possible, that at lower levels of disaggregation the re-specialization pattern in richer countries is more prominent, whereas it is not the case when looking at highly disaggregated data. That is, rich countries might specialize in certain aggregated sectors (e.g., electronics or chemicals), but within such sectors these countries remain highly diversified. This is something that can be tested using only different levels of sectoral aggregation in the same analysis. In the next section I test whether taking into account these two issues can bridge the gap between the contradicting evidence in the literature.

Revisiting Imbs and Warcziag (2003)

I start by revisiting the evidence presented by Imbs and Warcziag (2003). To do so, I replicate their results using more recent data. I limit the analysis to exports reported in the Harmonized System (HS) categorization, which goes up to six digits in terms of disaggregation, since 1996 until 2011. I also use real income per capita (PPP adjusted) reported by the Penn World Tables 9.0 (Feenstra et al., 2015). The final dataset has data for 114 countries, which is based on the sample of exporter countries used in Hausmann et al. (2011), excluding former Soviet Union countries given the volatility of their data in during the 1990s. I replicate IW methodology for the analysis (see Appendix Section A for more details). When it comes to concentration indexes, I limit the results of this note to the Herfindahl–Hirschman index (HHI) only, but results are robust for a number of different indexes.

Figure 2 visualizes the relationship between HHI and income per capital using exports data at the four digits level, following the IW methodology. The results are qualitatively consistent with those presented by IW: poor countries are highly concentrated, middle income countries are more diversified, and at high levels of development diversification stops and there is a re-specialization pattern.

Figure 2: Concentration (HHI, 4 digits) and income per capita



Note: This figure estimates the non-linear relationship between export concentration (using the Herfindahl-Hirschman Index based on four-digit HS categorization) and PPP-adjusted income per capita. The estimation follows the technique described in Imbs and Warcziag (2003) and it is explained in Appendix Section A.

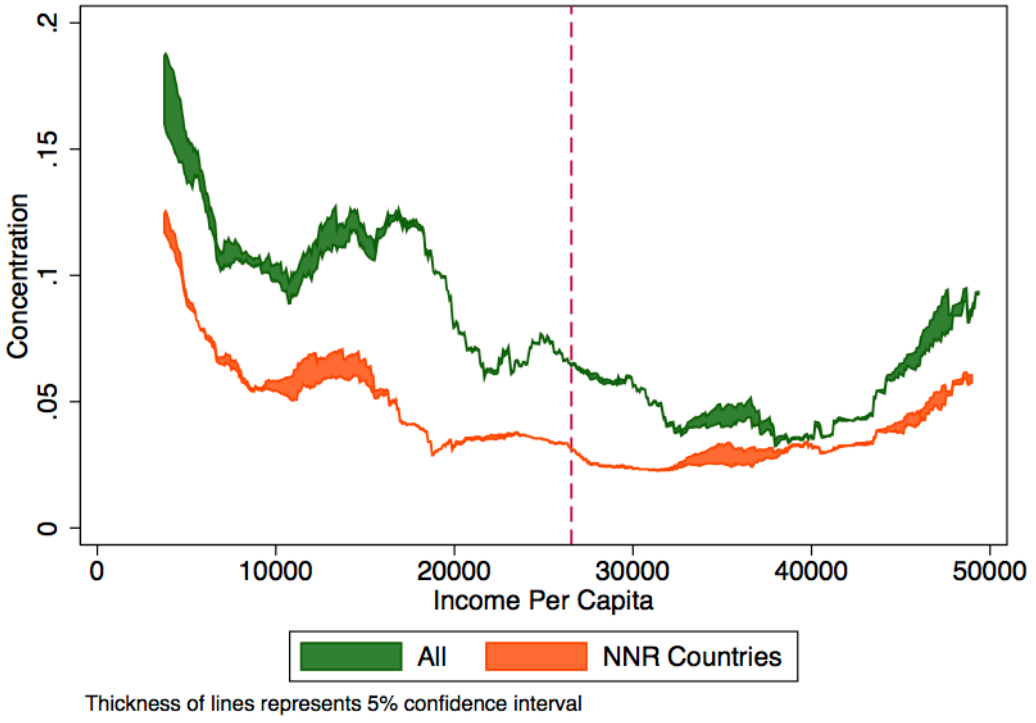
Next I explore the robustness of these results to two measurement peculiarities: the exclusion of natural resource rich countries and the level of disaggregation of the data used to compute concentration.

Natural resource rich countries

Natural resource rich countries tend to be outliers in the income per capita versus concentration of exports relationship (Bahar and Santos, 2016). How would these results be affected when excluding this set of countries? I explore this question by reestimating the relationship between concentration and income per capita, following the same methodology as in IW, excluding from the sample countries for which the natural resource rents are, on average, at least 10 percent of their GDP throughout the years of the sample (using data from the World Development Indicators). These countries are Angola, United Arab Emirates, Bolivia, Chile, Cameroon, Congo, Algeria, Ecuador, Egypt, Ethiopia, Gabon, Ghana, Guinea, Indonesia, Iran, Kuwait, Lao, Liberia, Libya, Mongolia, Mozambique, Mauritius, Malaysia, Nigeria, Norway, Oman, Papua New Guinea, Qatar, Saudi Arabia, Syria, Trinidad and Tobago, Uganda, Venezuela, Vietnam, Yemen, and Zimbabwe.

Figure 3 compares the concentration (using four digit export data) versus income relationship for all countries and for non-natural resource (NNR) countries in the data.

Figure 3: Concentration and income (All and NNR countries)



Note: This figure estimates the non-linear relationship between export concentration (using the Herfindahl-Hirschman Index based on 4-digit HS categorization) and PPP-adjusted income per capita. The estimation follows the technique described in Imbs and Warcziag (2003) and it is explained in Appendix Section A. The green line estimates the relationship for all countries and the orange line estimates the relationship for non-natural resource rich countries.

The first thing that should be noticed is that, for all levels of income, NNR countries are on average less concentrated (a result that is consistent with the findings of Bahar and Santos, 2016). However, more importantly, the re-specialization pattern, even if still present, is somewhat less pronounced for NNR countries only (orange line). Also the "bump" in the relationship for all countries in the 10K to 20K area in the income per capita range virtually disappears, hinting that it was driven by middle income natural resource rich countries. More generally, without establishing the significance of these results, it is important to notice that the robustness of these results are dependent on the sample of countries used. Yet, I still find some pattern of re-specialization in NNR countries. In the next subsection, I explore whether the disaggregation level of the export data can play a role in explaining it.

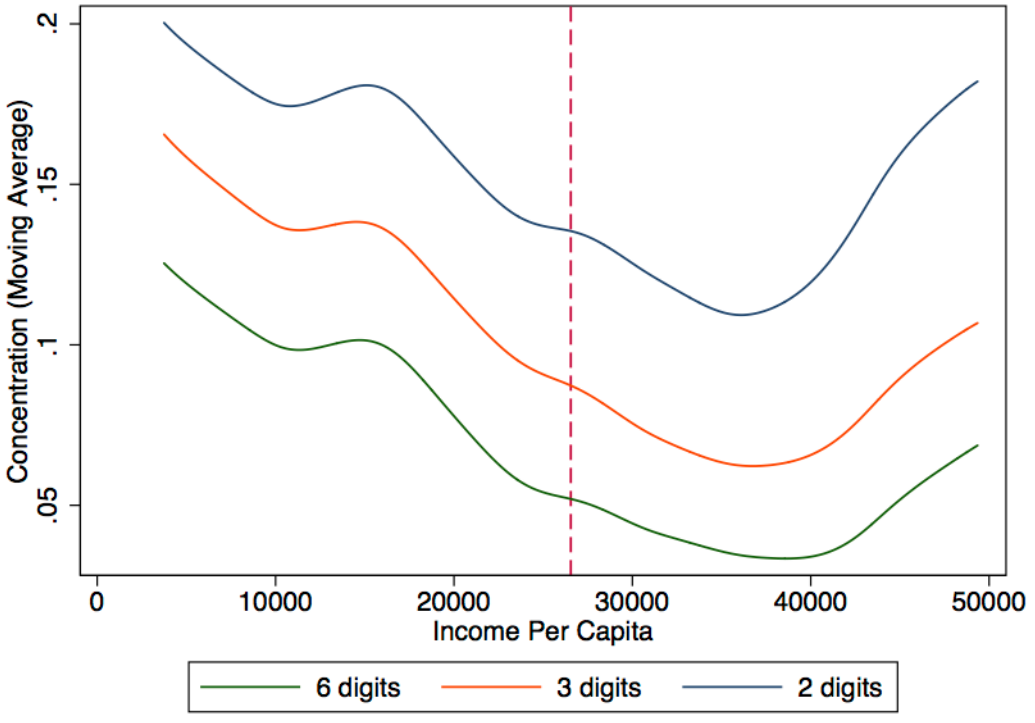
Disaggregation level of export data

The level of disaggregation of exports data can play an important role in explaining the documented patterns. Why? Because even if re-specialization occurs at higher levels of economic development, it might be only at highly aggregated sectors. For instance, East Asian countries are concentrated in a few clusters, electronics being the most prominent one, but within such clusters there is wide

diversification. Thus, the limitations of data (as well as the conceptualization of what a sector actually is) might bias the interpretation of the results.

I explore this by using in the same analysis concentration indexes computed using different levels of data disaggregation. Figure 4 presents the relationship between concentration and income per capita following IW's methodology (lines represent moving averages, for visualization purposes) for the HHI computed using export figures disaggregated at the two, three, and six digit levels, for all countries.

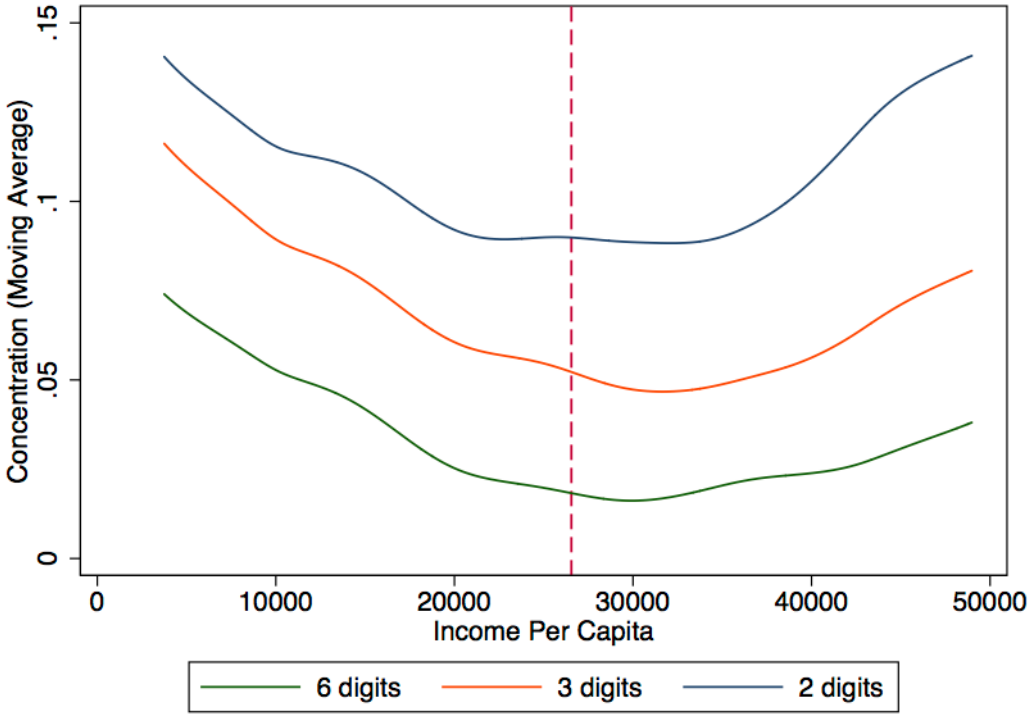
Figure 4: Concentration and income, different disaggregation levels



Note: This figure estimates the non-linear relationship between export concentration (using the Herfindahl-Hirschman Index based on two, three, and six digit HS categorization) and PPP-adjusted income per capita. The estimation follows the technique described in Imbs and Warcziag (2003) and it is explained in Appendix Section A. For visualization purposes, the lines are moving averages.

The results show that the re-specialization pattern at higher levels of income is much more pronounced the more aggregated data is used to compute the index. This also holds true for NNR countries, as can be seen in Figure 5.

Figure 5: Concentration and income, different disaggregation levels (NNR countries)



Note: This figure estimates the non-linear relationship between export concentration (using the Herfindahl-Hirschman Index based on two, three, and six digit HS categorization) and PPP-adjusted income per capita, for non-natural resource rich countries. The estimation follows the technique described in Imbs and Warcziag (2003) and it is explained in Appendix Section A. For visualization purposes, the lines are moving averages.

What are the implication of these results? It implies that while rich countries tend to concentrate in particular sectors, in terms of export varieties, they remain highly diversified, much more than poor countries. As more disaggregated data is being used to compute the level of concentration, the re-specialization pattern documented by IW disappears. Thus, it might be the case that the re-specialization pattern that has been documented by IW is, in fact, that the process of growth is associated with the development of highly diversified clusters of economic activity.

Looking at the bigger picture

A more careful analysis of the numbers ratifies the above visualizations. Table 1 summarizes the level of concentration in different percentiles of the income distribution: the 1st percentile, the median and the 99th for the HHI computed using two, four, and six digits of aggregation of exports data. The table also presents the ratio of the concentration level in the 99th to the 1st percentile of the income distribution. The column titled "All" uses all countries in the dataset while the column titled "NNR" uses only non-natural resource rich countries.

Table 1: HHI and income

	All	*NNR*
2 digits, p1	0.234	0.175
2 digits, p50	0.135	0.091
2 digits, p99	0.185	0.147
2 digits, 99th:1st	0.789	0.842
3 digits, p1	0.202	0.151
3 digits, p50	0.089	0.055
3 digits, p99	0.115	0.089
3 digits, 99th:1st	0.569	0.589
4 digits, p1	0.170	0.118
4 digits, p50	0.066	0.033
4 digits, p99	0.088	0.058
4 digits, 99th:1st	0.517	0.495
5 digits, p1	0.161	0.106
5 digits, p50	0.059	0.026
5 digits, p99	0.079	0.047
5 digits, 99th:1st	0.491	0.442
6 digits, p1	0.156	0.102
6 digits, p50	0.053	0.020
6 digits, p99	0.079	0.047
6 digits, 99th:1st	0.506	0.457

When looking at exports concentration computed using two digits categories, countries in the 1st percentile of the income distribution have, on average, an HHI of 0.23. Countries in the median of the distribution have an HHI of 0.135, while countries in the 99th percentile of the distribution have an HHI of 0.185, implying there is re-specialization at this level. The level of concentration for the countries in the 99th percentile of the income distribution is about 53 percent of that in the 1st percentile. A similar pattern occurs with NNR countries, where the re-specialization in the upper end of the income distribution reaches levels that are about 84 percent of the concentration in the bottom of the distribution.

However, as more disaggregated exports data is used to compute the HHI, the ratio of the concentration of income levels in the 99th percentile to income levels in the 1st percentile drops. At the four digit levels, the ratio is 51.7 percent for all countries and 49.5 percent for NNR countries, and at the six digit level these numbers become 50 percent and 45.7 percent, respectively. Thus, the evidence here suggests that, as more disaggregated data is used to compute concentration, the re-specialization pattern documented in the data becomes progressively less pronounced.

Concluding remarks

What is the relationship between structural transformation and economic development? This short note explores this question by revisiting some of the stylized facts that have been established in the literature. While economic theory suggests that specialization is a result of openness to trade, it is less clear what is the general equilibrium outcome of integration in the global economy. Naturally, the relationship between development and diversification is highly endogenous.

Diversification of a country's export basket might be both a cause and a consequence of the process of economic growth and development. The evidence in this note, however, suggests that after taking into account measurement peculiarities, re-specialization is not necessarily the norm among high income countries. Thus, in the presence of market failures that hinder diversification, there might be a place for public policy to overcome those failures. While the policies governments can implement to diversify their economies must be customized to address the particular context that defines each country, state or city, understanding the patterns in the data is crucial to devising them. Policies to boost diversification must be based on solving the market failures that hinder the emergence of new productive sectors. If market failures cannot be identified, then these policies are doomed to fail, as they did in the previous century in different emerging markets.

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Appendix

A Imbs and Warcziag (2003) methodology summary

I replicate the same methodology in IW, which estimates a non-linear relationship between levels of concentration and income per capita using country fixed effects. In particular, I estimate the average level of concentration *C* in a segment *s* of the income distribution according to following regression:

$$\hat{C} = \hat{\alpha}_s + \hat{\beta}_s \times x_s$$

Where *s* is a segment in the income distribution, in this case being \$5000, α_S represents the average intersect of the regression for segment *s*[2], β_S is the regressor of the income per capita term within the segment *s* and x_S represents the median of segment *s*. The regression is estimated for each segment in the income distribution of size *s* with an overlap of Δ which in this case is \$100. That is, for each data categorization (Harmonized System, Standard Industrial Trade Categories or the United Nations Industrial Development Organization database) and concentration index (Herfindahl–Hirschman, Gini, or Theil) there are more than 500 regressions. Simply put, the methodology estimates an average level of concentration for each range of the income per capita distribution, taking into account across country differences (by implementing a fixed effects estimator).

[2] Similarly to IW, it is the average of all "country dummies" regressors.