Uneven Growth in the Extensive Margin: Explaining the Lag of Agricultural Economies*

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December, 2018

Abstract

This paper documents that growth in the extensive margin is on average lower in the agricultural sector than in other activities. I introduce this new fact into a simple model of trade with expanding-variety growth, to show its relevance for regions specialized in the lagging sector. Diversity-loving consumers endogenously reduce the share of their expenditure devoted to that sector. The region specialized in it receives a decreasing share of world income, which results in diverging income and welfare trajectories with respect to the rest of the world. Appropriating a decreasing share of world value pushes downward the relative wage of the agricultural region and lowers the price of its exports relative to that of its imports, resulting in terms of trade deterioration. The prediction of falling terms of trade for the region specialized in the lagging agricultural sector is supported by empirical evidence and separates the results of my theory from those obtained in a similar model of uneven output growth between sectors. I present empirical evidence for the main testable results of the model. This theory is the first replicating these facts without the need of heterogeneous consumers or products, nor resorting to political or institutional explanations.

Keywords: diversification; agricultural economies; growth; welfare.
JEL Classification Numbers: F43, F62, O13, Q17.

*I gratefully acknowledge financial support from Fonds Nationale de la Recherche Scientifique, FRS-FNRS, grant FC 99040, Belgium. I am thankful to Raouf Boucekkine, Lorenzo Caliendo, David de la Croix, Swati Dhingra, Jonathan Eaton, Tim Kehoe, Florian Mayneris, John Morrow, Yasusada Murata, Peter Neary, Rachel Ngai, Gianmarco Ottaviano, Mathieu Parenti, Franck Portier, Víctor Ríos Rull, Kim Ruhl, Thomas Sampson, Gonzague Vannoorenberghe and seminar participants at the CEP Workshop in International Economics, IRES-Macro Lunch Seminar, ETSG Conference, CORE Brown Bag Seminar, DEGIT Conference, EDP Jamboree, Brown Bag Seminar at Humboldt University, Lunchtime Seminar in International Economics at Kiel IFW, Oxford Trade Student Workshop, RIDGE Workshop in Trade and Firm Dynamics, ECARES Seminar, GSIE Seminar, RIEF Conference and the Vigo Workshop on Dynamic Macroeconomics, for their valuable comments. Any remaining errors are my own responsibility.

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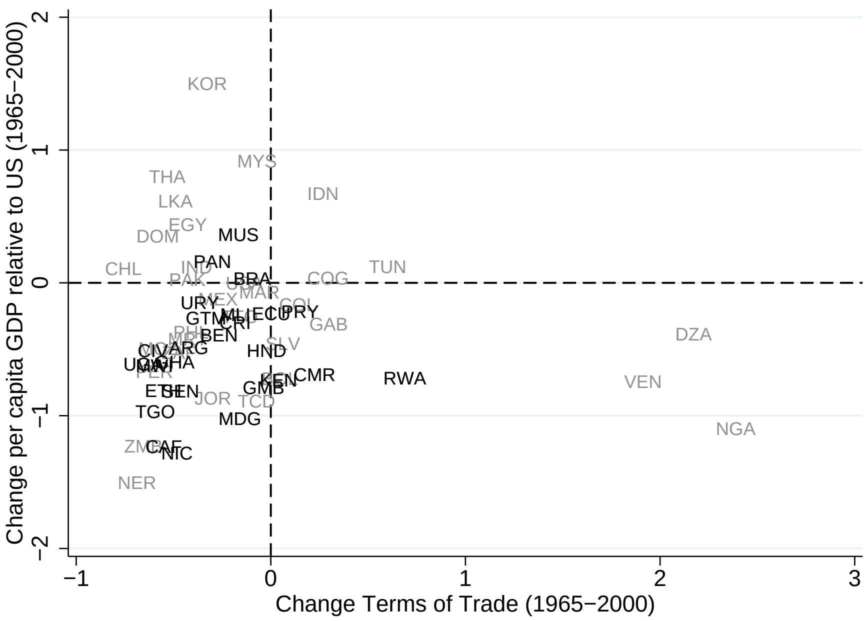
1 Introduction

Explaining differences in living conditions across countries in an increasingly globalized world demands considering the evolution of countries' output, but also the purchasing power of that output. Changes in the prices of exports relative to those of imports, usually referred as terms of trade, affect countries' consuming possibilities. Acemoglu and Ventura (2002) explain that economies experiencing fast output growth tend to suffer terms of trade deterioration, since they typically increase their export supply pushing the market equilibrium through a downward sloping demand so the price of their exports falls. At the same time, they increase their demand for imports potentially pushing their price up. The counterpart is terms of trade improving for slow growing regions. This terms-of-trade effect (TTE) is highlighted by the authors as a mechanism preventing income divergence. Theoretically, some degree of TTE would emerge as long as consumers perceive products from any two regions as imperfect substitutes, which implies that the demand for the exports of a given region is downward sloping. Empirically, while the TTE operates to some degree for a large sample of countries on average, the specific group of agricultural economies seem to escape this mechanism.

Figure 1: Change in real income relative to the US and terms of trade (1965-2000)



Notes: Change in terms of trade for the period 1965-1985 from Barro and Lee (1993) and for the remaining period from WDI. Data on real per capita GDP from PWT. Agricultural countries are signalled in bold and are defined as those for which exports of agricultural goods (A1 list in the Appendix) exceed 30% in 2000. Export data from Feenstra et al. (2005).

Economies specialized in agricultural production exhibit slow growth relative to the rest and terms of trade deterioration, further depressing their purchasing power, a combination that I will refer to as *reverse-TTE*. To show this in a simple way (I present further evidence in Section 3), Figure 1 plots the change in terms of trade against the change in real income (relative to the US) for each economy over a period of roughly 40 years.[1] A fully operational TTE would yield a negative relationship between these two variables. While the correlation for the full sample of countries is -0.07, it is clear that the group of countries with large shares of agricultural exports (in bold) contribute to a great extent against a stronger TTE, since almost all of them are located in the lower-left quadrant (the correlation for a sample ignoring these countries rises to -0.20). Given the relatively low growth in real income experienced by these economies, the fact that their terms of trade have not improve enough to shift their location to the rigth of the previous Figure, constitutes an important puzzle to explain. The finding that terms of trade movements depend on specialization patterns is of particular importance in the light of recent empirical literature attributing income differences to the sectoral composition of output between regions.[2] Understanding the driving forces behind this pattern becomes crucial to properly explain development problems faced by economies in which comparative advantage lies largely on the agricultural sector, most notably in South America and Sub-Saharian Africa. In this paper, I argue that lower product diversification in the agricultural sector can help explain the reverse-TTE found in the data for agricultural economies.

Economic development is characterized by productive capabilities being expanded in different dimensions. This paper focuses on what is arguably the least explored of these dimensions, i.e. the expansion of the set of goods produced, which can be referred to as the extensive margin of growth. My contribution is twofold. First, I present evidence showing that growth in the extensive margin is not balanced between sectors (see Section 4). Following the approach of Broda and Weinstein (2006) in accounting for different products, I show that diversification happens at consistently lower rates in agricultural activities. This result appears both in export and domestic production data. Moreover the result proves robust to the classification and disaggregation level in which the data are presented, and

[1]In Section A.1 I replicate and extend the exercise in Acemoglu and Ventura (2002), which implies controlling for steady state determinants, and highlight the particular position of agricultural economies. I also show that the TTE is independent of the size of the economy, which is compatible with an Armington world as the one set by Acemoglu and Ventura (2002) where consumers differentiate goods by country of origin.

[2]See for example Gollin et al. (2004), Caselli (2005) or McMillan and Rodrik (2011).

the definition of agricultural goods employed.

Second, I highlight the largely unexplored, but very intuitive role that uneven diversification can play to account for divergence enhanced by a reverse-TTE. For this, I include my new empirical result into a simple model of expanding varieties and trade. My theory abstracts from all other sources of growth, i.e. productivity growth, quality improvements and structural change, allowing growth only in the extensive margin. From this model, I derive the trend in terms of trade that is expected in a world where product diversification is uneven and no other mechanism is in place. The model comprises two regions (N and S) and each is completely specialized in one of two industries (M and A, respectively). Within each industry, firms develop new products every period and I allow the rate of product creation to be sector-specific. In a first stage, I show that if consumers devote fixed shares of their expenditure to both goods (as is often assumed implicitly in similar models) welfare divergence between regions cannot obtain, because fixed shares prevent any between-industry effect. As a result, diversification differences produce within-industry effects but have no impact on relative welfare between regions. However, when expenditure shares are endogenous, love for diversity may push consumers to increase their expenditure on the industry in which diversification is larger (say M), in both regions. Given the unbalanced nature of this version of the model, I analyse the asymptotic balanced growth path that results from it, and show that the total value of firms producing A decreases relative to those producing M, driving income and welfare in N to dominate that in S. Falling relative wages in S reduce prices of exports relative to imports, moving terms of trade against S, which further enhances the divergence process. In other words, my theory provides an explanation for the existence of a reverse-TTE, based on uneven growth in the extensive margin between regions.

A further contribution of my theory is shedding light on the main drivers of unbalanced product diversification between sectors. My model yields an expression for the sector-specific diversification rate and shows how both differences in the cost of product creation between industries, and in consumers' elasticities of substitution within sectors, can provide firms in the agricultural sector with less incentives to differentiate products.[3] The parameter conditions that need to hold for diversification to be unbalanced in detriment of the agricultural sector are supported by empirical evidence.

The present paper is related to different streams of the development literature.

[3]Future research exploring in depth the determinants of unbalanced diversification should be welcomed.

The classic literature on uneven sectoral growth usually focus on output growth, or growth in the intensive margin. A usual result is a TTE operating at least to some degree, since relative prices move in favour of the lagging economy creating a *substitution effect* of a magnitude that depends on the between-industry elasticity of substitution. If the elasticity is exactly one and consumers are set to devote a fixed fraction of their income to different goods, uneven growth across sectors yields relative price changes that exactly offset productivity differences, resulting in a one-to-one TTE. Exogenous shares is precisely what drives this effect in Acemoglu and Ventura (2002). But when that assumption is relaxed and consumers are allowed to shift expenditure shares across sectors following changes in relative prices, the effect depends on whether the elasticity of substitution is above or below unity (see Feenstra, 1996 or Ngai and Pissarides, 2007). When the parameter is greater than one (so goods are gross substitutes), these models reproduce a declining trend in the value sold by the lagging sector as the movement in relative prices less than compensate for changes in quantities. When the same parameter is below one (gross complements), uneven evolution of quantities is more than offset by relative price changes and the lagging economy increases its market share. Nevertheless, in all cases prices move to benefit the lagging economy, which contradicts the evidence for agricultural economies highlighted here. The present paper contributes to this literature by showing that a reverse-TTE can be obtained in an uneven development model if focus is placed on the extensive margin of growth.

Expenditure shifts against the agricultural sector could also be driven by an *income effect*. The empirical regularity that consumers tend to respond to rising income by reducing their expenditure share in basic needs (known as the Engel's law), drove several works to explore the macroeconomic consequences of non-homotheticities in preferences.[4] In these models, heterogeneous goods or consumers are responsible for shifts in consuming patterns. As the world economy grows and consumers get richer, they shift expenditure away from basic needs and towards more sophisticated products.[5] Although these contributions have enriched our understanding of the implications of consumer behaviour regularities on important macroeconomic patterns such as structural change, they have not

[4]See for example Matsuyama (1992, 2000), Kongsamut et al. (2001), Foellmi and Zweimüller (2008), Fieler (2011) Boppart (2014) or Caron et al. (2014).

[5]Section A.4 in the Appendix shows that including non-homothetic preferences into a simple model of uneven output growth is able to reproduce a reverse-TTE. Section 6 shows that some regularities that can be found in the data cannot be accounted for in such model, leaving room for uneven growth in the extensive margin to play a role.

provided a link between uneven technological improvements and biased preferences between sectors, thus treating these two sources of divergence in income as independent forces. This literature often assumes a high correlation between how goods rank according to the income elasticity of their demand and the technological differences in the production of each good (Assumption 2 in Matsuyama, 2000, makes it explicit). Such setting configures a suitable environment to reproduce a reverse-TTE, but no explanation is provided regarding why such correlation should be expected. Caron et al. (2014) explicitly bring attention to the lack of a theoretical link between goods' characteristics in the technological and preference sides. The model presented here is able to account for uneven expenditure paths between sectors (e.g. a declining relative expenditure on agricultural goods A), without resorting to product-specific income elasticities or household-specific preferences. My theory suggests that technological differences and consumers' expenditure shifts between sectors may not be orthogonal to each other, proposing a very intuitive link between the two.[6] The mechanism proposed here adds a technological component to the story since it is because diversification is uneven between sectors that diversity-loving consumers shift weights in their consumption across industries. Moreover, I provide a theory of why diversification rates differ across sectors, for which I also present empirical support. By doing this, I aim at contributing to explaining expenditure shifts against the agricultural sector.

The economic significance of expansion in the extensive margin has been documented in many previous works. Connolly and Peretto (2003) show that the number of firms in the US followed the impressive population growth of that economy over the XXth century. Broda and Weinstein (2010) highlight that 40 percent of household expenditure in the US is in new goods (i.e. products created in the last 4 years). Other works have emphasized the important magnitude that new products have in international trade. Hummels and Klenow (2005) report that the extensive margin is responsible for 60% of the difference in exported value between countries of different sizes. Kehoe and Ruhl (2013) show that a 10% increase in trade between two partners during the period 1995-2005 is associated with a 36% increase in the extensive margin, and the importance of that margin is increasing with the duration of the period analysed. Finally, other papers have emphasized the positive connection between openness and product creation. Feenstra and Kee

[6] This should not be interpreted as an argument against the existence of non-homothetic preferences, a feature for which plenty of evidence has been gathered. Rather, my model suggests that the declining share of worldwide value being captured by the agricultural sector may not be solely driven by such preferences, but also by the fact that diversification in this sector is relatively less prolific.

(2008) show that exporters to the US over the period 1980-2000 increased their exports in the extensive margin by 3.3%, a figure that matches their productivity growth over the period.

One of the earliest contributions on the relationship between diversification and terms of trade can be found in Krugman (1989). That work highlights the case of Japan during the period 1955-1965, a remarkable episode of fast output growth without falling terms of trade. Krugman's explanation is that, while the demand for what Japan exported at any given point in time could be considered relatively fixed, an important process of export diversification meant that the demand for Japan's exports was shifting outwards over time. This made possible for Japan to grow fast without necessarily seeing export prices falling.[7] The model presented here expands the framework in Krugman (1989) to a dynamic two-sector setting and focuses on between-industry differences given that the empirical evidence highlights important differences across sectors.

The current paper could be considered as complement to Acemoglu and Ventura (2002). While that work highlights that terms of trade can operate as a force for diminishing returns at the country level, i.e. terms of trade deteriorate for countries growing the most, it leaves room for this effect to be offset by changes in technology and the demand for goods that the country sells abroad. The mechanism put forward in the present paper provides justification for both, differences in growth rates across countries, and shifting expenditure shares between goods. Given that sectors expand at different rates, it is expected that long-term growth rates differ between countries as long as some degree of specialization remains. Moreover, uneven diversification can account for expenditure changes across sectors as stressed in the simple model presented here.

By showing that growth in the extensive margin is uneven and highlighting its consequences for development, this paper provides a new argument to the literature pointing at specialization as a source of welfare divergence. Potential development problems are underlined for regions that remain specialized in a lagging sector of the economy, and in this respect the present work is also related to the literature on structural change, which highlights moving away from original specialization as a key component of development.[8]

The rest of the paper proceeds as follows. Section 2 presents the data and

[7] More recently, Corsetti et al. (2013) present a model where product diversification can also offset terms of trade deterioration for a booming economy, but their model is set out to analyse what is known as the transfer problem, so focus is placed on effects through the capital account.

[8] A very long list in this literature would include Lewis (1954), Baumol (1967), Timmer (1988), Gollin et al. (2002) and Murata (2002), among many others.

definitions I use. Section 3 presents the main development fact that this paper aims at explaining, i.e. that while agricultural economies are on average outgrown by others with otherwise similar characteristics, their terms of trade tend to deteriorate (reverse-TTE). I review the existing literature and provide evidence specific to the group of countries that this paper targets. Section 4 documents that growth in the extensive margin is lower in the agricultural sector than in the rest of good-producing activities. This constitutes the main empirical contribution and provides the basis for the mechanism I put forward. Section 5 introduces a simple model of product creation and trade to explore the consequences of uneven growth in the extensive margin in an international setting. A first part imposes Cobb-Douglas preferences between industries to show that a setting in which too much structure on preferences is imposed does not reproduce welfare divergence between regions. A second part allows for endogenous expenditure shares between industries and replicates the main facts that emerge from the data. In Section 6 I compare testable predictions from the proposed model with those that obtain in a similar model with non-homothetic preferences. Finally, section 7 concludes.

2 Data and definitions

To show that growth in the extensive margin is uneven between sectors I use both international trade data and records on domestic production. International trade data have the advantage of being reported for a large sample of countries and long periods of time at good disaggregation levels, necessary for evaluating expansion in the extensive margin. Moreover, to consider how unbalanced diversification may impact terms of trade, it seems natural to focus not on production itself, but on the part of it that is traded across national borders. The primary source used here is UNCOMTRADE which gathers trade flows at the 5-digit disaggregation level (SITC Rev1) since the year 1962, thus providing a sufficient time span to evaluate long-term trends. To tackle potential issues of reliability of reporters I check these results with data presented in Feenstra et al. (2005) matching reports from exporters with those from importers using the raw UNCOMTRADE data, to establish consistent trade flows and presenting results at 4-digits (SITC Rev2).

Data at 5-digits allow for a decent distinction of goods. For example, it is possible to distinguish between code 02221 *Whole Milk and Cream* and code 02222 *Skimmed Milk*. More disaggregated data are available for shorter and more recent periods. Results are also reported using data at six-digits of the HS0 classification and also matching reports of exporters and importers for consistency, over the period 1995-2007, as reported by Gaulier and Zignago (2010) (BACI92 hereafter). Such disaggregation level allows further detail, e.g. we can identify code 040221 *Milk and cream powder unsweetened* $< 1.5\%$ *fat*. Besides the difference in time span covered and disaggregation level, there is a relevant difference between data classified using the SITC and HS systems: while SITC is constructed according to goods' stage of production, HS is based on the nature of the commodity. By using both I show the results are robust to the classification and the disaggregation level.

Records on domestic production are typically harder to collect and less comparable between countries. These data are recorded in domestic classifications, which are normally tailored to production, leaving little room for changes in the extensive margin. Nevertheless, I can present results for countries in the European Union and the US following an alternative approach, consisting in counting firms producing in each code at different moments in time, as is explained in detail below. Data from US firms come from the Census Bureau's Statistics of US Businesses (SUSB) which reports the number of producing firms by 6-digit sectors in the NAICS classification for the period 1998-2015. Data on producing firms in the European Union is collected by Eurostat: information for agricultural producers is extracted from the Agricultural Training of Farm Managers dataset covering years 2005, 2010 and 2013. Manufacturing firm records in the EU are reported for the period 2008-2015 in the Structural business statistics (SBS).

In what follows, focus is placed on primary goods of the non-extractive type, which I denote as A-goods, while countries specialized in these products are referred to as A-countries.

2.1 Characterizing A-goods

The reader can find in the Appendix the list of products classified here as A (Table A.2). Unlike a large part of the literature on the resource curse, I explicitly exclude from the analysis goods based on natural resources of the extractive type (E-goods from now on). The reason for this lies within the main characteristics of E-goods: the fact that they are non-renewable and the possibility of depletion, links their prices to fundamentals that are different from those driving prices of A-goods. As will be evident, the mechanism formalized in the model presented here does not consider these fundamentals.

A restrictive list of products, called $A1$, includes only narrowly defined non-manufactured goods of the non-extractive type. I also provide results for two broader alternatives as robustness checks: $A2$, which also includes basic chemical compounds intensively using primary inputs of non-extractive nature, and $A3$, which further incorporates manufactured goods intensive in the use of those resources. Given the nature of the analysis in this paper, it is important to state that none of the lists for agricultural products proposed here is a good proxy for homogeneous products.[9] Nevertheless, products classified here as agricultural are perceived by consumers as more substitutable than manufactured products. Using elasticities of substitution for 4-digit products presented by Broda and Weinstein (2006), I compare the mean and median elasticity of substitution within each group Ak and Mk (for $k = 1, 2, 3$, and where Mk is the set of all goods remaining when Ak and E are excluded). Results are reported in Table 1 and show both statistics being higher for A-goods. Moreover, notice that as the list for agricultural products gets broader and more inclusive, the mean and median elasticity of substitution is reduced.

Table 1: Summary statistics for the elasticity of substitution within each list of goods

k	Ak				Mk			
	mean	median	sd	Obs.	mean	median	sd	Obs.
1	9.851	3.509	20.713	184	5.596	2.527	13.245	491
2	8.954	3.442	19.398	213	5.743	2.527	13.628	462
3	8.335	3.390	18.134	248	5.839	2.527	14.100	427

Notes: Elasticities of substitution are as reported by Broda and Weinstein (2006) for four-digit SITCR2 classification. List of products Ak and Mk ($k = 1, 2, 3$) are as listed in the Appendix.

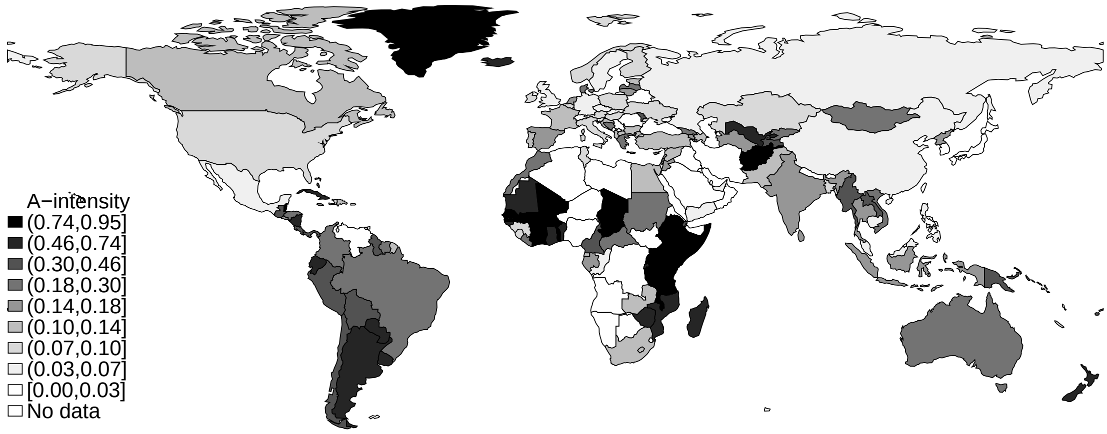
2.2 Characterizing A-countries

When looking at the share of A-goods in total exports, almost all countries show a decline over the last decades, a fact consistent with the structural change that the world economy has experienced during this period. Only 10 out of 165 countries show an increase in the importance of $A1$-goods in their exports during the period 1962-2000, the most salient cases being Venezuela and Bolivia for which the share

[9] Rauch (1999) classifies goods in three categories according to how homogeneous they are in world markets: homogeneous products are sold in centralized markets, partially-homogeneous products are sold in decentralized markets but reference prices exist for them, and products for which none of the previous conditions apply can be considered non-homogeneous. That work presents two of such classifications, a 'conservative' list that aims at maximizing the last set and a 'liberal' one doing the opposite. Comparing the lists for agricultural products defined here with all of Rauch's lists I find that the strongest correlation is 0.3941 (corresponding to our A2 list and the liberal list including both types of homogeneous goods together), while the smallest correlation is 0.2319 (between our list of A3 and Rauch's conservative list including only strictly homogeneous goods).

of those goods at the beginning of the period was very low (below 12% and 5% respectively). A similar trend is present when considering $A2$ and $A3$ goods. Figure 2 shows intensity of exports in $A1$-goods for the year 2000 in a world map. As can be seen in this figure, the number of countries that remain largely specialized in A-goods by the end of the period is not very large and comprises regions with an important comparative advantage in the production of these goods, being rich in fertile land and not densely populated.

Figure 2: Intensity of A-exports by country (2000)



Notes: The list of A1-goods was used for the construction of this figure (check Appendix). Data on exports from Feenstra et al. (2005).

Table A.3 in the Appendix shows that the probability of remaining highly specialized in agricultural goods is positively correlated with being an important exporter of those products at the beginning of the period and negatively correlated with initial levels of population density and trade openness. Other potentially relevant variables as the initial level of per capita income or the size of the government do not seem to play important roles in the process.

3 Reverse-TTE for agricultural economies

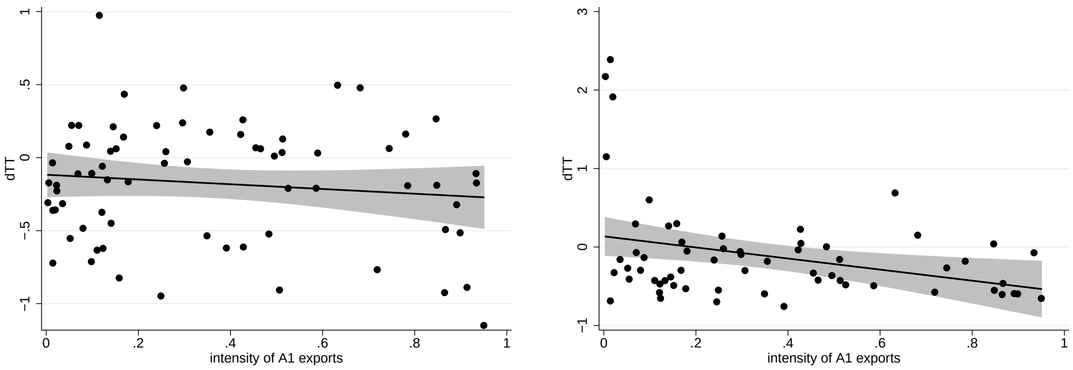
This section presents further evidence on the fact highlighted in Figure 1, showing that agricultural economies experience, on average, a reverse terms of trade effect. The literature on the resource curse has extensively shown that countries with large endowments of natural resources tend to exhibit lower growth rates than the rest (see for example Sachs and Warner, 2001 or Auty, 2007). Section A.5 in the Appendix provides in-depth evidence in support of such trend specifically for the subset of countries that this paper targets, i.e. those specialized in non-extractive primary products (A-countries). The evidence presented there is compatible with the well-known fact that economies that converge to the club of wealthiest countries in the world, do so by undergoing processes of structural change, i.e. reallocating resources from primary sectors towards more productive activities as they grow. Nevertheless, remaining specialized in a lagging sector should not automatically yield income divergence if a TTE was operational, i.e. if differences in output growth between sectors were compensated by relative price movements. Evidence showing A-countries' income diverging from the rest is enough to discard a one-to-one TTE, but it is not sufficient to refute the possibility of terms of trade improving for lagging economies, at least to some degree.

Concern regarding declining terms of trade for resource-intensive economies has been around policy circles for a long time. Since first stated several decades ago, the Prebisch-Singer hypothesis (see Prebisch, 1950 and Singer, 1950) was targeted by many empirical works. Most of these works focused on the evolution of the price of primary goods relative to manufactures.[10] Declining prices of primary goods relative to manufactures only yields falling terms of trade for economies that are net exporters of the first group of goods and importers of the second. Moreover, this position needs to remain sufficiently constant over time for changes in trade composition not to offset price movements. As explained before, many agricultural economies experienced important structural changes that affected the composition of their imports and exports over the period of analysis. This is probably why many of the papers analysing trends in relative prices are not conclusive regarding trends in terms of trade for agricultural producers (Grilli and Yang, 1988 and Sarkar and Singer, 1991 explicitly make this point). A further condition is that relative productivity changes between sectors do not compensate for price losses something that seems at odds with the evidence presented above.

In what follows, focus is placed on the evolution of terms of trade during the period 1962-2000 for A-countries. Given that the goal of this work is to explore the conditions under which an economy can experience income divergence due to its specialization, I need an environment that is sufficiently exempted from external shocks. In other words, the mechanism stressed here can only become evident in a world where some region specializes in A-goods, another specializes in the rest of the activities and expenditure paths follow a natural trajectory driven by trade patterns between these two regions over the long term. As it is well known, the years following China's trade liberalization program (after 2000), provided an

[10]See for example Grilli and Yang (1988), Ardeni and Wright (1992), Cuddington (1992), Harvey et al. (2010), Arezki et al. (2014) or Yamada and Yoon (2014).

Figure 3: Evolution of net barter terms of trade and intensity of A-exports



Notes: dTT is the change in the net barter terms of trade (as reported in the WDI) of each country and $A1$ corresponds to the $A1$ list of agricultural products in the Appendix. The figure in the left presents results with data from the period 1985 and 2000 using net barter terms of trade reported in WDI. The figure in the right extends the period using data from Barro and Lee (1993) for years between 1965-1985. Export data are from Feenstra et al. (2005) in both cases. The grey area reports the 95% confidence interval of the fitted line.

important shock in the relative price of primary goods to manufactured products, which is certainly disruptive to the mechanism highlighted here.

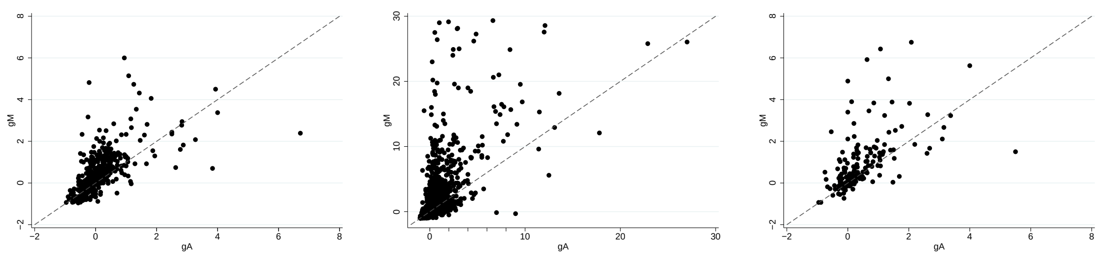
I use two different data sources: Barro and Lee (1993) report 5-year changes in net barter terms of trade for the period 1960-1985, while for the period 1985-2000 the index available in the World Development Indicators (WDI) can be used. In Figure 3, I plot the change in net barter terms of trade against the intensity of exports of $A1$-goods at the end of the period. The panel in the left considers total changes in the period 1965-2000 combining both available datasets. The panel in the right uses only the most recent data from WDI. According to both figures, it is not possible to state that terms of trade deteriorate for countries with a low share of A-exports. The fitted line shows a clear negative slope suggesting that larger shares of A-exports are correlated with a worst evolution of terms of trade. This negative correlation is significant at the 95% level when that share is relatively high (i.e. greater than 40% when considering the entire period and 25% when only the last 15 years are considered) for $A1$ products. A very similar picture arises using the broader classifications for A-products: $A2$ and $A3$. I also evaluate the robustness of this relationship for alternative periods finishing in years 1995, 2005 and 2010. The change in terms of trade is still declining in the intensity of agricultural exports, but when the period after 2000 is included the slope becomes less steep. In fact, considering the period until 2010, the hypothesis that the change is different from zero cannot be rejected even for largely agricultural economies (see Figure A.3 in the Appendix). This is the result of the aforementioned improvement in terms of trade for agricultural economies in the period 2000-2010, following China's entering world markets.

According to the evidence presented here, agricultural economies have experienced a reverse terms of trade effect since a relatively slow real income growth is not offset but rather enhanced by terms of trade movements. Section 5 shows that the puzzle of a reverse-TTE for agricultural economies can be explained in a simple model of unbalanced growth in the extensive margin, as consumers shift their expenditure away from primary products following their taste for diversity. The mechanism I put forward there relies on one key assumption: diversification rates are different between sectors, being lower in agricultural activities. Therefore, it is important to empirically evaluate that assumption.

4 Uneven growth in the extensive margin

The rate at which countries diversify their production is significantly unbalanced in detriment of agricultural goods. To show this, I compare diversification rates in both industries (g_A and g_M respectively) for each country. In the main exercise, I follow Broda and Weinstein (2006), in defining a good as a code in a classification.[11] Then, each diversification rate is computed here as $g_{ckt} = (n_{ckt+dt} - n_{ckt})/n_{ckt}$, i.e. the percent change of the number of goods exported with positive value (n), by a country c, in industry $k = A.M$, over a certain period of time dt.

Figure 4: Diversification rates in M and A goods for each country (g_{A1} and g_{M1})



Notes: Diversification rates g_{A1} and g_{M1} are computed as the percent change in the amount of different goods exported by a country in a certain period, using the list of A1 goods in the Appendix. Each dot represents a pair (g_{A1},g_{M1}) for one country in each sub-period. The figure in the left, centre and right, uses the datasets at 4, 5 and 6 digits respectively.

In Figure 4, I plot the resulting rates for periods of ten years along with a 45-degree line and consider A1-goods, defining M1-goods as all those not classified as

[11]It must be noted that even at the highest disaggregation level, the exercise of counting codes in a classification constitutes only an approximation to growth in the extensive margin. Any code is in reality a bundle of goods defined ex-post so there can always be new production within an already counted code, which this approach is overlooking.

A1 or E products. The graph in the left uses 4-digit exports from Feenstra et al. (2005), the one at the centre presents results using 5-digits UNCOMTRADE data, and that at the right is based on 6-digit export data from BACI92. Inspection of these figures show that while both rates are normally positive, the rate of diversification in manufactures tends to be larger than that in non-extractive primary goods.[12]

I perform several mean tests, where the null hypothesis is that on average $g_A = g_M$. These tests reject $g_A = g_M$ and $g_A > g_M$, but not $g_A < g_M$, at a 1% confidence level. Table 2 shows the results of testing $g_{Mk} = g_{Ak}$ for $k = 1, 2, 3$ using each of the export datasets. For the construction of this Table some outliers were dropped. A similar table in the Appendix (Table A.13) shows results for all observations. Notice that, in all cases, the hypothesis of equality and inequality in favour of g_A can be rejected with high significance, while the alternative hypothesis of $g_{Ak} < g_{Mk}$ cannot be rejected.

Table 2: Testing for differences in diversification rates

	4-digits			5-digits			6-digits		
$gMk = gAk$	$k=1$	$k=2$	$k=3$	$k=1$	$k=2$	$k=3$	$k=1$	$k=2$	$k=3$
mean(gM)	0.681	0.673	0.653	0.379	0.362	0.368	0.766	0.770	0.754
sd(gM)	5.599	5.478	4.935	1.013	0.981	0.998	1.264	1.281	1.218
mean(gA)	0.210	0.233	0.270	0.162	0.192	0.198	0.375	0.393	0.428
sd(gA)	1.668	1.725	1.997	0.516	0.551	0.559	0.806	0.759	0.812
Obs.	559	559	559	4,679	4,674	4,658	219	219	217
$Ha : gM < gA$	0.996	0.995	0.998	1.000	1.000	1.000	1.000	1.000	1.000
$Ha : gM \neq gA$	0.008	0.009	0.004	0.000	0.000	0.000	0.000	0.000	0.000
$Ha : gM > gA$	0.004	0.005	0.002	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Each column presents the result of a mean-comparison t-test, where the null hypothesis is $g_{Mk} = g_{Ak}$ for $k = 1, 2, 3$ as listed in the Appendix. The first and third row give the mean of g_{Mi} and g_{Ai} respectively, while the second and fourth provide the respective standard deviation. The last three rows show the p-value of a t-test for different alternative hypothesis.

Given that the diversification rates are computed by counting codes in a given classification, they are sensible to how the classification is built. If one of the broad sectors defined here (A and M) is split into many more codes than the other in the classifications used here, balanced product creation between sectors could artificially appear uneven in these exercises. To reach results that are less dependent on how classifications distribute codes, I proceed to compute diversification rates for a given sector as the simple average of diversification rates in each 2-digit product line belonging to that sector. It is expected that results from this

[12] Diversification rates using 4-digit exports from Feenstra et al. (2005) are computed for 10-year periods starting in 1962, 1972, 1982 and 1991. Rates using 5-digits UNCOMTRADE data are calculated for each 10-year period starting between 1962-2004. Finally, rates for 6-digit data from BACI92 are constructed for only one 13-year period starting in 1995.

exercise are less affected by a biased availability of codes for each industry. Table 3 shows the outcome of this exercise, further providing support to the previous finding.

Table 3: Testing for differences in diversification rates (within 2-digit lines)

	4-digits			5-digits			6-digits		
$gMk = gAk$	$k=1$	$k=2$	$k=3$	$k=1$	$k=2$	$k=3$	$k=1$	$k=2$	$k=3$
mean(gM)	0.530	0.541	0.540	0.625	0.608	0.622	1.302	1.310	1.352
sd(gM)	1.398	1.606	1.604	1.553	1.521	1.593	2.651	2.653	2.611
mean(gA)	0.266	0.285	0.314	0.313	0.354	0.393	1.021	1.052	1.080
sd(gA)	0.649	0.705	0.764	0.666	0.791	0.872	1.917	1.949	2.220
Obs.	562	562	561	491	490	489	876	879	884
$Ha : gM < gA$	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
$Ha : gM \neq gA$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Ha : gM > gA$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

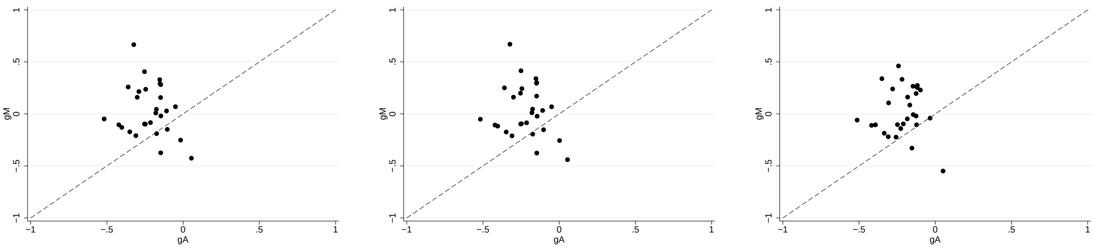
Notes: Each column presents the result of a mean-comparison t-test, where the null hypothesis is $g_{Mk} = g_{Ak}$ for $k = 1, 2, 3$ as listed in the Appendix. The reported diversification rate in each sector (A and M) is the simple average of diversification rates computed within every 2-digit line belonging to that sector. The first and third row give the mean of g_{Mk} and g_{Ak} respectively, while the second and fourth provide the respective standard deviation. The last three rows show the p-value of a t-test for different alternative hypothesis.

A similar pattern arises when varieties are considered instead of products. The literature on trade with differentiated varieties often treats varieties as pairs of goods and country of origin, under the assumption that consumers tend to perceive product-origin pairs as imperfect substitutes (following the Armington approach). The diversification rate of varieties within each broad industry (A and M) is computed for each year in the database. This approximates the yearly change in the availability of varieties for a *global consumer*, i.e. one that can shop around the world. Comparing these rates gives the same results as obtained before (see Table A.14), further supporting this result.

Finally, it is possible to see the same regularity emerging in domestic production data. Using the data described in Section 2, I compute diversification rates in each sector by counting firms producing in each of them, within the EU and the US. Given the limited time frames of these data, I compute one observation per country using the information at the first and last year available, resulting in 29 observations. Raw results are presented in Figure 5 and mean tests are shown in Table A.15. The observation that $g_A < g_M$ holds with domestic production data helps rule out the possibility of the regularity being exclusively driven by M-goods being more tradeable than A-goods.

The fact that growth in the extensive margin happens at a lower rate in the agricultural sector than in manufactures is compatible with a growing literature arguing that technological linkages between production lines are not uniformly

Figure 5: Diversification rates in M and A goods for each country (g_{Ak} and g_{Mk}) using domestic production data for EU countries and the US



Notes: Diversification rates g_{Ak} and g_{Mk} ($\forall k = 1, 2, 3$), are computed as the percent change in the amount of different goods exported by a country in each industry Ak and Mk, at the beginning and end of a certain period, defined by data availability from Eurostat and the US Census Bureau. Each dot represents a pair (g_{Ak},g_{Mk}) for one country in each sub-period. The figure in the left, centre and right, defines agricultural goods using lists A1, A2 and A3 respectively as defined in the Appendix.

distributed. For example, evidence in Hidalgo et al. (2007) and Hausmann and Hidalgo (2011) supports the notion that technological proximity among manufactures is much greater than that among primary activities, suggesting that it may be easier for diversification to happen in the former industry rather than the latter. In a different vein, Koren and Tenreyro (2007) argue that industry-specific volatility is a very important factor preventing diversification in developing economies. These elements may help explain uneven diversification between sectors. The model in the next section provides a theory for which factors determine diversification and how they interact with each other.

Bilateral trade flows data allow to evaluate the dynamics of the extensive margin of imports for the different sectors. Given that the mechanism put forward in this paper relies on consumers shifting expenditure shares away the agricultural sector due to lagging diversification, we should expect a decreasing number of different agricultural goods being imported by most countries relative to manufactures. This is actually one of the predictions that can be derived from the model in the next section. When analysing the evolution of countries' import diversification a positive time-trend is found for the entire list of products, meaning that on average, countries tend to buy an increasing diversity of products from abroad. However, the proportion of differentiated A-goods imported shows a clear downward trend.

Table 4 shows the results of panel regressions where a time-trend and country fixed-effects are the main regressors and the dependent variable is the ratio defined as the number of different Ak-goods to the total number of products imported (for $k = 1, 2, 3$). Results are presented for the baseline group of A-goods (A1) in column

Table 4: Trends in import diversification

Dependant variable:	Ratio A1 (1)	Ratio A2 (2)	Ratio A3 (3)
year	-0.007***	-0.008***	-0.011***
	(0.000)	(0.000)	(0.000)
Constant	15.156***	15.877***	21.397***
	(0.332)	(0.341)	(0.367)
Country-FE	Yes	Yes	Yes
Obs.	5688	5688	5688
R^2	0.265	0.272	0.369

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Standard errors in parenthesis. Ratio Ak is the number of imports from the Ak group to the total number of imports (with $k = 1, 2, 3$). Each ratio is computed using 4-digit data from Feenstra et al. (2005) for each year of the period 1962-2000.

1 and for the two alternative groups proposed here (A2 and A3) in columns 2 and 3. They show significantly negative trends for the ratio considering any selected group.

5 Theory

In this section I present a theory in which product creation is the only source of growth and economies are open to trade. Such setting allows me to explore the macroeconomic consequences of uneven product creation across sectors and, in particular, it will allow me to show how this fact can play a key role in explaining income divergence enhanced by deterioration in terms of trade for agricultural economies. Time is continuous and the world is composed of two regions (denoted $c = N, S$) and two sectors ($i = M, A$).[13] In both sectors, technology is such that labour is the sole input and each region is endowed with an amount L_c of labour. Each region is perfectly specialized in one industry: region N produces M-goods and region S produces A-goods.[14] Every firm in each industry undertakes two activities: they engage in R&D efforts to develop a new product and then

[13]Departing from one sector models (as in Feenstra, 1996) provides this setting with a more natural context for the absence of spillovers between countries, which constitutes an important feature of uneven development models. Instead of assuming away international spillovers, in the present model the absence of international spillovers is based on the difference in specialization between regions and industry specific spillovers.

[14]Although not necessary for my mechanism to hold, this assumption simplifies greatly the exposition. Excluding the possibility of structural change, which in reality constitutes an important driver of development, helps highlight the role played by uneven growth in the extensive margin. Specialization could be originally rooted in an asymmetric distribution across regions of a specific factor of production not included in the model (i.e. fertile land).

they use that knowledge and labour to produce and sell their product. Their R&D efforts generate a private return but also spillovers to other firms within the industry. Firms within a given sector are homogeneous. There is no population growth and labour cannot move between regions. Financial resources are also constrained within boarders, an assumption that brings the present setting closer to comparable models (in particular to Acemoglu and Ventura, 2002). Finally, there are no frictions to international trade.

5.1 Consumers

Consumers from country c face three choices at each moment t. First, they choose how much to consume and save, i.e. they decide their optimal expenditure level $E_c(t)$ for a given income $I_c(t)$. Aggregate expenditure in region N is set as *numeraire* ($E_N = 1$). Then, they choose how much to spend in each industry, i.e. $E_{ci}(t)$ with $E_c(t) = E_{cM}(t) + E_{cA}(t)$. In the third stage, consumers split their industry-specific expenditure among the different products of that industry available at each t.

Welfare in country c at t is defined as the present value of future consumption of the final good composite $Q_c(t)$, that is:

$$U_c(t) = \int_t^{\infty} e^{-\rho(s-t)} \ln\left[Q_c(s)\right] \mathrm{d}s \qquad (1)$$

where $\rho > 0$ is the rate of pure time preference and is the same for individuals in both regions. At every moment in time t, consumers maximize (1) subject to the budget constraint $Y_c(t) = E_c(t) + S_c(t)$ where $Y_c(t)$ is income, $S_c(t)$ are savings and $E_c(t) = Q_c(t)P_c(t)$ being $P_c(t)$ the price index of the composite. Each of the L_c consumers in country c is endowed with one unit of labour which is inelastically supplied in the labour market in return for a wage w_c. Consumers also receive the returns on their past savings at rate $r_c(t)$. The conditions for an optimal expenditure path arising from this dynamic problem are a transversality condition and the following Euler condition

$$\frac{\dot{E}_c(t)}{E_c(t)} = r_c(t) - \rho \qquad (2)$$

which establishes that the consumption path will be increasing (decreasing) whenever the interest rate is greater (smaller) than the time preference parameter.

Once consumers have established their optimal level of aggregate consumption, they choose how much to spend in each industry $i = M, A$, with a constant elasticity of substitution $\beta > 0$ between the composite of each industry driving their preferences:

$$Q_c(t) = \left[\omega_M Q_{cM}(t)^{(\beta-1)/\beta} + \omega_A Q_{cA}(t)^{(\beta-1)/\beta}\right]^{\beta/(\beta-1)} \tag{3}$$

with $\omega_i > 0$ representing consumers' taste for the composite of industry i and $\omega_M + \omega_A = 1$. The previous is a simple version of a heavily used specification for between-industry preferences. By using this function I show that, focusing on uneven product creation, the present model is able to provide a technologically driven explanation for a reverse-TTE, even within a framework that has been explored extensively in the past, and dispensing heterogeneous agents or goods.

Let me denote $\alpha(t)$ the share of expenditure devoted to the A-good, i.e.:

$$E_{cA}(t) = \alpha(t)E_c(t) \quad \text{and} \quad E_{cM}(t) = [1 - \alpha(t)]E_c(t) \tag{4}$$

so the aggregate price index can be written as:

$$P(t) = \left[\omega_A \left(\frac{\alpha(t)}{P_A(t)}\right)^{(\beta-1)/\beta} + \omega_M \left(\frac{1-\alpha(t)}{P_M(t)}\right)^{(\beta-1)/\beta}\right]^{\beta/(1-\beta)} \tag{5}$$

At each t, consumers must decide how much of their expenditure in industry i is spent in each product θ belonging to the set $\Theta_i(t)$ of available products in that industry ($i = M, A$). Free trade implies that the set $\Theta_i(t)$ is the same in both regions $\forall i = M, A$. Consumer preferences over products within a given industry are CES, with $\sigma_i > 1 \forall i = M, A$ as the constant elasticity of substitution between any two products. This, together with Dixit-Stiglitz competition in the market of final goods (see Dixit and Stiglitz, 1977) yields:

$$\begin{aligned} Q_{ci}(t) &= \left[\int_{\theta\in\Theta_i(t)} q_{ci}(\theta,t)^{1-1/\sigma_i} \mathrm{d}\theta\right]^{1/(1-1/\sigma_i)} \\ P_{ci}(t) &= \left[\int_{\theta\in\Theta_i(t)} p_{ci}(\theta,t)^{1-\sigma_i} \mathrm{d}\theta\right]^{1/(1-\sigma_i)} \end{aligned} \tag{6}$$

where $q_{ci}(\theta, t)$ and $p_{ci}(\theta, t)$ represent quantities demanded and price paid in c for each product θ of industry i at time t. Without trade costs, the price charged for a certain product is the same in every market so $p_{ci}(\theta, t) = p_i(\theta, t)$ $\forall \theta \in \Theta_i(t)$, which gives $P_{ci}(t) = P_i(t)$, $\forall i = M, A$ and $\forall t$. Consumers from different regions of the world have the same preferences, which is reflected here by the fact that ρ, β,

ω_i and σ_i, are not country-specific. This gives $P_c(t) = P(t)\ \forall c = N, S$. In words, the price index faced by consumers in both regions of the world are the same. This means that any difference in consuming possibilities between regions is going to be rooted in their respective expenditure paths. Finally, global expenditure is the sum of expenditure in each region of the world $E(t) = E_N(t) + E_S(t)$.

5.2 Producers

The setting for producers within each country, resembles that in the standard model of endogenous growth with expanding product varieties and knowledge spillovers in Grossman and Helpman (1991, section 3.2). Any potential entrant to industry i must develop a blueprint for producing good θ which implies incurring in a one-time sunk cost that is independent of future production. The fact that it is costless for producers to differentiate their production, together with all products entering within-industry preferences symmetrically, give firms no incentives to produce a good that is produced by a competitor. Moreover, there are no multi-product firms, so firms and products are matched one to one. Once in business, a firm continues to produce forever. After sinking the cost of developing a product, a firm can perfectly estimate their expected stream of income. Since only one sector operates in each region I can spare the use of the country sub-index in this section.

Technology in each industry i is represented by a linear cost function where labour is the sole input and there are no fixed costs. Dixit-Stiglitz competition in the final good sector implies that every firm in i sets the same price of

$$p_i(t) = \frac{\sigma_i w_i(t) z_i}{\sigma_i - 1} \tag{7}$$

In the previous expression, $z_i > 0$ is the marginal cost in terms of labour of final good production in sector i.[15] Changes in parameter z_i reflect changes in efficiency in the production of final goods in that sector. Since the current model abstracts from this source of growth I assume $z_i = 1 \forall i = M, A$ for simplicity.

The assumption of homogeneous firms in sector i, together with expression (6) gives

$$Q_i(t) = n_i(t)^{\sigma_i/(\sigma_i-1)} q_i(t) \quad \text{and} \quad P_i(t) = n_i(t)^{1/(1-\sigma_i)} p_i(t) \tag{8}$$

where $n_i(t)$ is the number of existing products in industry i at time t.

[15] Regions' full specialization in this model could be rationalized by assuming that $z_{A,N} \to +\infty$ and $z_{M,S} \to +\infty$, while maintaining $z_{M,N} = z_{A,S} = 1$.

Consumer's love for diversity and the absence of trade costs, results in all firms of industry i being present and enjoying the same market share in both regions $1/n_i(t)$. The pricing rule in (7) implies that each firm has a markup over its sales of $1/\sigma_i$ so aggregate operating profits in sector i are $\Pi_i(t) = [E_{Ni}(t) + E_{Si}(t)]/\sigma_i$ and operating profits of any single firm within that sector are

$$\pi_i(t) = \frac{E_{Ni}(t) + E_{Si}(t)}{n_i(t)\sigma_i} \tag{9}$$

The previous expression can be used to write the present value at time t of a firm in sector i as

$$v_i(t) = \int_t^\infty e^{-[R_i(s)-R_i(t)]}\pi_i(s)\mathrm{d}s \tag{10}$$

where $R_i(t)$ is the cumulative discount factor for profits that firms in i consider at t. Equilibrium in the capital market requires the returns from investing in financing the production of final goods to equal those of a risk-free loan. The returns at t of owning all shares of a firm from sector i over a period dt, equal the operating profits made plus the eventual capital gains during that period, i.e. $[\pi_i(t)+\dot{v}_i(t)]dt$. If the same amount is instead placed as a loan for the same period of time, the return equals $r_i(t)v_i(t)dt$. No arbitrage opportunities in the financial market imposes equality between the two options which yields the following no-arbitrage condition:

$$\pi_i(t) + \dot{v}_i(t) = r_i(t)v_i(t) \tag{11}$$

A firm developing a final product in industry i generates its own private return by acquiring the right of selling its product forever. But the activity of product creation also generates spillovers in the form of knowledge within that industry. In other words, the fact that previous firms have created products in the past reduces the cost of future developments. Knowledge spillovers are crucial for the model to reproduce sustained growth in equilibrium. Product creation in industry i follows

$$\dot{n}_i(t) = \frac{L_{R,i}(t)K_i(t)}{a_i}$$

where $L_{R,i}(t)$ represents the amount of labour devoted to the creation of products and $K_i(t)$ is the level of knowledge in industry i. This stock of knowledge is the measure of spillovers within sector i and the larger it is, the more productive are resources devoted to research in that sector. I follow Grossman and Helpman (1991) (and many others including Feenstra, 1996) in setting $K_{ci} = n_i$. That is, the stock of knowledge is equal to the amount of products existing in that industry, which is a simple way to introduce learning-by-doing at the industry level. Industry-specific spillovers, together with the assumption of regions fully specialized in different sectors, implies there are no international spillovers. Finally, $1/a_i$ represents the part of efficiency in R&D activities of industry i that is independent of spillovers.[16] Then, defining the diversification rate in i as $g_i(t) = \dot{n}_i(t)/n_i(t)$, I reach

$$g_i(t) = \frac{L_{R,i}(t)}{a_i} \tag{12}$$

From here on, I denote the growth rate of any other variable X as $g_X = \dot{X}/X$.

Finally, free-entry into production of final goods imposes the following free-entry condition:

$$\frac{w_i(t)a_i}{n_i(t)} = v_i(t) \tag{13}$$

The left-hand side of this expression represents the cost of developing a new product in sector i at moment t, while the right-hand side constitutes the discounted value at time t, of being able to sell that product in the final goods market.

5.3 Instantaneous equilibrium

At any moment t the vector $[E_c, v_i, n_i]$ is given by history according to dynamic equations (2), (11) and (12) respectively. Optimal saving decisions determine the amount of resources that can be spent in t. Past investing decisions determine the evolution of firms' value. Finally, the path of optimal allocation of labour between activities in each region determines how many products are developed within each industry in every period, and therefore the set available for consumption in both economies at t. Given a value for that vector, the instantaneous equilibrium of the model implies solving for the rest of the endogenous variables. The free-entry condition in (13) gives the wage rate (w_i). Marginal costs are fully known by firms so they can set optimal prices p_i following (7), and (8) gives the industry price level P_i. Given between-industry preferences (3), the following expression for the share of expenditure in the agricultural sector is obtained:

$$\alpha = \left[\left(\frac{\omega_M}{\omega_A} \right)^{\beta} \left(\frac{n_A^{1/(1-\sigma_A)} p_A}{n_M^{1/(1-\sigma_M)} p_M} \right)^{\beta-1} + 1 \right]^{-1} \tag{14}$$

[16] A very intuitive way to endogenize parameter a_i is to introduce firm heterogeneity in the model, in the vein of Baldwin and Robert-Nicoud (2008) or Ourens (2016). In those works, efficiency in the development of new products depends on average efficiency in the production process in the industry.

The share α is determined by the proportion of A-products in the set of all consumption goods (weighted by a function of the elasticity of substitution within industry σ_i) and by its relative price. When goods from different industries are substitutes from one another, i.e. $\beta > 1$, a greater number of A-goods available or a lower relative price yields expenditure shift towards A-goods in detriment of M. On the other hand, when products of different industries are perceived as complements, i.e. $\beta < 1$, then the same conditions imply an increase in the expenditure share devoted to M in detriment of A. The share of A-goods in world expenditure is time-variant since the number of products of each industry available to consumers at every t can change over time and so can relative prices, which follow wage movements. The only exception is when $\beta = 1$ in which case α is a parameter and expenditure shares in each industry are constant.

Knowing α, equation (5) gives the aggregate price level P. Moreover, firms in industry i are able to compute how many profits (π_i) they make (by 9), so they can take fully informed producing decisions. Firms consider demand conditions for their production decisions, so the market for each product clears. A given level of expenditure for consumers automatically gives the level of consumption in each industry, by (4), and in each product by (8).

Equilibrium in the labour market imposes that the amount of resources used in the development of products and in their production equals its fixed supply L_c, at each economy. By (12), the amount of labour used in product development equals $L_{R,i} = g_i a_i$. For final good production, each firm in industry i requires a quantity of labour of $L_{F,A} = \alpha E/n_A p_A$ and $L_{F,M} = (1-\alpha)E/n_M p_M$, so the total amount of labour used in industry i equals n_i times that amount, $\forall i = M, A$. This gives the following labour market clearing conditions

$$g_A a_A + \frac{\alpha E}{p_A} = L_S \ , \ g_M a_M + \frac{(1-\alpha)E}{p_M} = L_N \qquad (15)$$

The above conditions give the allocation of resources to both final good production and R&D activities which, by (12), yields the growth rate of products in each industry. Merging (15) with the free-entry condition in (13) and equations (7) and (9) I get:

$$g_i = \frac{L_i}{a_i} - (\sigma_i - 1)\frac{\pi_i}{v_i} \qquad (16)$$

Trade balance at every t requires exports of one region to match exports of the other, i.e. $E_{S,M} = E_{N,A}$ which, by (4) yields the following condition:

$$\frac{\alpha}{1-\alpha} = \frac{E_S}{E_N} \tag{17}$$

The instantaneous equilibrium in the model resembles that in the static model of Krugman (1989), the main difference being that the present model allows for different elasticities among the sectors and wages between countries, resulting in price differences between industries. The full solution of the model, developed in the next section, entails finding the values for ($g_{E,c}$, $g_{v,i}$ and r_c) at t which give the values for the vector (E_c, v_i, n_i) in the future.

5.4 Dynamics of the model

The choice for the numeraire immediately gives $g_{E,N} = 0$, $r_N = \rho$ (by 2) and $g_{v,M} = \rho - \pi_M/v_M$ (by 11). As explained in the Appendix (see Section A.8), a solution with both positive product creation and final good production requires the following condition to hold:

$$g_i = \frac{\pi_i}{v_i} - \rho \tag{18}$$

Merging (18) together with equation (16) yields:

$$g_i = \frac{L_i}{a_i\sigma_i} - \frac{\sigma_i - 1}{\sigma_i}\rho \tag{19}$$

Products are created at constant rates in both industries so the path for new varieties at equilibrium follows $n_i(t) = n_i(s)e^{(t-s)g_i}$. For the model to reproduce positive growth I assume that the allocation of resources towards the development of new products is positive. Equation (19) provides a microfounded explanation of why diversification can differ across sectors. The diversification rate in any industry depends positively on the size of the producing economy (L_i). In other words, the model features a scale effect that is common in the literature. Diversification happens at a higher pace when product creation requires less units of labour (lower a_i), i.e. when efficiency in the R&D sector is larger. A smaller elasticity of substitution within industry σ_i also contributes to larger sectoral diversification since lower substitutability increases firms' operating profits, ultimately increasing entry. Intuitively, firms face reduced incentives to develop new products in a given industry when consumers perceive goods in that industry to be highly replaceable by other goods within the same industry.

The model yields uneven growth in the extensive margin when diversification rates are different between sectors. Given the evidence presented in Section 4, the analysis that follows is constrained to the case in which $g_A < g_M$ holds, so I impose the following assumption:

Assumption 1 *Assume* $\frac{L_A}{a_A} - \frac{\sigma_A L_M}{\sigma_M a_M} < \rho(\sigma_A - 1)\left[1 - \frac{(\sigma_M-1)\sigma_A}{(\sigma_A-1)\sigma_M}\right]$*, such that* $g_A < g_M$.

Notice that Assumption 1 is the only asymmetry imposed between sectors and therefore regions. For this assumption to hold, either $\sigma_A > \sigma_M$, $L_A < L_M$, $a_A > a_M$, or a combination of some of these conditions need to hold. I do not impose any of these particular conditions since the results of the model do not require any more structure to replicate the facts targeted here.

Empirically, results in Table 1 suggest that the elasticity of substitution within each industry is much higher in the agricultural sector (the median σ_A is around 35% larger than the median σ_M), which can partially explain the result $g_A < g_M$. Inspection of Figure 2 hints that population in agricultural economies is much lower than in the rest, which provides scale economies that also contribute to this outcome. Even considering the largest list of agricultural economies, the population advantage in non-agricultural economies is larger than 50% in the year 2000. Finally, while there is no direct evidence regarding relative efficiency in product development between sectors, recent empirical evidence has shown that diversification is likely to be easier in labour and knowledge-intensive sectors where production processes may be more flexible to allow new developments. Hidalgo et al. (2007), suggest a measure of technological proximity between any two products based on the probability that both are exported by the same country. I use their proximity indicator as an approximation to the inverse of the cost of diversification, and compute the average proximity that a good belonging to sector $i = A, M$ has with all other goods (see Table A.16 in the Appendix). I find a lower average proximity for A, suggesting that the distance between a representative A-good and any other good in the product space is larger than that of the representative M-good. According to this result diversification possibilities are more costly in the former than in the latter industry. Table A.17 shows results for average proximity between a representative good in industry i and all other goods belonging to the same industry. The fact that the average proximity is lower in A in this exercise suggests that within industry diversification is also more costly in the agricultural sector. This could constitute primary evidence supporting $a_A > a_M$. Overall, it is not impossible that all three of the conditions on σ's, L's and a's making

Assumption 1 hold, may be contributing together to explain the relative lag in diversification within the agricultural sector that was documented in Section 4.

It is important to notice at this point that, as highlighted in Acemoglu (2009, section 13.4), an equilibrium path with uninterrupted introduction of products yields growth in real income. Although the present model does not feature improvements in the productive process of firms, the fact that consumers have love for diversity implies that an ever-expanding set of products increases consumer's utility over time. In this sense, whenever this model reproduces increasing living conditions, it resembles models of output growth.[17]

5.4.1 Case with exogenous shares of expenditure between industries

While the mechanism put forward by this model is fundamentally technological, this section shows that uneven diversification rates between industries cannot reproduce a reverse-TTE when too many restrictions are imposed in consumers' preferences. In particular, if consumers are forced to devote an exogenous share of their expenditure to each industry ($\beta = 1$, so α is fixed and equal to ω_A), terms of trade cannot deteriorate for the lagging economy. Under such restrictions, preferences in (3) are reduced to a Cobb-Douglas specification, a widely used setting in both trade and growth literatures, so it is useful to analyse the results of the theory proposed here in this benchmark case. Moreover, this exercise puts forward interesting results regarding the mechanics of the model useful for the following section.

An exogenous α implies by definition $g_\alpha(t) = 0$, and also gives:

$$P(t) = P_A(t)^\alpha P_M(t)^{1-\alpha} B \quad \text{where} \quad B = \alpha^{-\alpha}(1-\alpha)^{\alpha-1} \tag{20}$$

Under this setting, imposing $E_N = 1$ yields constant expenditure in both regions ($g_{E,S} = g_{E,N} = 0$), by the trade balance condition (17). The Euler condition (2) consumers follow in each region, determines that the returns from savings in both countries must equal the time preference parameter. By equality of preferences among consumers from both regions we can establish $r_S = r_N = r = \rho$.

Equation (19) determines constant creation of new goods within each indus-

[17] A formal argument showing how product expansion in this setting implies growth, even in the absence of efficiency improvements in the production of final goods, is provided in Ethier (1982). Notice that the amount of resources used in the production of final goods in industry i is $q_i n_i(t)$. However, by (6), consumption of final goods is $Q_i = n_i(t)^{\sigma/(\sigma_i-1)} q_i$. This means that the ratio of consumed final goods to resources devoted to their production is $n_i(t)^{1/(\sigma_i-1)}$, which increases with the number of products in sector i.

try i. According to (9), with constant shares of expenditure to each industry, profits for any given firm in sector i fall as the creation of new varieties reduces its market share, creating a competition effect within each industry ($g_{\pi i} = -g_i$). Nevertheless, aggregate profits in each sector ($\pi_i n_i$) are constant. Constant product creation in industry i also implies a time-unvarying ratio π_i/v_i (by 18), so $g_{vi} = g_{\pi i} = -g_i$. Then, the free-entry condition in (13) determines constant wages in both regions. As a result, this version of the model predicts no income divergence, as consumers' aggregate income is the sum of the mass of wages ($L_c w_c$) and aggregate firm's profits and both components remain unchanged over time. Constant wages in both regions has another important implication. Defining terms of trade for the South as p_A/p_M, it is possible to see that this ratio is constant, even in a context of uneven product creation between industries.

Even when costs and markups remain unchanged over time, constant creation of new products in industry i pushes the price of the CES composite in that industry to fall at rate $g_{Pi} = -g_i/(\sigma_i - 1)$, according to (8). By (20), this results in a falling aggregate price level.

The predictions of this version of the model regarding welfare outcomes are straightforward. At the equilibrium path, constant expenditure and falling price indexes lead to real consumption growing in both regions. Since all consumers face the same prices across borders, they enjoy the same reduction in the price index over time, so the evolution of consumers' purchasing power is the same in both regions. This means that, even though the level of real consumption may differ between countries (due to different levels of constant expenditure), there is no divergence at the equilibrium path. Intuitively, the fact that consumers devote fixed shares of their expenditure to the different industries means that greater product creation in one of them does not contribute to revenue differences between industries. Since wages are constant in both regions, a parallel path for firms' revenues between economies implies that income grows at the same rate in both of them. Uneven diversification affects only the level of competition within-industry and therefore yields a larger reduction in sales for firms of the industry where creation is greater. In other words, the fact that S has specialized in an industry in which product expansion is less prolific, means that firms within that region face lower future entry from competing firms, but is innocuous in terms of its consumers' income and welfare. These conclusions can be summarized in the following result

Result 1 *With fixed expenditure shares to each industry product creation reduces prices and rises consumption in both regions at the same rate, so there is no* *divergence in income or welfare between them.*

At this point it is important to underline a fundamental difference between models of product creation and output growth that is relevant to the purpose of this paper. As shown above, specializing in a relatively laggard industry is not a sufficient condition for income or welfare to follow a divergent path in the present model. The same outcome appears in models with different sources of real income growth, as long as exogenous shares of expenditure between industries are imposed. The compensating mechanism however does depend on the type of growth we consider. To show this notice that a constant α yields a fixed expenditure ratio between sectors, so the relative value of production in each sector (i.e. $[Q_M P_M]/[Q_A P_A]$) must be constant. In a model of uneven output growth, the ratio Q_M/Q_A changes over time, but constant expenditure to each industry pushes relative prices to perfectly offset differences in quantities. If the technological gain is directed towards reducing costs, then is relative prices that change and quantities compensate. In the model presented here, equation (8) gives $(Q_M P_M)/(Q_A P_A) = (q_M p_M n_M)/(q_A p_A n_A)$. With constant relative wages, relative prices do not change over time. It is then clear that uneven product creation must be perfectly compensated by changes in the relative sales of the representative firm in each industry. The following result can be stated

Result 2 *With fixed expenditure shares to each industry, welfare results in the model of uneven product creation resemble those that would obtain in a similar model of technological improvements, but the adjustment mechanism is different. In the former, prices are constant, and unbalanced growth is perfectly offset by changes in relative quantities. In the latter, changes in prices offset changes in quantities.*

The previous result highlights that the type of growth considered affects the adjustment mechanism of the model. The implications of this conclusion to explain important development facts becomes evident in a context in which expenditure shares between sectors are endogenous.

5.4.2 Case with endogenous shares of expenditure between industries

Even though exogenous shares of expenditure between industries is a widely used simplifying assumption, it is against intuition and a large body of empirical evidence. Of particular importance to this paper, it is against the declining trend in the share of expenditure in agricultural products (i.e. $g_\alpha < 0$), a trend supported by empirical evidence as shown in Section A.10. Relaxing the assumption $\beta = 1$ imposed to consumer preferences between industries in the previous section, is a very easy way to endogenize expenditure shares and has been used extensively in the literature. In this section I show how uneven product creation interacts with this setting, and is able to reproduce a reverse-TTE for agricultural economies.

As in the previous case, setting $E_N = 1$ implies $g_{E,N} = 0$ and $r_N = \rho$. Again, the condition in (18) is imposed to both economies so both product creation and production are positive.[18] With my choice for the numeraire, the northern economy plays the role of anchor in the model. The full solution for N is exactly the same as that in the previous section: the diversification rate in M is constant and equals that in (19), firm profits and value are reduced by exactly that rate and wages and the return rate are constant.

Also like in the previous case, the diversification rate in S is a constant given by (19), but a time variant $\alpha(t)$ makes other endogenous variables in S change over time. In particular, the time-varying rate at which expenditure in S evolves is obtained by merging the dynamic version of the trade balance condition with $E_N = 1$, obtaining:

$$g_{ES}(t) = \frac{g_\alpha(t)}{1 - \alpha(t)} \tag{21}$$

This shows in a very straightforward way that expenditure in S is directly linked to the share of consumption attracted by its firms in world markets. Merging the previous result with (9) and (13), I solve for the dynamic version of equation (14):

$$g_\alpha(t) = [1 - \alpha(t)]\frac{\beta - 1}{\beta}\left[\frac{g_A}{\sigma_A - 1} - \frac{g_M}{\sigma_M - 1}\right] \tag{22}$$

The share of consumers' expenditure in A is affected by the difference in product creation between sectors. It is easy to show that if industries were symmetric (so $g_A = g_M$ and $\sigma_A = \sigma_M$), then $g_\alpha = 0$. The solution in such a case would resemble that in the previous section and no income nor welfare divergence would follow. From now on, I focus in the case in which the term in brackets is different from zero which implies imposing:

Assumption 2 *Assume* $\frac{L_A}{a_A} - \frac{\sigma_A(\sigma_A - 1)L_M}{\sigma_M(\sigma_M - 1)a_M} \neq \rho(\sigma_A - 1)\left[1 - \frac{\sigma_A}{\sigma_M}\right]$.

Remember that, under Assumption 1, $g_A/g_M < 1$ holds. This is something supported by the evidence presented in Section 4. Given this and the indicative

[18] Section A.9 in the Appendix explores an alternative solution where this condition is not imposed in S. The main results in this section still hold in this environment and, in particular, the model replicates a reverse-TTE under certain conditions.

evidence that $\sigma_A > \sigma_M$ in Table 1, the new Assumption 2 setting $g_A/g_M \neq (\sigma_A - 1)/(\sigma_M - 1)$ is not implausible.

At this point it is important to make explicit the kind of equilibrium I analyse here. The unbalanced nature of the model prevents the existence of a balanced growth path for the global economy in the absence of too restrictive assumptions. Therefore, in the remaining of the section, results are provided for an Asymptotic Balanced Growth Path defined as follows:

Definition 1 *The Asymptotic Balanced Growth Path (ABGP) is characterized by constant $L_{R,i}$, $L_{F,i}$ and g_i, $\forall i = A, M$. Under Assumptions 1 and 2, α is time varying, but converges to a constant when $t \to +\infty$.*

Fixed allocation of labour between different activities within each sector implies product creation happens at constant rates (by 12), and uneven product creation yields a time varying share of expenditure in the agricultural sector. Following this definition, the asymptotic value of α depends on the sign of the bundle of parameters in the right hand side of equation (22): it is zero if the bundle is negative, or 1 if the bundle is positive. The fact that the ratio $g_\alpha(t)/[1 - \alpha(t)]$ must be constant according to (22), implies that g_{ES} also is by (21), and as is shown next, most other endogenous variables in the South are either constant or growing at a constant rate.

From here on I analyse the case in which $g_\alpha < 0$ since, as established in Section A.10, this is the empirically relevant scenario. Equation (22) shows that our model of product creation can replicate a declining α in a number of ways. The option I focus on here is to have uneven diversification such that the term in brackets is negative, combined with $\beta > 1$. In this case, the stagnant sector captures a decreasing share of world expenditure, a result that, as discussed before, resembles what would obtain in similar models with technological improvements as the engine of growth, when the elasticity of substitution is above unity. While this is not the only combination of parameter values that could yield $g_\alpha < 0$ in theory, I disregard other options as empirically ungrounded.[19]

[19]An interesting novelty in the model lays in the possibility of having $g_\alpha < 0$ even with $\beta < 1$. This is not possible in a similar model of uneven output growth, where the combination of $\beta < 1$ and uneven development yields expenditure shifts in favour of the lagging sector ($g_\alpha > 0$), since changes in relative prices more than compensate for differences in quantities (see discussion at the end of the current section). This new possibility can be achieved if $\beta < 1$, combined with a positive term in brackets, which is compatible with $g_A < g_M$ as long as $(\sigma_A - 1)/(\sigma_M - 1) < g_A/g_M < 1$. In such situation, even though product creation is smaller in A, consumer valuation of any new product that sector is very high (because substitutability within that industry is very low). In that case, consumers' valuation of product development is larger

The rest of the solution in S is given by the Euler and no arbitrage conditions:

$$
\begin{aligned}
r_S &= g_{ES} + \rho && (23) \\
g_{vA} &= r_S - \frac{\pi_A}{v_A} && (24)
\end{aligned}
$$

Notice that the Euler equation determines that a constant expenditure path must be accompanied by a constant rate of returns to savings in S. Then the no arbitrage condition imposes a constant growth rate of firm's value in the agricultural sector. The path followed by the most relevant variables of this model can now be fully determined.

Evolution of relative consumption between regions

According to (21), a shrinking expenditure share in agricultural goods ($g_\alpha < 0$), pushes down aggregate expenditure in S, which undertakes a divergent path with respect to constant expenditure in N. Given that the price index is identical for consumers in both countries, divergent expenditure paths directly yield divergence in consumption paths. The mechanism for this result is very straightforward in my model: when consumers in both regions shift their consumption shares in detriment of A, then S earns a decreasing part of global expenditure, so the region has to reduce its consumption level relative to N. This result constitutes the main difference between this version of the model and the one in the previous section. I can summarize the conclusions regarding the time path of relative consumption between regions as follows:

Result 3 *When uneven product creation reduces α, consumers from S obtain an decreasing share of world income, translating into expenditure divergence between regions. All consumers face the same price index, so divergence in consumption follows.*

The Euler condition in (23) establishes that a negative expenditure path in S must be accompanied by a rate of returns to savings (r_S) that is lower than the time-preference parameter (ρ). Notice that, the previous result means that returns on savings in S are always lower than in N ($r_S < r_N = \rho$), which is the intuitive outcome of firms from S earning a shrinking share of world value.

in industry A even when actual diversification is smaller. Although theoretically possible, this scenario does not seem to square with the empirical evidence presented here (Table 1) suggesting that $(\sigma_A - 1)/(\sigma_M - 1) > 1$.

Evolution of relative income between regions

To assess the evolution of income in both regions notice first that, while aggregate profits in N are constant as in the case with exogenous α, this is no longer the case in S. Indeed, aggregate profits in N remain constant due a combination of an increasing global market share captured by sector M, with an exactly offsetting fall in global expenditure, explained by the decreasing expenditure level of the South. In other words, $g_{\pi M} = -g_M$ still holds meaning that the aggregate mass of profits earned by M-firms is constant. On the contrary, in S:

$$g_{\pi A} = -g_A + \frac{g_\alpha(t)}{1-\alpha(t)} \tag{25}$$

Again, since $g_\alpha(t)/[1-\alpha(t)]$ is constant, then $g_{\pi A}$ must be constant too. The fall in operating profits for any A-firm is now greater than what was found in the previous section. The reason is that, if expenditure shares in each sector are constant, the profits of any one firm in each sector fall only due to the reduction of that firm's share within that sector. An endogenous share to each industry creates a further loss for firms in the lagging sector A, given that the entire industry loses importance in the world market. Unlike the model in the previous section and what happens in the current setting for N, aggregate profits in S unequivocally fall over time (at rate $g_\alpha/[1-\alpha]$).

To establish the time-path of wages notice that using the free-entry condition (13) and (25), together with a constant ratio π_A/v_A (which follows from condition 18), I obtain

$$g_{wS} = \frac{g_\alpha(t)}{1-\alpha(t)} \tag{26}$$

This expression shows that wages in S evolve at a constant rate and in the same direction as the share of agricultural products in consumers expenditure. When that share is decreasing, the aggregate value of firms in S falls as consequence, then wages move downwards in the South. With aggregate profits falling in S, then decreasing wages imply falling income in that region. Notice that both variables are constant in N. The following result summarizes the findings regarding income divergence:

Result 4 *With endogenous expenditure shares, the model reproduces income divergence since both aggregate profits and wages fall in S with respect to those in N.*

Evolution of consumption in each region

Result 3 summarizes the conclusions regarding the evolution of expenditure and real consumption of one country relative to the other. To reach conclusions regarding absolute trends of these aggregates we need to know the time path of the aggregate price index. Unlike the case with exogenous shares, when shares are endogenous, the evolution of the price index over time may not be trivial. Even if the price index of each industry decreases monotonically ($g_{P,i}(t) < 0$, $\forall i = M, A$ and $\forall t$), the aggregate price could potentially rise at some moment in time driven by weight shifts within the index. For example, if the price of the M-good maintains a positive difference with that of good A, an increase in the weight that the former has on the aggregate index P can make this index grow, even when its two main components (P_M and P_A) are falling.

Nevertheless, it can be shown that in the case of $\beta \neq 1$, the dynamic version of (5) is given by:

$$g_P(t) = \alpha(t) g_{PA} + [1 - \alpha(t)] g_{PM} \qquad \text{with} \qquad g_{Pi} = g_{wi} - \frac{g_i}{\sigma_i - 1}$$

The previous expressions show that the aggregate price level needs to fall over time. The reason why the possibility of a rising aggregate price is ruled out lies in the fact that, as is usual in expanding variety models, real consumption must grow in the anchor economy. This means that aggregate prices must fall relative to expenditure in N.

For real consumption to increase in the South too the fall in expenditure in that region needs to be lower than the fall in prices, i.e. $g_{ES} > g_P$ has to hold, which occurs if and only if:

$$\frac{\alpha(t)}{1 - \alpha(t)} > \frac{1 - \beta}{\beta} - \frac{g_M(\sigma_A - 1)}{\beta g_A(\sigma_M - 1)} \tag{27}$$

The term in the left-hand side is always positive and goes to 0 when α does. The sign of the constant term in the right-hand side depends of the value of β. If $\beta > 1$, the entire term is negative so the condition always holds. Only if $\beta < 1$ and the value of that parameter is low enough, can the constant term be positive and the entire condition could not hold at some t. Conclusions regarding the evolution of real consumption in absolute terms, within each region, can be summarized as follows:

Result 5 *With endogenous expenditure shares to each good, the North experiences* *growing consumption. If also condition (27) holds, then the same is true for the South.*

Notice that, according to this condition, it is theoretically possible that the South experiences growing aggregate consumption during a certain period and this is suddenly reverted when α falls below the threshold established in the previous result.

Evolution of terms of trade for the South

Finally, the model reproduces terms of trade deterioration for S (falling p_A/p_M). Notice that equation (7) establishes that the only determinant for changes in relative prices are movements in relative wages. Since wages are constant in N, the price of products created there is also time-invariant. The price of final production in S evolves following wages in that region, and according to previous results, they fall due to a shrinking α. The following result summarizes the straightforward conclusion regarding terms of trade in this version of the model:

Result 6 *With endogenous expenditure shares to each good, a falling α yields terms of trade deterioration for S.*

Notice that a situation of terms of trade falling in S is also one in which aggregate income in that region falls with respect to that in N. Such a situation constitutes what I call here a reverse-TTE, i.e. terms of trade enhancing rather than offsetting income divergence, a result supported by the evidence presented above for agricultural economies.

Uneven diversification vs. uneven technological improvements

A situation of reverse-TTE cannot be obtained in a similar model of uneven technological improvements between sectors since, in such setting, relative prices always move in favour of the lagging sector as the TTE would predict. It is easy to show this by deriving the FOC of the maximization problem of the consumer and including (6) to obtain:

$$\left[\frac{q_M(t)}{q_A(t)}\right]^{1/\beta} = \frac{\omega_M p_A(t) n_A(t)^{\frac{\sigma_A-\beta}{(\sigma_A-1)\beta}}}{\omega_A p_M(t) n_M(t)^{\frac{\sigma_M-\beta}{(\sigma_M-1)\beta}}} \tag{28}$$

With a constant ratio of available varieties (n_A/n_M), models where growth is caused by technological improvements feature a negative relationship between relative prices and quantities, as long as $\beta > 0$. In a context of specialization, this implies terms of trade offset differences in output growth to some degree.[20]

A model of uneven diversification is capable of reproducing a reverse-TTE because, as shown in the previous section, the adjustment mechanism is different. The fact that the ratio of varieties in each sector is time-varying means that relative prices in equation (28) do not necessarily compensate for changes in relative quantities. In the present model, changes in relative prices follow shifts in relative wages, as efficiency in the production of final goods remains unchanged. Relative wages are in turn determined by the aggregate value of firms in each sector (according to the free-entry condition in 13) and ultimately by the movements in the share of expenditure devoted to each sector in (22). Since a falling share of expenditure in A reduces the value of A-firms relative to M-firms, the relative wage of workers in S also falls and terms of trade deteriorate for that region. Differences in product creation between sectors are adjusted by changes in sales for individual firms so the equality in (28) holds.

6 Relative price index vs terms of trade

This section evaluates one of the main empirical predictions separating the model presented here from a similar model with non-homothetic preferences. In a context where within-industry preferences are CES and there is monopolistic competition within each sector, terms of trade for the South can be written as:

$$\frac{p_A(t)}{p_M(t)} = \frac{n_A(t)^{1/(\sigma_A - 1)}}{n_M(t)^{1/(\sigma_M - 1)}} \frac{P_A(t)}{P_M(t)}$$

with A representing exports by S, and M representing its imports. This expression is common to both the model in Section 5 , and a similar one with non-homothetic preferences as presented in Section A.4. The equation shows how terms of trade for S (p_A/p_M) are related to the price index of A relative to M (P_A/P_M) and the ratio of varieties available within each set (n_A/n_M). The difference between p_A/p_M

[20]The strength of the adjustment depends on the value of the elasticity of substitution between industries β. If $\beta = 1$, the TTE is one-to-one as in Acemoglu and Ventura (2002): the relative values produced and consumed of both industries remain constant. If consumers perceive industry composites as substitutes ($\beta > 1$), the lagging sector benefits from a relatively small price adjustment that is not sufficient to fully compensate its technological lag, so it loses world market share over time. In the opposite case in which consumers find both composites to be complements of each other ($\beta < 1$), then the adjustment is such that the lagging sector actually expands its traded value.

and P_A/P_M is very important to our purposes. Terms of trade (p_A/p_M) aim at measure the amount of imports that can be bought with a country's export, so the ratio is computed as the price of exports relative to imports for each country, using unit values for each good, and weighting each observation by the value share of that good in overall exports or imports. The ratio of price indexes (exports relative to imports P_A/P_M) is a somewhat more abstract concept, since each price index is derived from utility functions. This ratio can be interpreted as the utility that consumers within a country need sacrifice in terms of goods not consumed (exports) to obtain a certain level of utility from abroad (through imports).

According to the previous expression, absent unbalanced growth in the extensive margin (i.e. when n_M/n_A is constant), the ratio of price indexes P_A/P_M must evolve proportionally to terms of trade p_A/p_M. As shown in Section A.4, this is what obtains in a model with uneven growth in the intensive margin and non-homothetic preferences. The expression above highlights that the same result does not hold in the model presented in this paper, since uneven product creation between sectors relaxes the relationship between terms of trade and the ratio of price indexes. In particular, my theory predicts that countries for which terms of trade fall, also experience relative lagging growth in the extensive margin. In the plane $[\Delta(P_A/P_M), \Delta(p_A/p_M)]$, while the model with non-homothetic preferences predicts a slope of one, my model proposes a less steep relationship. By measuring the ratio of price indexes and comparing its evolution with terms of trade for each country, I can evaluate whether the mechanism proposed by my model adds an important component to our understanding of the interaction between relative price movements and uneven development, on top of what the theory has already explained using non-homothetic preferences.

Measuring terms of trade is relatively simple since this only requires international trade price data and weights in exports and imports for each country. Here I take terms of trade as reported in WDI. The same cannot be said about relative price indexes of exports over imports. Being concepts related to consumers preferences, measuring these requires some structure. Several works have undertaken the task of computing import price indexes, as these help measure gains from trade. The most recent literature aims at reflecting product creation as a further source of gains. In this section, I follow Broda and Weinstein (2004) since their proposal fits my model very closely: they assume CES preferences and homogeneous imports (which implies equal prices and a single elasticity of substitution across imports). Section A.11 presents similar results following a less restrictive structure proposed in Broda and Weinstein (2006). The price index for imports requires computing, for each country, the yearly change in the average price of its imports (weighted by value) and then correcting for the change in the amount of varieties imported. The formula that can be derived for each price index using the current setting is:

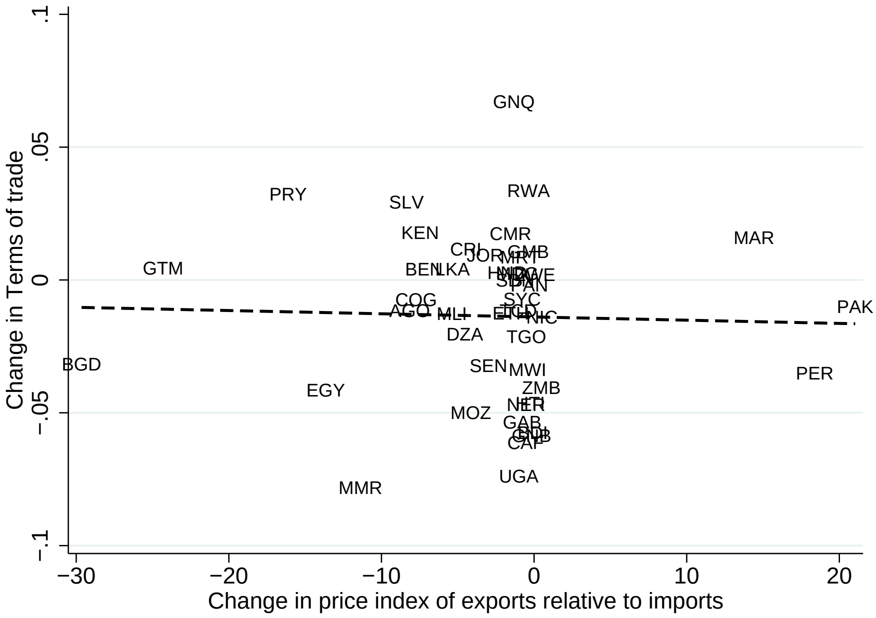
$$P_{c,t}^{imp} = P_{c,t}^{*} \prod_{f} \left[\frac{n_{f,c,t-1}^{imp}}{n_{f,c,t}^{imp}} \right]^{1/(\sigma_c - 1)} \tag{29}$$

where $P_{c,t}^{*}$ is the conventional import price index ignoring product creation, $n_{f,c,t}$ is the amount of four-digit codes (f) imported at time t by country c, and σ_c is the elasticity of substitution between imports, which I compute at the country level averaging the product-level data presented in Broda and Weinstein (2006). I use trade flows from Feenstra et al. (2005), which reports values exported since 1962, but only includes quantities from 1984 onwards, so the latter is set as the initial year.

Computing a price index for exports is not as straightforward. A natural question is whether the index should be constructed based on domestic or foreign consumption patterns. For example, when measuring the elasticity of substitution of goods exported, should one consider preferences of the importers or those of the exporters? I've chose to use preferences from the exporting country since this is compatible with the interpretation provided before for the ratio of price indexes: if the target is the rate at which a domestic consumer exchanges utility of forgone consumption (exports) for new goods (imports), it makes sense to compute the price index of exports considering the preferences of domestic consumers. With this definition I proceed to compute a price index for exports (exp) closely following (29).

Figure 6 shows the change in the price indexes of exports relative to imports computed as described before, plotted against change in terms of trade for each country. The figure shows that points are not aligned with a slope of 1 as would be expected from the model with non-homothetic preferences. The fact that the slope of the fitted line (dashed) is lower than 1 suggests that the countries for which terms of trade felt the most experience, on average, a less-than-proportional decline in the price index of their exports relative to their imports. Deviations from the unity-slope relationship are negatively correlated (-0.35) with countries' variety diversification rate for the period. A similar conclusion is derived from our less restrictive exercise presented in Section A.11. This result is in line with the predictions of my model and suggests that uneven growth in the extensive margin plays a role in determining the movement of these variables.

Figure 6: Change in terms of trade vs change in price index of exports relative to imports (1985-2000)



Notes: Change in terms of trade from WDI. Change in price indexes computed following Broda and Weinstein (2004) and using trade flows from Feenstra et al. (2005) and elasticities of substitution from Broda and Weinstein (2006).

7 Conclusions

This work joins a large literature in pointing at specialization as a cause of welfare divergence. I focus on the extensive margin of development and highlight the role that uneven diversification between sectors can play to account for key development facts left unexplained by previous literature, i.e. divergence enhanced by falling terms of trade for agricultural producers.

The first contribution of this paper is to document that growth in the extensive margin is unbalanced between sectors: diversification happens at a lower rate in the agricultural sector than in the rest of good-producing activities. This finding is in line with recent works showing that technological linkages are scarcer and uncertainty is higher in the primary sector.

The second contribution is to highlight in a simple model, how this fact can account for terms of trade movements that enhance divergence, an outcome that cannot be replicated in a model of uneven technological improvements, absent further structure in the preference side. The proposed model abstracts from all other sources of growth to focus on uneven diversification in a two country setting with no trade shocks or structural change. When individuals value diversity in their consumption, a region specialized in an industry in which diversification is lower than in other activities, captures a decreasing fraction of global expenditure while devoting an increasing share of its domestic expenditure to imported products. This region experiences income and welfare trajectories that are dominated by those in the region producing in the dynamic sector. Since domestic firms earn a decreasing share of world income, the wages they are able to pay to their workers also fall relative to those in the dynamic economy, pushing down the price of exports relative to imports. The lagging economy faces deterioration in its terms of trade which enhances its income and welfare divergence, a phenomenon referred here as reverse terms of trade effect.

The mechanism proposed here connects in an intuitive way low diversification with terms of trade deterioration for the case of agricultural economies, since both regularities appear clearly in the data for them. Nevertheless, the same mechanism is potentially valid in other contexts in which different sets of products (or services) could exhibit unbalanced diversification. Future research in this matter should be welcomed.

References

Acemoglu, D. (2009). *Introduction to Modern Economic Growth.* Princeton University Press, New Jersey, first edition.

Acemoglu, D. and Ventura, J. (2002). The World Income Distribution. *Quarterly Journal of Economics*, 117(2):659–694.

Ardeni, G. P. and Wright, B. (1992). The Prebisch-Singer Hypothesis: A Reappraisal Independent of Stationarity Hypotheses. *Economic Journal*, 102(413):803–812.

Arezki, R., Hadri, K., Loungani, P., and Rao, Y. (2014). Testing the Prebisch-Singer hypothesis since 1650: Evidence from panel techniques that allow for multiple breaks. *Journal of International Money and Finance*, 42(April):208–223.

Auty, R. M. (2007). Natural resources, capital accumulation and the resource curse. *Ecological Economics*, 61(4):627–634.

Baldwin, R. E. and Robert-Nicoud, F. (2008). Trade and Growth with Heterogeneous Firms. *Journal of International Economics*, 74(1):21–34.

Barro, R. J. and Lee, J. J.-W. (1993). International Comparisons of Educational Attainment. *Journal of Monetary Economics*, 32(3):363–394.

Baumol, W. J. (1967). Macroeconomics of unbalanced growth: the anatomy of urban crisis. *American Economic Review*, 57(3):415–426.

Boppart, T. (2014). Structural change and the Kaldor facts in a growth model with relative price effects and non-Gorman preferences. *Econometrica*, 82(6):2167–2196.

Broda, C. and Weinstein, D. E. (2004). Variety growth and world welfare. *American Economic Review*, 94(2):139–144.

Broda, C. and Weinstein, D. E. (2006). Globalization and the gains from variety. *Quarterly Journal of Economics*, 121(2):541 – 585.

Broda, C. and Weinstein, D. E. (2010). Product creation and destruction: Evidence and price implications. *American Economic Review*, 100(June):691–723.

Caron, J., Fally, T., and Markusen, J. R. (2014). International trade puzzles: A solution linking production and preferences. *Quarterly Journal of Economics*, 129(3):1501–1552.

Caselli, F. (2005). Accounting for Cross-Country Income Differences. In Aghion, P. and Durlauf, S. N., editors, *Handbook of Economic Growth*, number 1, chapter 9, pages 679–741. North-Holland, 1 edition.

Connolly, M. and Peretto, P. F. (2003). Industry and the family: Two engines of growth. *Journal of Economic Growth*, 8(1):115–148.

Corsetti, G., Martin, P., and Pesenti, P. (2013). Varieties and the transfer problem. *Journal of International Economics*, 89(1):1–12.

Cuddington, J. T. (1992). Long-run trends in 26 primary commodity prices: A disaggregated look at the Prebisch-Singer hypothesis. *Journal of Development Economics*, 39:207–227.

Dixit, A. K. and Stiglitz, J. E. (1977). Monopolistic Competition and Optimum Product Diversity. *American Economic Review*, 67(3):297–308.

Easterly, W. and Levine, R. (1997). Africa's Growth Tragedy: Policies and Ethnic Divisions. *Quarterly Journal of Economics*, 112(4):1203–1250.

Ethier, W. J. (1982). National and International Returns to Scale in the Modern Theory of International Trade. *American Economic Review*, 72(3):389–405.

Feenstra, R. C. (1996). Trade and uneven growth. *Journal of Development Economics*, 49(1):229–256.

Feenstra, R. C. and Kee, H. L. (2008). Export variety and country productivity: Estimating the monopolistic competition model with endogenous productivity. *Journal of International Economics*, 74:500–518.

Feenstra, R. C., Lipsey, R. E., Deng, H., Ma, A. C., and Mo, H. (2005). World Trade Flows: 1962-2000.

Fieler, A. C. (2011). Nonhomotheticity and Bilateral Trade: Evidence and a Quantitative Explanation. *Econometrica*, 79(4):1069–1101.

Foellmi, R. and Zweimüller, J. (2008). Structural change, Engel's consumption cycles and Kaldor's facts of economic growth. *Journal of Monetary Economics*, 55(7):1317–1328.

Francois, J., Manchin, M., and Tomberger, P. (2015). Services Linkages and the Value Added Content of Trade. *World Economy*, 38(11):1631–1649.

Gallup, J. L., Mellinger, A., and Sachs, J. D. (2010). Geography Datasets.

Gaulier, G. and Zignago, S. (2010). BACI: International Trade Database at the Product-Level. The 1994-2007 Version.

Gollin, D., Parente, S. L., and Rogerson, R. (2002). The Role of Agriculture in Development. *American Economic Review*, 92(2):160–164.

Gollin, D., Parente, S. L., and Rogerson, R. (2004). Farm work, home work and international productivity differences. *Review of Economic Dynamics*, 7(4):827–850.

Grilli, E. R. and Yang, M. C. (1988). Primary Commodity Prices, Manufactured Good Prices, and the Terms of Trade of Developing Countries: What the Long Run Shows. *World Bank Economic Review*, (2):1–48.

Grossman, G. M. and Helpman, E. (1991). *Innovation and Growth in the Global Economy*. The MIT Press, Cambridge, Massachusetts. London, England, 6 edition.

Harvey, D. I., Kellard, N. M., Madsen, J. B., and Wohar, M. E. (2010). The Prebisch-Singer Hypothesis: Four Centuries of Evidence. *Review of Economics and Statistics*, 92(2):367–377.

Hausmann, R. and Hidalgo, C. A. (2011). The network structure of economic output. *Journal of Economic Growth*, 16:309–342.

Heston, A., Summers, R., and Aten, B. (2011). Penn World Table Version 7.0. Technical report, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Hidalgo, C. A., Klinger, B., Barabási, A.-L., and Hausmann, R. (2007). The product space conditions the development of nations. *Science*, 317(5837):482–7.

Hummels, D. and Klenow, P. J. (2005). The Variety and Quality of a Nation's Exports. *American Economic Review*, 95(3):704–723.

Kehoe, T. J. and Ruhl, K. J. (2013). How Important Is the New Goods Margin in International Trade? *Journal of Political Economy*, 121(2):358–392.

Kongsamut, P., Rebelo, S., and Xie, D. (2001). Beyond Balanced Growth. *Review of Economic Studies*, 68:869–882.

Koren, M. and Tenreyro, S. (2007). Volatility and Development. *Quarterly Journal of Economics*, 122(1):243–287.

Krugman, P. R. (1989). Differences in income elasticities and trends in real exchange rates. *European Economic Review*, 33(5):1031–1046.

Lewis, W. A. (1954). Economic Development with Unlimited Supplies of Labour. *The Manchester School*, 22(2):139–191.

Matsuyama, K. (1992). Agricultural productivity, comparative advantage, and economic growth. *Journal of Economic Theory*, 58(2):317–334.

Matsuyama, K. (2000). A Ricardian Model with a Continuum of Goods under Nonhomothetic Preferences: Demand Complementarities, Income Distribution, and North-South Trade. *Journal of Political Economy*, 108(6):1093–1120.

McMillan, M. and Rodrik, D. (2011). Globalization, structural change and productivity growth, with an update on Africa. In Bachetta, M. and Jansen, M., editors, *Making Globalization Socially Sustainable*, chapter 2, pages 49–85. ILO, Geneva, Switzerland.

Murata, Y. (2002). Rural-urban interdependence and industrialization. *Journal of Development Economics*, 68(1):1–34.

Ngai, R. L. and Pissarides, C. A. (2007). Structural Change in a Multi-Sector Model of Growth. *American Economic Review*, 97(1):429–443.

Ourens, G. (2016). Trade and growth with heterogeneous firms revisited. *Journal of International Economics*, 100(1):194–202.

Prebisch, R. (1950). The Economic Development of Latin America and Its Principal Problems. *Economic Bulletin for Latin America*, 7:1–59.

Rauch, J. E. (1999). Networks versus markets in international trade. *Journal of International Economics*, 48(1):7–35.

Sachs, J. D. and Warner, A. M. (2001). The curse of natural resources. *European Economic Review*, 45(4-6):827–838.

Sala-i Martin, X. (1997). I Just Ran Two Million Regressions. *American Economic Review*, 87(2):178–183.

Sala-i Martin, X., Doppelhofer, G., and Miller, R. I. (2004). Determinants of Long-Term Growth : A Bayesian Averaging of Classical Estimates (BACE) Approach. *American Economic Review*, 94(4):813–835.

Sarkar, P. and Singer, H. W. (1991). Manufactured exports of developing countries and their terms of trade since 1965. *World Development*, 19(4):333–340.

Singer, H. W. (1950). The Distribution of Gains Between Investing and Borrowing Countries. *American Economic Review Papers and Proceedings*, 40(2):473–485.

Timmer, P. C. (1988). The agricultural transformation. In Chenery, H. and Srinivasan, T., editors, *Handbook of Development Economics*, volume 1, chapter 8, pages 275–331. Amsterdam.

Yamada, H. and Yoon, G. (2014). When Grilli and Yang meet Prebisch and Singer: Piecewise linear trends in primary commodity prices. *Journal of International Money and Finance*, 42:193–207.

Appendix

A.1 Terms of trade effect in Acemoglu and Ventura (2002)

This section replicates and extend the empirical results showing the TTE in Acemoglu and Ventura (2002), and highlights the particular situation of A-countries.

Table A.1: Terms of trade and growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Panel A: 2SLS					
gdpgr	-0.595**	-0.578**	-0.693**	-0.688**	-0.680**	-0.609**	-0.671**	-0.609**	-0.602**	-0.609**
	(0.266)	(0.261)	(0.316)	(0.319)	(0.306)	(0.272)	(0.304)	(0.272)	(0.274)	(0.272)
yr	-0.001		-0.003							
	(0.002)		(0.002)							
syr		-0.002		-0.001	-0.002	-0.000	-0.002	-0.000	-0.001	-0.000
		(0.006)		(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
hyr		0.019		0.001	-0.005	-0.012	-0.005	-0.012	-0.009	-0.012
		(0.034)		(0.037)	(0.036)	(0.035)	(0.036)	(0.035)	(0.035)	(0.035)
pyr		-0.002		-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
		(0.003)		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
llifee	0.043*	0.046*	0.055*	0.057*	0.054*	0.051*	0.055*	0.051*	0.048*	0.051*
	(0.024)	(0.025)	(0.028)	(0.030)	(0.028)	(0.027)	(0.029)	(0.027)	(0.027)	(0.027)
opec	0.091***	0.090***	0.082***	0.082***	0.078***	0.081***	0.078***	0.081***	0.082***	0.081***
	(0.010)	(0.010)	(0.012)	(0.013)	(0.013)	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)
A1_30end					-0.013					
					(0.009)					
A1_50end						-0.019*				
						(0.011)				
A2_30end							-0.011			
							(0.008)			
A2_50end								-0.019*		
								(0.011)		
A3_30end									-0.013**	
									(0.007)	
A3_50end										-0.019*
										(0.011)
_cons	-0.172*	-0.182*	-0.210*	-0.216*	-0.203*	-0.195*	-0.207*	-0.195*	-0.180*	-0.195*
	(0.090)	(0.092)	(0.106)	(0.111)	(0.106)	(0.101)	(0.107)	(0.101)	(0.100)	(0.101)
					Panel B: First-stage for GDP Growth					
loggdp	-0.019***	-0.020***	-0.021***	-0.021***	-0.021***	-0.023***	-0.021***	-0.023***	-0.023***	-0.023***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R^2	0.350	0.359	0.330	0.335	0.481	0.509	0.450	0.509	0.449	0.509
					Panel C: OLS					
gdpgr	0.037	0.037	-0.045	-0.045	-0.076	-0.100	-0.073	-0.100	-0.105	-0.100
	(0.106)	(0.107)	(0.139)	(0.141)	(0.155)	(0.152)	(0.151)	(0.152)	(0.146)	(0.152)
Obs.	79	79	55	55	55	55	55	55	55	55

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. t-statistic in parenthesis. Columns (1) and (2) replicate results of Acemoglu and Ventura (2002) using data from Barro and Lee (1993) for the period (1965-1985). Columns (3) and (4) expand the time period using product figures from PWT and terms of trade from WDI and OECD. The remaining columns introduce different indicators for A countries to the group of determinants of steady state income. Each variable $Ak_j end$ takes value 1 when a country's exports of Ak exceeds the share of $j\%$ in 2000.

Economies tend to converge to a steady state that is determined by a set of fundamentals (Z), an idea that can be represented in the following equation:

$$g_{GDP,t} = -\mu_1 GDP_{t-1} + Z_t'\mu_2 + u_t$$

where $g_{GDP,t}$ is the growth rate of output at t.

Then, estimations of the relationship between terms of trade and growth are potentially biased. An economy could experience fast growth either because it managed to accumulate more resources moving forward along its current growth path or because it achieved a shift upwards in its steady state. Only the first of these causes is related to falling terms of trade. To properly identify the relationship, I follow Acemoglu and Ventura (2002) computing the following specification

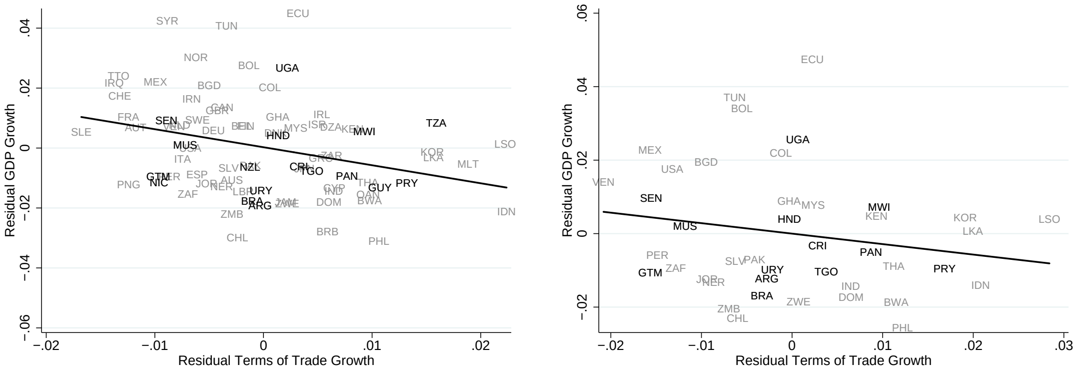
$$g_{TT,t} = \epsilon_1 g_{GDP,t} + Z_t'\epsilon_2 + e_t$$

where $g_{TT,t}$ is the growth rate of terms of trade and the vector Z_t includes determinants of steady state income. This equation is estimated using Two-Stage Least Squares (2SLS) and instrumenting $g_{GDP,t}$ by its predicted value stemming from the previous equation. The excluded instrument is GDP_{t-1} since, conditional on growth and the steady state determinants, terms of trade should not be related to the initial level of income. Results for these regressions for the period (1965-1985) are reported in columns (1) and (2) of Table A.1, using years of education, life expectancy at 1965 and a dummy variable signalling OPEC countries, as basic determinants of steady state income so results replicate those in Acemoglu and Ventura (2002). Columns (3) and (4) expand the time span to cover 1965-2005. The remaining columns introduce different indicators of A-countries in the set Z.

All specifications show a negative coefficient for the growth rate which can be interpreted as evidence in favor of the existence of a TTE. The dummy indicating A-countries takes negative values implying that, other things being equal, terms of trade tend to adjust less favourably for agricultural economies. Figure A.1 plots the part of terms of trade changes and growth changes not explained by shifts in the steady state income determinants. These determinants are the same as those used in column (1) of Table A.1. The figure in the left replicates the result of AV02 using data for 1965-1985 only, and the figure in the right presents results for the extended time period.

In both figures, the position of A-countries is highlighted, so it is easy to notice that these group of countries tend to be below the fitted line. This implies that terms of trade adjustment tends to be lower than expected for agricultural

Figure A.1: Changes in Terms of trade and GDP growth controlling for steady state income shifts



Notes: Part of terms of trade and growth changes not explained by shifts in the steady state income determinants (i.e. years of education, life expectancy at 1965 and a dummy for OPEC countries). The panel in the left uses data for 1965-1985 only and therefore replicates results in as in Acemoglu and Ventura (2002). The panel in the right expands the time period until 2005.

economies.

Finally, I test whether the TTE is related to the size of the economy. Total population is introduced into Z as measure for size, to evaluate whether the relationship between changes in terms of trade and growth is influenced by this variable. Results show that size is not significant as a control Z. As a parallel exercise, I used the residual GDP and terms of trade changes, as plotted in the left panel of Figure A.1, and evaluated whether the correlation between these two variables is affected by controlling for size. Again, results give non-significant coefficients for that variable.

A.2 List of A and E products

Table A.2 lists the products considered in this work as A1, A2, A3 and E respectively. The categorization is based in the SITCRev2 classification. The set of Mi comprises all products not included in Ai or E $\forall i = 1, 2, 3$. Using this classification yields 308, 351, 401 and 158 different products in categories A1, A2, A3 and E, respectively out of a total of 1239 4-digit goods in SITCRev2. In the SITC-R1 5-digit classification, the same figures are 375 (A1), 461 (A2), 669 (A3) and 206 (E) over a total of 1659. In the HS0 6-digit classification, these figures are 833 (A1), 1183 (A2), 1983 (A3), 1032 (E) and 5038 (total).

A.3 Characterization of A-countries

The characterization of A-countries is complemented by evaluating which variables are correlated with countries finishing the period of analysis being large exporters of agricultural products. Table A.3 presents results of probit regressions where the indicator of countries exporting more than $j\%$ of their exports in Ak products at the year 2000, is the main dependant variable. Columns (1)-(3) present results for $k = 1$, while columns (4)-(6) do so for $k = 2$ and (7)-(9) for $k = 3$. Within each set of results, the first column sets the export threshold at 30%, the second at 40% and the third at 50%. Explanatory variables selected are relevant variables evaluated in 1965 and include different measures of the degree of comparative advantage in the production of agricultural products (the export intensity in Ak, size and share of arable land as a total country's territory) and other variables that could potentially be relevant for comparative advantage to change over time (degree of trade openness, per capita GDP, population density, size of government expenditure). Overall, results show that the most important feature of countries that finish the period as large exporters of agricultural products is the initial intensity of those exports. The size and share of arable land does not present an important correlation. Population density has a negative effect in most specifications which can be interpreted as a relevant factor for industrialization. A similar conclusion can be drawn regarding the degree of trade openness: more open economies tend to reduce the intensity of their exports in agricultural products over this period. Finally it is interesting to see that the initial income level of the economy and government size do not seem to play an important role.

A.4 Similar model with non-homothetic preferences

This section shows that a model where non-homothetic preferences are imposed can replicate a reverse-TTE for the country that is specialized in the basic sector. For this exercise I propose a very basic setting of two countries (N and S) each specialized in a sector (M and A respectively), there is no population growth and the output growth rate of each sector g_{Qi} is exogenous, constant and positive $\forall i = M, A$. Instead of equation (3), between-industry preferences in country c are given by:

$$Q_c(t) = [Q_A(t) - \gamma]^{\frac{\omega_A}{\omega_M}} Q_M(t) \tag{A.1}$$

where γ represents the minimum aggregate requirement of the basic good and is the same in both regions. To ensure that the production of the basic good is enough to cover basic needs, I impose $0 < 2\gamma < Q_A$. The specification then resembles that in Matsuyama (1992). As is explained in that paper, it suffices to have $\gamma > 0$ for preferences to be non-homothetic. Maximization of (A.1) under the same budget constraint as before, gives the following expression (which replaces equation 28):

$$Q_A(t) = Q_M(t)\frac{\omega_A}{\omega_M}\frac{P_M(t)}{P_A(t)} + \gamma \tag{A.2}$$

and the share of expenditure in the A-good is now:

$$\alpha(t) = \left[1 + \frac{\omega_M}{\omega_A}\left(\frac{Q_A(t) - \gamma}{Q_A(t)}\right)\right]^{-1} \tag{A.3}$$

This expression differs from (14) in that, the share of expenditure in A, no longer depends on relative product creation, but instead, it depends on the ratio of production above the subsistence requirement over total production of agricultural goods. According to this expression, positive growth in quantities produced (in sector A and therefore also in M) will necessarily make the share of expenditure in the agricultural sector fall over time.

The within-industry structure of the model remains as before so equations (7)-(8) still hold. This simplified variation of the model features exogenous growth stemming from externalities in the production process so there is no need of saving resources or investing into R&D. Sectors grow at constant rate $g_{Qi} > 0 \forall i = M, A$ and the labour-market clearing conditions are given by

$$L_S = \frac{\alpha(t)E(t)}{n_A p_A(t)} \ , \ L_N = \frac{[1 - \alpha(t)]E(t)}{n_M p_M(t)} \tag{A.4}$$

Finally, the trade balance condition in (17) is still operative. Using the above mentioned equations, and using again expenditure in the N as the numeraire, the new equilibrium of this model is solved for, obtaining the following expression for wages:

$$w_A(t) = \frac{\sigma_A - 1}{\sigma_A n_A L_S}\frac{\alpha(t)}{1 - \alpha(t)} \ , \ w_M(t) = \frac{\sigma_M - 1}{\sigma_M n_M L_N} \tag{A.5}$$

Similarly to the results of the model in Section 5, the current variation also features wage divergence between sectors. Given that wages are the only time-varying part of prices according to (7), this simple variation of the model shows that terms of trade (p_A/p_M) must deteriorate for the region specialized in the basic sector.

Provided the structure of the model within industry is the same as in Section 5 (i.e. CES preferences and monopolistic competition between n_i homogeneous firms in sector $i = A, M$), except now there is no product creation (n_i is constant $\forall i = A, M$), then terms of trade in S can be expressed as follows:

$$\frac{p_A(t)}{p_M(t)} = \frac{n_A^{1/(\sigma_A - 1)}}{n_M^{1/(\sigma_M - 1)}} \frac{P_A(t)}{P_M(t)}$$

This expression is key to explaining the results in Section 6. It states that the relationship between changes in terms of trade and changes in the price index of exports over imports for both regions has a slope of 1.

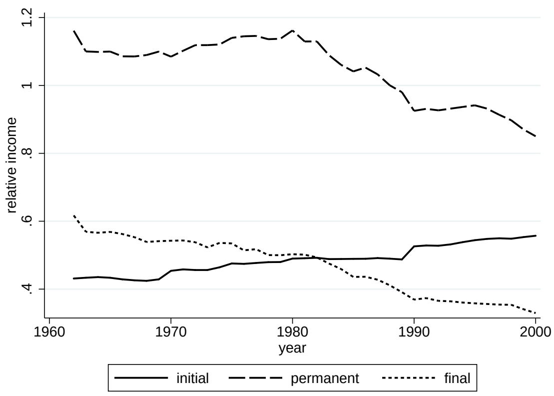
A.5 Agricultural economies are outgrown by the rest

A-countries are defined by using two sets of dummy variables: variable Ak_j signals countries in which the share of Ak-goods exported is above $j\%$ for more than 30 years in the time span analysed here, while Ak_j_end equals one when the share of Ak-goods exported by an economy is above $j\%$ at the end of the period (with $k = 1, 2, 3$ and $j = 30, 40, 50$). The list of A-countries can vary greatly depending on the criteria used: the list can range from 54 countries when $A3\_30 = 1$ to 15 when $A1\_50end = 1$. Finally, to signal countries that were important exporters of agricultural products at the beginning of the period, I set $Ak\_j\_ini = 1$ when share of Ai-goods exported is above $j\%$ at each country's initial year. A list of such countries can rise up to 131 (when $A3\_30ini = 1$).

Figure A.2 shows the per capita income (in constant prices) of A-countries relative to world average. Real income of agricultural exporters is represented by the dotted and dashed lines, the former considering countries that were large exporters of agricultural products at the end of the period ($A1\_30end = 1$) and the latter including a sample of countries that exported agricultural products to a large extent for a long period of time ($A1\_30 = 1$). The full line includes countries that were agricultural exporters only at the beginning of the period ($A1\_30ini = 1$).

This figure clearly shows that exporting a large share of A-goods at some moment in time does not necessarily prevent future income convergence. Notice that the bold line depicting the relative income of countries with initial specialization in A-goods exhibits an upward trend consistent with a reduction in the income gap between this set of countries and world average. Nevertheless the figure also shows that remaining specialized in A-goods over the period is positively correlated with lower growth: there is a clear divergent trend for the income per capita of exporters of A-goods in most years of the sample and also for those that finished the period being heavy exporters of those products. This result is robust to chang-

Figure A.2: Evolution of per capita real income in A-countries relative the rest



Notes: Evolution of per capita GDP (constant prices) of A-countries (defined using A1 list, check Appendix) relative to sample average. The line *initial* shows the evolution of relative per capita GDP of countries for which the proportion of A1-exports was above 30% at the initial year ($A1\_30ini = 1$), *permanent* shows the same for countries for which exports in A1 where above the same threshold for 30 years or more ($A1\_30 = 1$), and *final* exhibits the same for those for which the same threshold is surpassed at the end of the period ($A1\_30end = 1$).

ing the variables used to define A-countries (similar pictures arise $\forall k = 1, 2, 3$ and $\forall j = 30, 40, 50$) and also to limiting the country sample to regions that were relatively rich at the beginning of the period.

The same result obtains when controlling for other growth determinants. I perform cross-country growth regressions using the growth rate of the whole period as dependent variable and including as controls all variables identified in Sala-i Martin et al. (2004) as robust growth regressors. The controls selected in that work constitute a wide range of measures of basic growth fundamentals (initial wealth, investment costs, human capital, etc.), as well as indexes of institutional quality, regional, cultural and geographical characteristics. Table A.4 lists all controls used along with the description for each variable, and provides the source were the data can be found.

The first column in Table A.5 shows how the baseline regression looks like when all 20 controls are included. The rest of the table presents results for similar specifications but replacing geographical and regional dummies by indicators signalling A-countries. For this task, I use variable $A1\_jend$ which signals countries for which the share of $A1$-goods exported is above $j\%$ (with $j = 30, 40, 50$) at the end of the period (year 2000). In columns (2)-(4) variables excluded are those strictly geographical. For columns (5)-(7), I exclude even more controls related with geographical factors and therefore closely linked with the type of specialization of an economy. Results show that the variable indicating economies that remained specialized in A during the period 1962-2000 is highly significant and negative in most specifications.

Similar results are obtained using alternative variables to signal A-countries. Tables A.6-A.10 present results for the same specifications in Table A.5 but using different indicators for A-countries. As these tables show, using different indicators for agricultural economies, still yields significantly negative coefficients for the indicator. The result that agricultural economies tend grow less than other economies with other similar characteristics is robust to that choice.

These results indicate that, even controlling for other robust growth determinants, having remained specialized in A-goods is negatively related to growth. A-countries tend to have lower growth rates over the period analysed here than countries with otherwise similar characteristics.

Table A.11 presents an exercise to test how important the indicator of A-countries can be in growth regressions. The first column presents a regression with all 20 variables selected in Sala-i Martin et al. (2004), plus the main indicator $A1\_30end$. In the following specifications (columns 2-13) I proceed to remove, one by one, the variable that turns out to be the least significant in the previous regression (largest p-value). I do not eliminate variables that are significant at a 10% confidence level so the exercise ends when all variables have reached that significance level. As can be seen, the variable signalling A-countries is never dropped out in this exercise and it remains within the group of significant regressors even when there is only five variables left. Moreover, the main variable is one of the few that presents significant coefficients in all specifications. Again, this result is robust to the use of alternative variables signalling A-countries. Notice that the number of observations increases as variables are removed. This is so because relevant information is not available for many countries. In particular, detailed information on education in the 60's or 70's is limited to a very small sample of countries. Specifications with fewer controls show that the conclusion that specialization in agricultural production is related to lower growth is not driven by a small country sample. Table A.12 shows the result of a similar exercise using nominal income instead of real income since this approximates better the specification I have in the model. The same conclusion remains. Overall, these results indicate that there is robust correlation between having remained specialized in agricultural production and slow growth relative to other countries with similar values of all other growth determinants during this period.

Table A.2: List of Ak and E-goods ($\forall k = 1, 2, 3$) as classified in SITCRev2 (4-digits)

SITCRev2 Code	**Description**	**A1**	**A2**	**A3**	**E**
0011-0XXX	Food and live animals chiefly for food	X	X	X	
1110-1XXX	Beverages and tobacco	X	X	X	
2111-2320	Hides, skins and furskins, raw; Oil-seeds and oleaginous fruit; Natural rubber Cork and wood; Pulp and waste paper; Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)	X	X	X	
2331-23XX	Synthetic or reclaimed rubber, waste and scrap of unhardened rubber.				X
2440-271X	Cork and wood; Pulp and waste paper; Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric); Fertilizers, crude	X	X	X	
2731-28XX	Stone, sand and gravel; Sulphur and unroasted iron pyrites; Natural abrasives, N.E.S. (including industrial diamonds); Other crude minerals; Metalliferous ores and metal scrap				X
2911-29XX	Crude animal and vegetable materials, N.E.S.	X	X	X	
3221-3XXX	Mineral fuels, lubricants and related materials				X
4111-4XXX	Animal and vegetable oils, fats and waxes	X	X	X	
5111-51XX	Organic Chemicals		X	X	
5221-52XX	Inorganic chemicals				X
5311-55XX	Dyeing, tanning and colouring materials; Medicinal and pharmaceutical products; Essential oils and perfume materials; Toilet, polishing and cleansing preparations				
5621-56XX	Fertilizers, manufactured		X	X	
5721-5XXX	Explosives and pyrotechnic products; Artificial resins and plastic materials, and cellulose esters and ethers; Chemical materials and products N.E.S.				
6112-61XX	Leather, leather manufactures, N.E.S., and dressed furskins			X	
6210-62XX	Rubber manufactures, N.E.S.				
6330-64XX	Cork and wood manufactures (excluding furniture); Paper, paperboard and articles of paper pulp, of paper or of paperboard			X	
6511-65XX	Textile yarn, fabrics, made-up articles, N.E.S. , and related products				
6611-661X	Lime, cement and fabricated construction materials (except glass and clay materials)				X
6623-666X	Clay construction materials and refractory construction materials; Mineral manufactures N.E.S; Glass; Glassware; Pottery				
6671-672X	Pearls, precious and semi-precious stones, unworked and worked; Pig iron, spiegeleisen, sponge iron, iron or steel powders and shot, and ferro-alloys; Ingots and other primary forms of iron and steel				X
6731-67XX	Iron and steel bars, rods, angles, shapes and sections; Universal plates and sheets of iron and steel; Hoops and strip of iron or steel, hot-rolled or cold-rolled; Rails and railway track construction materials of iron or steel; Wires, tube pipes and fittings of iron or steel.				
6811-68XX	Non-ferrous metals				X
6911-7XXX	Manufactures of metal N.E.S; Machinery and transport equipment				
8121-8XXX	Miscellaneous manufactured articles				
9110-9XXX	Commodities and transactions not classified elsewhere in the SITC				

Table A.3: Characterizing A-countries

Dependant variable:	Dummy for exporting A$k > j$% in 2000								
$[k, j] =$	$[1, 30]$	$[1, 40]$	$[1, 50]$	$[2, 30]$	$[2, 40]$	$[2, 50]$	$[3, 30]$	$[3, 40]$	$[3, 50]$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
exports in A1 (%)	2.287***	3.212**	1.750*						
	(0.005)	(0.021)	(0.088)						
exports in A2 (%)				2.265***	3.180**	1.726*			
				(0.004)	(0.013)	(0.094)			
exports in A3 (%)							1.238*	2.614***	1.605
							(0.061)	(0.007)	(0.121)
Trade openness	-0.012*	-0.005	-0.006	-0.013*	-0.006	-0.006	-0.013**	-0.006	-0.006
	(0.079)	(0.450)	(0.537)	(0.054)	(0.403)	(0.539)	(0.045)	(0.374)	(0.555)
Pop. density	-0.009*	-0.013**	-0.007	-0.010**	-0.010*	-0.007	-0.009**	-0.013**	-0.007
	(0.079)	(0.031)	(0.208)	(0.040)	(0.089)	(0.205)	(0.023)	(0.026)	(0.188)
arable land (% of land)	0.004	0.030*	0.019	0.014	0.015	0.019	0.005	0.015	0.019
	(0.817)	(0.088)	(0.295)	(0.398)	(0.414)	(0.298)	(0.756)	(0.405)	(0.284)
arable land (total)	-0.000*	-0.000*	-0.000	-0.000*	-0.000	-0.000	-0.000*	-0.000	-0.000
	(0.099)	(0.098)	(0.455)	(0.058)	(0.336)	(0.454)	(0.082)	(0.205)	(0.448)
GDPpc (logs)	-0.249	-0.027	-0.311	-0.214	-0.058	-0.317	-0.341*	-0.174	-0.337
	(0.181)	(0.905)	(0.170)	(0.242)	(0.788)	(0.160)	(0.055)	(0.396)	(0.124)
Gov. expenditure	0.009	-0.030	0.011	0.011	-0.021	0.011	-0.016	-0.051	0.008
	(0.838)	(0.508)	(0.758)	(0.801)	(0.625)	(0.769)	(0.671)	(0.252)	(0.829)
Constant	0.773	-2.038	0.100	0.611	-1.897	0.167	2.747	0.061	0.416
	(0.695)	(0.445)	(0.966)	(0.753)	(0.443)	(0.943)	(0.133)	(0.978)	(0.855)
Obs.	83	83	83	83	83	83	83	83	83
Pseudo-R^2	0.332	0.355	0.213	0.335	0.313	0.211	0.282	0.331	0.204

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. GDPpc (in logs) extracted from PWT, the rest of the controls are from WDI2015.

Table A.4: Controls used in growth regressions

var name	Description	Data source
East-Asia	Dummy for East-Asian countries.	Own construction following https://en.wikipedia.org/wiki/East_Asia
Primary enrol. rate	Enrolment rate in primary education (avg. 1962-1972).	Own construction using SE.PRM.TENR in WDI
Investment price PPP	Investment price level (avg. 1960-1964) PPP.	pi in PWT6.3 in Heston et al. (2011)
GDPpc (logs)	Log of GDP per capita in 1960.	rgdpl PWT6.3 in Heston et al. (2011)
Tropic land	Proportion of country's land area within geographical tropics.	lnd100km in geodata.dta in Gallup et al. (2010)
Coastal pop.	Coastal (within 100 km of coastline) population per coastal area in 1960's 1965.	dens65c in geodata.dta in Gallup et al. (2010)
Malaria prevalence	Index of malaria prevalence in 1966.	Mal66a in malaria.dta in Gallup et al. (2010)
Life Expectancy	Life expectancy in 1960.	X2 in Sala-i Martin (1997)
Confucian pop.	Fraction of population Confucian in 1960.	X53 in Sala-i Martin (1997)
S-S Africa	Dummy for Sub-Saharan African countries.	X4 in Sala-i Martin (1997)
LATAM	Dummy for Latin American countries.	X5 in Sala-i Martin (1997)
Mining GDP	Fraction of GDP in mining.	X59 in Sala-i Martin (1997)
Frm Spanish colony	Dummy for former Spanish colonies.	X50 in Sala-i Martin (1997)
Years open	Number of years economy has been open between 1950 and 1994.	X23 in Sala-i Martin (1997)
Muslim pop.	Fraction of population Muslim in 1960.	X56 in Sala-i Martin (1997)
Buddhist pop.	Fraction of population Buddhist in 1960.	X51 in Sala-i Martin (1997)
Linguistic diffs.	Average of five different indices of ethnolinguistic fractionalization which is the probability of two random people in a country not speaking the same language.	muller in othervar.dta in Easterly and Levine (1997)
Gov. expenditure	Share of expenditures on government consumption to GDP in 1961.	NE.CON.GOVT.ZS in WDI
Pop. density	Population per area in 1960.	EN.POP.DNST in WDI
RER distortions	Real exchange rate distortions.	X41 in Sala-i Martin (1997)

Table A.5: Cross-country growth regressions (A1-list 2000)

Dependant variable:	growth rate 1962-2000						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East-Asia	-63.801						
	(44.963)						
Primary enrol. rate	0.005	0.009	0.007	0.004	0.011*	0.005	0.002
	(0.009)	(0.007)	(0.010)	(0.008)	(0.005)	(0.007)	(0.007)
Investment price PPP	0.000	-0.001	0.002	0.003	-0.002	-0.001	-0.001
	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)
GDPpc (logs)	-0.032	-0.506	-0.338	-0.253	-0.540***	-0.645***	-0.660***
	(0.287)	(0.299)	(0.399)	(0.194)	(0.150)	(0.200)	(0.209)
Tropic land	0.211	0.176	0.246	0.463			
	(0.293)	(0.345)	(0.415)	(0.307)			
Coastal pop.	0.002	0.001	0.003	0.004	0.001	0.001	0.002
	(0.007)	(0.006)	(0.007)	(0.005)	(0.003)	(0.003)	(0.004)
Malaria prevalence	0.182	0.194	0.343	0.095			
	(0.353)	(0.368)	(0.403)	(0.293)			
Life expectancy	0.025	0.047**	0.043	0.014	0.034**	0.052**	0.053**
	(0.028)	(0.021)	(0.032)	(0.024)	(0.014)	(0.021)	(0.020)
Confucian pop.	151.065	8.653	0.334	5.654			
	(97.905)	(7.055)	(9.137)	(5.870)			
S-S Africa	-0.298						
	(0.807)						
LATAM	0.557						
	(0.527)						
Mining GDP	-2.925	-2.823	-2.446	-2.043	-2.553*	-1.483	-1.153
	(2.349)	(1.838)	(2.203)	(1.229)	(1.394)	(1.548)	(1.559)
Frm Spanish colony	-0.644***	0.215	-0.131	-0.459**			
	(0.194)	(0.262)	(0.258)	(0.163)			
Years open	0.481	0.253	0.250	0.362*	0.331	0.300	0.291
	(0.412)	(0.240)	(0.263)	(0.176)	(0.196)	(0.214)	(0.319)
Muslim pop.	0.692	0.290	0.421	0.061			
	(0.558)	(0.274)	(0.331)	(0.219)			
Buddhist pop.	73.955	0.404	0.210	0.137			
	(51.676)	(0.230)	(0.270)	(0.256)			
Linguistic diffs.	0.749	0.798***	0.462	-0.176	0.415	0.360	0.013
	(0.458)	(0.249)	(0.345)	(0.343)	(0.251)	(0.264)	(0.315)
Gov. expenditure	0.038*	0.027	-0.004	-0.010	0.012	0.007	0.025
	(0.021)	(0.026)	(0.029)	(0.026)	(0.018)	(0.020)	(0.026)
Pop. density	-0.003	-0.002	-0.003	-0.005	-0.001	-0.001	-0.002
	(0.007)	(0.006)	(0.007)	(0.005)	(0.003)	(0.003)	(0.004)
RER distortions	0.002	0.001	0.001	-0.001	0.001	0.003	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)
A1_30_00		-0.651**			-0.606***		
		(0.274)			(0.138)		
A1_40_00			-0.385			-0.603***	
			(0.290)			(0.184)	
A1_50_00				-0.835***			-0.784***
				(0.166)			(0.143)
Constant	-2.152	0.917	0.006	1.622	2.197**	2.304**	2.803**
	(2.399)	(2.105)	(2.547)	(1.565)	(0.837)	(0.980)	(1.306)
Obs.	33	33	33	33	33	33	33
R^2	0.905	0.861	0.822	0.889	0.817	0.784	0.791

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources.

Table A.6: Cross country growth regressions (A2-list 2000)

Dependant variable:	growth rate 1962-2000						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East-Asia	-63.801						
	(44.963)						
Primary enrol. rate	0.005	-0.000	0.007	0.004	-0.000	0.005	0.002
	(0.009)	(0.008)	(0.010)	(0.008)	(0.006)	(0.007)	(0.007)
Investment price PPP	0.000	-0.001	0.002	0.003	-0.004	-0.001	-0.001
	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)
GDPpc (logs)	-0.032	-0.552	-0.338	-0.253	-0.770***	-0.645***	-0.660***
	(0.287)	(0.320)	(0.399)	(0.194)	(0.192)	(0.200)	(0.209)
Tropic land	0.211	0.242	0.246	0.463			
	(0.293)	(0.351)	(0.415)	(0.307)			
Coastal pop.	0.002	0.001	0.003	0.004	0.002	0.001	0.002
	(0.007)	(0.006)	(0.007)	(0.005)	(0.004)	(0.003)	(0.004)
Malaria prevalence	0.182	0.381	0.343	0.095			
	(0.353)	(0.342)	(0.403)	(0.293)			
Life expectancy	0.025	0.076**	0.043	0.014	0.073***	0.052**	0.053**
	(0.028)	(0.031)	(0.032)	(0.024)	(0.020)	(0.021)	(0.020)
Confucian pop.	151.065	11.171	0.334	5.654			
	(97.905)	(9.533)	(9.137)	(5.870)			
S-S Africa	-0.298						
	(0.807)						
LATAM	0.557						
	(0.527)						
Mining GDP	-2.925	-3.371*	-2.446	-2.043	-2.554*	-1.483	-1.153
	(2.349)	(1.825)	(2.203)	(1.229)	(1.430)	(1.548)	(1.559)
Frm Spanish colony	-0.644***	0.033	-0.131	-0.459**			
	(0.194)	(0.288)	(0.258)	(0.163)			
Years open	0.481	0.088	0.250	0.362*	0.195	0.300	0.291
	(0.412)	(0.313)	(0.263)	(0.176)	(0.247)	(0.214)	(0.319)
Muslim pop.	0.692	0.475	0.421	0.061			
	(0.558)	(0.272)	(0.331)	(0.219)			
Buddhist pop.	73.955	0.494	0.210	0.137			
	(51.676)	(0.287)	(0.270)	(0.256)			
Linguistic diffs.	0.749	0.780*	0.462	-0.176	0.415	0.360	0.013
	(0.458)	(0.398)	(0.345)	(0.343)	(0.332)	(0.264)	(0.315)
Gov. expenditure	0.038*	0.019	-0.004	-0.010	0.019	0.007	0.025
	(0.021)	(0.032)	(0.029)	(0.026)	(0.022)	(0.020)	(0.026)
Pop. density	-0.003	-0.002	-0.003	-0.005	-0.002	-0.001	-0.002
	(0.007)	(0.006)	(0.007)	(0.005)	(0.004)	(0.003)	(0.004)
RER distortions	0.002	-0.002	0.001	-0.001	-0.000	0.003	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)
A2_30_00		-0.427*			-0.443***		
		(0.220)			(0.145)		
A2_40_00			-0.385			-0.603***	
			(0.290)			(0.184)	
A2_50_00				-0.835***			-0.784***
				(0.166)			(0.143)
Constant	-2.152	0.755	0.006	1.622	3.005**	2.304**	2.803**
	(2.399)	(1.959)	(2.547)	(1.565)	(1.117)	(0.980)	(1.306)
Obs.	33	33	33	33	33	33	33
R^2	0.905	0.829	0.822	0.889	0.753	0.784	0.791

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources.

Table A.7: Cross country growth regressions (A3-list 2000)

Dependant variable:	growth rate 1962-2000						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East-Asia	-63.801						
	(44.963)						
Primary enrol. rate	0.005	-0.001	0.007	0.008	-0.002	0.005	0.005
	(0.009)	(0.009)	(0.010)	(0.008)	(0.006)	(0.007)	(0.005)
Investment price PPP	0.000	-0.001	0.002	0.004	-0.004	-0.001	0.001
	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)
GDPpc (logs)	-0.032	-0.491	-0.338	-0.369	-0.746***	-0.645***	-0.732***
	(0.287)	(0.311)	(0.399)	(0.247)	(0.197)	(0.200)	(0.190)
Tropic land	0.211	0.282	0.246	0.316			
	(0.293)	(0.348)	(0.415)	(0.301)			
Coastal pop.	0.002	0.003	0.003	0.001	0.003	0.001	-0.000
	(0.007)	(0.006)	(0.007)	(0.005)	(0.004)	(0.003)	(0.003)
Malaria prevalence	0.182	0.381	0.343	0.230			
	(0.353)	(0.346)	(0.403)	(0.298)			
Life expectancy	0.025	0.073**	0.043	0.038	0.075***	0.052**	0.061***
	(0.028)	(0.031)	(0.032)	(0.025)	(0.019)	(0.021)	(0.016)
Confucian pop.	151.065	11.291	0.334	4.468			
	(97.905)	(10.394)	(9.137)	(6.696)			
S-S Africa	-0.298						
	(0.807)						
LATAM	0.557						
	(0.527)						
Mining GDP	-2.925	-3.407*	-2.446	-3.007*	-2.533	-1.483	-1.951
	(2.349)	(1.880)	(2.203)	(1.473)	(1.478)	(1.548)	(1.339)
Frm Spanish colony	-0.644***	-0.015	-0.131	-0.268			
	(0.194)	(0.284)	(0.258)	(0.193)			
Years open	0.481	0.156	0.250	0.039	0.251	0.300	0.004
	(0.412)	(0.324)	(0.263)	(0.207)	(0.267)	(0.214)	(0.215)
Muslim pop.	0.692	0.474	0.421	0.316			
	(0.558)	(0.275)	(0.331)	(0.213)			
Buddhist pop.	73.955	0.466	0.210	0.130			
	(51.676)	(0.309)	(0.270)	(0.252)			
Linguistic diffs.	0.749	0.754*	0.462	0.154	0.428	0.360	0.094
	(0.458)	(0.385)	(0.345)	(0.326)	(0.330)	(0.264)	(0.306)
Gov. expenditure	0.038*	0.019	-0.004	-0.022	0.023	0.007	-0.002
	(0.021)	(0.035)	(0.029)	(0.027)	(0.023)	(0.020)	(0.021)
Pop. density	-0.003	-0.004	-0.003	-0.002	-0.003	-0.001	0.000
	(0.007)	(0.006)	(0.007)	(0.005)	(0.004)	(0.003)	(0.004)
RER distortions	0.002	-0.001	0.001	-0.001	0.000	0.003	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)
A3_30_00		-0.385*			-0.419***		
		(0.211)			(0.137)		
A3_40_00			-0.385			-0.603***	
			(0.290)			(0.184)	
A3_50_00				-0.633***			-0.779***
				(0.148)			(0.122)
Constant	-2.152	0.356	0.006	1.099	2.687**	2.304**	3.076**
	(2.399)	(1.870)	(2.547)	(1.622)	(1.179)	(0.980)	(1.197)
Obs.	33	33	33	33	33	33	33
R^2	0.905	0.823	0.822	0.883	0.746	0.784	0.829

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources.

Table A.8: Cross country growth regressions (A1-list permanent)

Dependant variable:	growth rate 1962-2000						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East-Asia	-63.801						
	(44.963)						
Primary enrol. rate	0.005	0.000	0.004	0.005	-0.004	0.004	0.002
	(0.009)	(0.008)	(0.012)	(0.011)	(0.006)	(0.008)	(0.008)
Investment price PPP	0.000	-0.001	-0.001	0.003	-0.005*	-0.003	-0.002
	(0.003)	(0.004)	(0.005)	(0.004)	(0.003)	(0.002)	(0.003)
GDPpc (logs)	-0.032	-0.414	-0.497	-0.252	-0.783***	-0.656***	-0.668***
	(0.287)	(0.318)	(0.356)	(0.261)	(0.200)	(0.204)	(0.235)
Tropic land	0.211	0.284	0.265	0.508			
	(0.293)	(0.252)	(0.351)	(0.346)			
Coastal pop.	0.002	0.002	0.001	0.003	0.000	-0.002	-0.001
	(0.007)	(0.005)	(0.007)	(0.007)	(0.004)	(0.003)	(0.004)
Malaria prevalence	0.182	0.393	0.253	0.388			
	(0.353)	(0.328)	(0.362)	(0.332)			
Life expectancy	0.025	0.062**	0.056	0.041	0.081***	0.054**	0.060**
	(0.028)	(0.029)	(0.034)	(0.031)	(0.018)	(0.024)	(0.022)
Confucian pop.	151.065	5.819	2.106	1.688			
	(97.905)	(7.170)	(8.379)	(7.075)			
S-S Africa	-0.298						
	(0.807)						
LATAM	0.557						
	(0.527)						
Mining GDP	-2.925	-3.349*	-2.663	-4.018**	-2.253*	-2.267	-3.100*
	(2.349)	(1.865)	(1.928)	(1.710)	(1.250)	(1.403)	(1.590)
Frm Spanish colony	-0.644***	-0.167	0.110	-0.098			
	(0.194)	(0.223)	(0.300)	(0.194)			
Years open	0.481	0.070	0.122	0.025	0.080	0.157	0.000
	(0.412)	(0.269)	(0.221)	(0.231)	(0.194)	(0.177)	(0.278)
Muslim pop.	0.692	0.453	0.357	0.510**			
	(0.558)	(0.267)	(0.278)	(0.228)			
Buddhist pop.	73.955	0.124	0.214	0.110			
	(51.676)	(0.232)	(0.285)	(0.293)			
Linguistic diffs.	0.749	0.217	0.528	0.376	-0.014	0.246	0.123
	(0.458)	(0.399)	(0.342)	(0.351)	(0.370)	(0.281)	(0.357)
Gov. expenditure	0.038*	-0.026	0.003	-0.015	-0.013	-0.002	-0.001
	(0.021)	(0.024)	(0.026)	(0.026)	(0.023)	(0.019)	(0.025)
Pop. density	-0.003	-0.002	-0.001	-0.004	-0.001	0.002	0.001
	(0.007)	(0.005)	(0.007)	(0.007)	(0.004)	(0.003)	(0.004)
RER distortions	0.002	0.002	0.002	-0.001	0.004	0.003	-0.001
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
A1_30_30yr		-0.487**			-0.618***		
		(0.177)			(0.153)		
A1_40_30yr			-0.575*			-0.643***	
			(0.321)			(0.165)	
A1_50_30yr				-0.459**			-0.554***
				(0.187)			(0.181)
Constant	-2.152	0.681	0.812	-0.146	3.297***	2.776**	3.086**
	(2.399)	(1.995)	(2.329)	(1.938)	(1.152)	(1.030)	(1.425)
Obs.	33	33	33	33	33	33	33
R^2	0.905	0.856	0.843	0.846	0.795	0.804	0.753

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources.

Table A.9: Cross country growth regressions (A2-list permanent)

Dependant variable:	growth rate 1962-2000						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East-Asia	-63.801						
	(44.963)						
Primary enrol. rate	0.005	-0.001	-0.010	0.005	-0.005	-0.007	0.002
	(0.009)	(0.009)	(0.007)	(0.011)	(0.006)	(0.005)	(0.008)
Investment price PPP	0.000	-0.002	-0.003	0.003	-0.006*	-0.004	-0.002
	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)	(0.002)	(0.003)
GDPpc (logs)	-0.032	-0.493	-0.778**	-0.252	-0.848***	-0.801***	-0.668***
	(0.287)	(0.355)	(0.302)	(0.261)	(0.208)	(0.158)	(0.235)
Tropic land	0.211	0.364	0.162	0.508			
	(0.293)	(0.270)	(0.272)	(0.346)			
Coastal pop.	0.002	0.001	-0.004	0.003	0.000	-0.003	-0.001
	(0.007)	(0.005)	(0.005)	(0.007)	(0.004)	(0.003)	(0.004)
Malaria prevalence	0.182	0.303	0.267	0.388			
	(0.353)	(0.339)	(0.297)	(0.332)			
Life expectancy	0.025	0.072*	0.096***	0.041	0.091***	0.076***	0.060**
	(0.028)	(0.034)	(0.025)	(0.031)	(0.021)	(0.016)	(0.022)
Confucian pop.	151.065	10.560	7.080	1.688			
	(97.905)	(9.279)	(8.007)	(7.075)			
S-S Africa	-0.298						
	(0.807)						
LATAM	0.557						
	(0.527)						
Mining GDP	-2.925	-3.777*	-2.151	-4.018**	-2.547*	-1.864	-3.100*
	(2.349)	(1.821)	(1.864)	(1.710)	(1.237)	(1.236)	(1.590)
Frm Spanish colony	-0.644***	-0.143	0.294	-0.098			
	(0.194)	(0.236)	(0.233)	(0.194)			
Years open	0.481	0.021	0.070	0.025	0.049	0.202	0.000
	(0.412)	(0.294)	(0.187)	(0.231)	(0.201)	(0.170)	(0.278)
Muslim pop.	0.692	0.461	0.415**	0.510**			
	(0.558)	(0.272)	(0.189)	(0.228)			
Buddhist pop.	73.955	0.159	0.462*	0.110			
	(51.676)	(0.246)	(0.216)	(0.293)			
Linguistic diffs.	0.749	0.418	0.710**	0.376	0.186	0.242	0.123
	(0.458)	(0.412)	(0.297)	(0.351)	(0.387)	(0.284)	(0.357)
Gov. expenditure	0.038*	-0.016	0.009	-0.015	-0.004	-0.006	-0.001
	(0.021)	(0.026)	(0.021)	(0.026)	(0.024)	(0.019)	(0.025)
Pop. density	-0.003	-0.002	0.003	-0.004	-0.001	0.003	0.001
	(0.007)	(0.005)	(0.005)	(0.007)	(0.004)	(0.003)	(0.004)
RER distortions	0.002	0.002	0.002	-0.001	0.004	0.003	-0.001
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
A2_30_30yr		-0.483*			-0.570***		
		(0.230)			(0.168)		
A2_40_30yr			-0.810***			-0.716***	
			(0.207)			(0.148)	
A2_50_30yr				-0.459**			-0.554***
				(0.187)			(0.181)
Constant	-2.152	0.800	2.190	-0.146	3.200**	3.755***	3.086**
	(2.399)	(2.083)	(1.907)	(1.938)	(1.184)	(0.794)	(1.425)
Obs.	33	33	33	33	33	33	33
R^2	0.905	0.844	0.893	0.846	0.771	0.828	0.753

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources.

Table A.10: Cross country growth regressions (A3-list permanent)

Dependant variable:	growth rate 1962-2000						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
East-Asia	-63.801						
	(44.963)						
Primary enrol. rate	0.005	-0.003	-0.008	0.005	-0.010	-0.010	0.002
	(0.009)	(0.010)	(0.013)	(0.011)	(0.006)	(0.006)	(0.008)
Investment price PPP	0.000	-0.002	-0.001	0.003	-0.007**	-0.005*	-0.002
	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)
GDPpc (logs)	-0.032	-0.450	-0.563	-0.252	-0.846***	-0.799***	-0.668***
	(0.287)	(0.290)	(0.353)	(0.261)	(0.212)	(0.194)	(0.235)
Tropic land	0.211	0.336	0.189	0.508			
	(0.293)	(0.259)	(0.324)	(0.346)			
Coastal pop.	0.002	0.003	0.001	0.003	0.001	0.001	-0.001
	(0.007)	(0.005)	(0.006)	(0.007)	(0.004)	(0.004)	(0.004)
Malaria prevalence	0.182	0.317	0.464	0.388			
	(0.353)	(0.321)	(0.317)	(0.332)			
Life expectancy	0.025	0.074**	0.086**	0.041	0.101***	0.086***	0.060**
	(0.028)	(0.032)	(0.040)	(0.031)	(0.020)	(0.018)	(0.022)
Confucian pop.	151.065	2.324	6.404	1.688			
	(97.905)	(6.585)	(8.217)	(7.075)			
S-S Africa	-0.298						
	(0.807)						
LATAM	0.557						
	(0.527)						
Mining GDP	-2.925	-3.462*	-2.800	-4.018**	-2.459*	-2.244*	-3.100*
	(2.349)	(1.688)	(1.910)	(1.710)	(1.232)	(1.285)	(1.590)
Frm Spanish colony	-0.644***	-0.124	0.007	-0.098			
	(0.194)	(0.221)	(0.278)	(0.194)			
Years open	0.481	0.126	0.055	0.025	0.134	0.110	0.000
	(0.412)	(0.271)	(0.315)	(0.231)	(0.214)	(0.233)	(0.278)
Muslim pop.	0.692	0.476*	0.419	0.510**			
	(0.558)	(0.247)	(0.262)	(0.228)			
Buddhist pop.	73.955	0.043	0.416	0.110			
	(51.676)	(0.289)	(0.319)	(0.293)			
Linguistic diffs.	0.749	0.462	0.471	0.376	0.303	0.156	0.123
	(0.458)	(0.372)	(0.319)	(0.351)	(0.349)	(0.311)	(0.357)
Gov. expenditure	0.038*	-0.004	0.001	-0.015	0.011	0.003	-0.001
	(0.021)	(0.028)	(0.027)	(0.026)	(0.020)	(0.024)	(0.025)
Pop. density	-0.003	-0.004	-0.002	-0.004	-0.001	-0.001	0.001
	(0.007)	(0.005)	(0.006)	(0.007)	(0.004)	(0.004)	(0.004)
RER distortions	0.002	0.003	0.000	-0.001	0.004	0.002	-0.001
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
A3_30_30yr		-0.438**			-0.598***		
		(0.175)			(0.138)		
A3_40_30yr			-0.522*			-0.590***	
			(0.284)			(0.167)	
A3_50_30yr				-0.459**			-0.554***
				(0.187)			(0.181)
Constant	-2.152	0.199	0.981	-0.146	2.825**	3.387**	3.086**
	(2.399)	(1.578)	(2.120)	(1.938)	(1.259)	(1.223)	(1.425)
Obs.	33	33	33	33	33	33	33
R^2	0.905	0.847	0.839	0.846	0.793	0.781	0.753

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. Robust standard errors in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources.

Table A.11: Evaluating importance of *A*-countries dummy in growth regressions

Dependant variable:	growth rate 1962-2000										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Primary enrol. rate	0.010	0.010	0.010	0.010	0.003						
	(0.182)	(0.137)	(0.141)	(0.151)	(0.700)						
Investment price PPP	0.001	0.001									
	(0.892)	(0.873)									
GDPpc (logs)	-0.366	-0.368	-0.384*	-0.422**	-0.438**	-0.325***	-0.326***	-0.288***	-0.279***	-0.278***	-0.283***
	(0.183)	(0.165)	(0.076)	(0.021)	(0.032)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tropic land	0.268	0.269	0.251	0.212	0.352*	0.231*	0.231*	0.176	0.175	0.156	
	(0.396)	(0.379)	(0.282)	(0.208)	(0.054)	(0.067)	(0.065)	(0.109)	(0.112)	(0.156)	
Coastal pop.	0.002	0.002	0.002								
	(0.697)	(0.689)	(0.674)								
Malaria prevalence	0.267	0.275	0.249	0.225	0.179	0.007					
	(0.430)	(0.320)	(0.264)	(0.287)	(0.474)	(0.974)					
Life expectancy	0.036*	0.037*	0.038**	0.039**	0.047**	0.038***	0.038***	0.037***	0.036***	0.036***	0.038***
	(0.094)	(0.051)	(0.015)	(0.015)	(0.024)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Confucian pop.	6.769	6.883	7.173	8.853	8.743*	4.918***	4.910***	2.901***	2.887***	2.701***	2.780***
	(0.361)	(0.319)	(0.281)	(0.133)	(0.063)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mining GDP	-3.083*	-3.076*	-3.084*	-3.168*	-2.219	-0.217	-0.220	0.351			
	(0.096)	(0.085)	(0.070)	(0.061)	(0.163)	(0.820)	(0.816)	(0.681)			
Years open	0.275	0.275	0.260	0.248	0.210	0.419**	0.419**	0.352**	0.340**	0.320**	0.330**
	(0.279)	(0.261)	(0.255)	(0.283)	(0.365)	(0.018)	(0.019)	(0.012)	(0.015)	(0.022)	(0.017)
Muslim pop.	0.343	0.342	0.336	0.323	0.188	0.321*	0.320*	0.302**	0.297**	0.290**	0.281**
	(0.224)	(0.210)	(0.186)	(0.188)	(0.440)	(0.058)	(0.059)	(0.027)	(0.031)	(0.034)	(0.037)
Buddhist pop.	0.284	0.290*	0.305**	0.317**	0.337**	0.429**	0.428**	0.606***	0.610***	0.571***	0.605***
	(0.210)	(0.087)	(0.046)	(0.045)	(0.020)	(0.023)	(0.024)	(0.003)	(0.003)	(0.003)	(0.001)
Linguistic diffs.	0.633**	0.635**	0.633**	0.675**	0.609*	0.020	0.020				
	(0.048)	(0.035)	(0.029)	(0.033)	(0.075)	(0.933)	(0.931)				
Gov. expenditure	0.011	0.011	0.013	0.011							
	(0.580)	(0.551)	(0.476)	(0.536)							
Pop. density	-0.003	-0.003	-0.003	-0.001	-0.001*	-0.000	-0.000*	-0.000	-0.000		
	(0.614)	(0.602)	(0.577)	(0.157)	(0.078)	(0.112)	(0.098)	(0.454)	(0.441)		
RER distortions	0.000										
	(0.944)										
A1_30_00	-0.513***	-0.511***	-0.514***	-0.539***	-0.582***	-0.222*	-0.221*	-0.207**	-0.216**	-0.219**	-0.225**
	(0.007)	(0.005)	(0.003)	(0.000)	(0.000)	(0.064)	(0.055)	(0.033)	(0.028)	(0.025)	(0.017)
Constant	0.413	0.427	0.557	0.896	1.189	0.845	0.861**	0.640*	0.646*	0.654*	0.643*
	(0.837)	(0.827)	(0.721)	(0.435)	(0.352)	(0.228)	(0.042)	(0.066)	(0.067)	(0.064)	(0.065)
Obs.	33	33	33	33	37	72	72	92	92	93	95
R^2	0.854	0.854	0.854	0.851	0.791	0.695	0.695	0.698	0.698	0.696	0.694

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. All estimations using heteroskedasticity-consistent standard errors. p-values in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources. A-countries defined as those for which the share of exports in A1-goods is larger than 30% in 2000.

Table A.12: Evaluating importance of *A*-countries dummy in growth regressions with nominal income

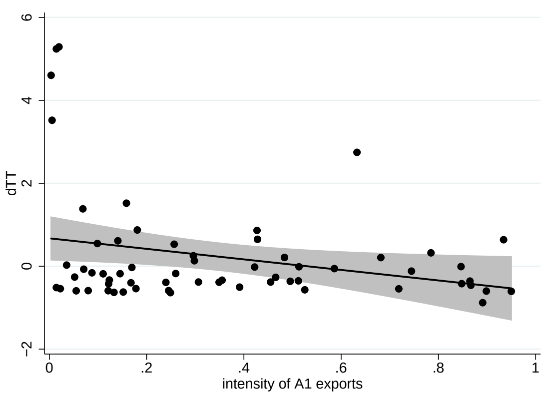
Dependant variable:	growth rate 1962-2000										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Primary enrol. rate	0.004	0.004	0.003								
	(0.730)	(0.621)	(0.657)								
Investment price PPP	-0.003	-0.005	-0.004	-0.000	-0.000	-0.000	-0.000	-0.000			
	(0.403)	(0.183)	(0.331)	(0.106)	(0.153)	(0.150)	(0.316)	(0.300)			
Nominal GDPpc (log)	-0.534**	-0.256	-0.271	-0.247*	-0.259*	-0.255*	-0.353**	-0.365***	-0.372***	-0.371***	-0.390***
	(0.038)	(0.240)	(0.231)	(0.083)	(0.077)	(0.078)	(0.014)	(0.004)	(0.002)	(0.002)	(0.001)
Tropic land	0.046	0.298	0.293	0.240	0.244	0.248	0.233	0.235	0.243*	0.224	
	(0.809)	(0.183)	(0.162)	(0.137)	(0.138)	(0.129)	(0.113)	(0.110)	(0.092)	(0.126)	
Coastal pop.	-0.009**	-0.004	-0.005	0.002*	0.002*	0.002*	0.002*	0.001*	0.002*	0.002**	0.002**
	(0.031)	(0.338)	(0.264)	(0.095)	(0.068)	(0.061)	(0.053)	(0.062)	(0.056)	(0.048)	(0.043)
Malaria prevalence	0.299	0.258	0.290	0.276	0.270	0.268	0.083				
	(0.370)	(0.396)	(0.273)	(0.228)	(0.256)	(0.256)	(0.703)				
Life expectancy	0.080**	0.049**	0.050**	0.053***	0.053***	0.053***	0.062***	0.061***	0.061***	0.057***	0.061***
	(0.023)	(0.034)	(0.026)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Confucian pop.	19.294**	14.175*	14.946*	2.154**	2.191**	2.176**	3.223***	3.253***	3.239***	3.049***	3.082***
	(0.046)	(0.078)	(0.061)	(0.036)	(0.029)	(0.028)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mining GDP	-4.405**	-3.725**	-3.690**	0.176	0.161						
	(0.020)	(0.019)	(0.016)	(0.842)	(0.857)						
Years open	0.035	0.172	0.194	0.660***	0.678***	0.675***	0.595***	0.588***	0.601***	0.614***	0.616***
	(0.847)	(0.443)	(0.371)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Muslim pop.	0.291	0.137	0.133	0.184	0.179	0.182	0.255	0.242	0.249		
	(0.275)	(0.560)	(0.576)	(0.283)	(0.284)	(0.268)	(0.117)	(0.168)	(0.147)		
Buddhist pop.	1.255***	1.163***	1.194***	0.102							
	(0.001)	(0.000)	(0.000)	(0.863)							
Linguistic diffs.	0.830***	0.588*	0.584*	-0.195	-0.195	-0.189					
	(0.004)	(0.077)	(0.079)	(0.482)	(0.477)	(0.484)					
Gov. expenditure	-0.001										
	(0.951)										
Pop. density	0.007*	0.003	0.004	-0.002*	-0.002*	-0.002*	-0.002*	-0.002*	-0.002*	-0.002**	-0.002**
	(0.054)	(0.445)	(0.366)	(0.088)	(0.063)	(0.056)	(0.050)	(0.059)	(0.053)	(0.047)	(0.047)
RER distortions	0.000	0.002									
	(0.929)	(0.635)									
A1_30_00	-0.687***	-0.790***	-0.786***	-0.321***	-0.325***	-0.326***	-0.336**	-0.330**	-0.336**	-0.382***	-0.392***
	(0.000)	(0.000)	(0.000)	(0.006)	(0.005)	(0.004)	(0.015)	(0.013)	(0.011)	(0.001)	(0.001)
Constant	-0.875	-1.301	-1.102	-1.883***	-1.825***	-1.823***	-1.576**	-1.385***	-1.373***	-1.105***	-1.092***
	(0.428)	(0.225)	(0.352)	(0.004)	(0.007)	(0.007)	(0.011)	(0.000)	(0.000)	(0.002)	(0.002)
Obs.	33	37	37	72	72	72	92	92	92	92	92
R^2	0.922	0.889	0.888	0.793	0.793	0.793	0.783	0.783	0.782	0.776	0.770

Notes: *, ** and ***, significant at a 10, 5 and 1% confidence level respectively. All estimations using heteroskedasticity-consistent standard errors. p-values in parenthesis. Controls are variables identified as robust growth regressors in Sala-i-Martin et al. (2004). See Table A.4 for description of variables and data sources. A-countries defined as those for which the share of exports in A1-goods is larger than 30% in 2000.. Nominal income is the product of real GDP at current prices and current prices as reported in PWT.

A.6 Robustness of results in Sections 3 and 4

Figure A.3 replicates results in Figure 3, for an extended period that includes the first decade of the new millennium. Terms of trade are still decreasing on the share of exports in A-products but even for high values of this share, I cannot reject that the change is different from zero (at 95% confidence). The difference between this result and that in Figure 3 can be explained by the well-known positive effect that trade liberalization in China had on terms of trade for agricultural economies after 2000.

Figure A.3: Evolution of net barter terms of trade and intensity of A-exports for the period 1965-2010

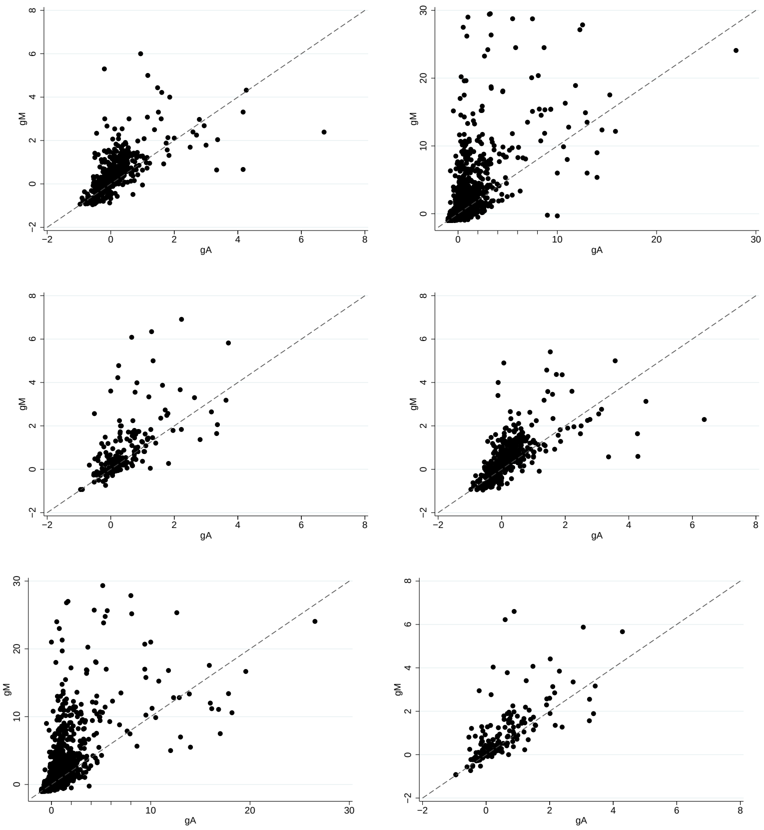


Notes: dTT is the change in the net barter terms of trade (as reported in the WDI) of each country and $A1$ is the share of $A1$-products over total exports of that country (list of A1 products in the Appendix). Terms of trade from Barro and Lee (1993) for years between 1965-1985 and from WDI for the period 1985-2010. Export data are from Feenstra et al. (2005) in both cases. The grey area reports the 95% confidence interval of the fitted line (in black).

Figure A.4 shows identical results as those in Figure 4, using alternative lists of A-goods. Table A.13 complements the picture with the corresponding mean tests (no outliers excluded).

Finally, Tables A.14 and A.15 present similar results counting varieties instead of products. The former counts pairs product-origin, and therefore measures the change in the number of varieties available at the world level. Given that this exercise gives only one observation per year and industry I do not present results at 6-digits as the very few resulting observations prevent proper mean tests. The latter table counts firms on domestic production datasets for the US and the EU.

Figure A.4: Diversification rates in M and A goods for each country (g_{Ak} and g_{Mk} with $k = 2, 3$)



Notes: Diversification rates g_{Ak} and g_{Mk} are computed as the percent change in the amount of different goods exported by a country in a certain period, using the list of Ak goods in the Appendix, for $k = 2, 3$. Each dot represents a pair (g_{Ak},g_{Mk}) for one country in each sub-period. Figures on the left plot diversification rates using 4-digit exports from Feenstra et al. (2005). Figures in the center use 5-digit data from COMTRADE. Figures on the right plot diversification rates using 6-digit exports from BACI92. Figures in the top use the list of A2 goods while those in the bottom use A3.

A.7 Proximity by sector

This section presents summary statistics by sector using the technological proximity index presented in Hidalgo et al. (2007). The index is constructed using export data and defines technological proximity between goods a and b as the minimum between the probability of a given country exporting good a conditional of it exporting b and the probability that a country exports b provided it exports a. Table A.16 reports the technological proximity between the representative good belonging to industry $k = A, M$ and all other goods in the product space. It is possible to see that for any list of A-goods the average proximity is smaller in sector A than in M, which is interpreted here as evidence supporting a higher diversification cost

Table A.13: Testing for differences in diversification rates (all obs.)

$gMk = gAk$	4-digits $k=1$	4-digits $k=2$	4-digits $k=3$	5-digits $k=1$	5-digits $k=2$	5-digits $k=3$	6-digits $k=1$	6-digits $k=2$	6-digits $k=3$
mean(gM)	0.858	0.935	0.898	1.468	1.464	1.473	0.809	0.812	0.860
sd(gM)	6.605	7.755	7.133	13.852	14.260	12.298	1.415	1.418	1.510
mean(gA)	0.269	0.274	0.321	0.350	0.416	0.473	0.463	0.474	0.501
sd(gA)	2.171	1.977	2.322	2.289	2.642	3.347	1.542	1.411	1.230
Obs.	561	561	561	4,846	4,850	4,847	220	220	220
$Ha : gM < gA$	0.998	0.995	0.996	1.000	1.000	1.000	1.000	1.000	1.000
$Ha : gM \neq gA$	0.003	0.010	0.007	0.000	0.000	0.000	0.000	0.000	0.000
$Ha : gM > gA$	0.002	0.005	0.004	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Each column presents the result of a mean-comparison t-test, where the null hypothesis is $g_{Mk} = g_{Ak}$ for $k = 1, 2, 3$ as listed in the Appendix. The first and third row give the mean of g_{Mi} and g_{Ai} respectively, while the second and fourth provide the respective standard deviation. The last three rows show the p-value of a t-test for different alternative hypothesis.

Table A.14: Testing for differences in diversification rates (varieties)

	4-digits $gM1 = gA1$	4-digits $gM2 = gA2$	4-digits $gM3 = gA3$
mean(gM)	0.026	0.023	0.028
sd(gM)	0.560	0.558	0.564
mean(gA)	-0.158	-0.139	-0.123
sd(gA)	0.441	0.450	0.460
Obs.	44	44	44
$Ha : gM < gA$	1.000	1.000	1.000
$Ha : gM \neq gA$	0.000	0.000	0.000
$Ha : gM > gA$	0.000	0.000	0.000

Notes: Each column presents the result of a mean-comparison t-test, where the null hypothesis is $g_{Mk} = g_{Ak}$ for $k = 1, 2, 3$. Diversification rates measure the percentage change in the quantity of pairs (country of origin-product) at the beginning and end of 10-year intervals starting at each year of the period 1962-1992. 4-digit data from Feenstra et al. (2005) is used. The first and third row give the mean of g_{Mk} and g_{Ak} respectively, while the second and fourth provide the respective standard deviation. The last three rows show the p-value of a t-test where the alternative hypothesis are $g_{Mk} < g_{Ak}$, $g_{Mk} \neq g_{Ak}$ and $g_{Mk} > g_{Ak}$ respectively.

in that industry ($a_A > a_M$). Table A.17, presents the average proximity within each industry and shows that the average proximity within A is lower than in M, further suggesting that diversification is harder in the agricultural sector.

Table A.15: Testing for differences in diversification rates using domestic production data

$gMk = gAk$	$k = 1$	$k = 2$	$k = 3$
mean(gM)	0.323	0.335	0.494
sd(gM)	1.601	1.666	2.554
mean(gA)	-0.233	-0.230	-0.226
sd(gA)	0.146	0.146	0.137
Obs.	29	29	29
$Ha : gM < gA$	0.957	0.954	0.925
$Ha : gM \neq gA$	0.086	0.092	0.151
$Ha : gM > gA$	0.043	0.046	0.075

Notes: Each column presents the result of a mean-comparison t-test, where the null hypothesis is $g_{Mk} = g_{Ak}$ for $k = 1, 2, 3$ as listed in the Appendix. The reported rate in each sector (A and M) results from comparing the number of firms producing in each of them, at the beginning and end of the data collected by Eurostat and the US Census Bureau. The first and third row give the mean of g_{Mk} and g_{Ak} respectively, while the second and fourth provide the respective standard deviation. The last three rows show the p-value of a t-test for different alternative hypothesis.

Table A.16: Summary statistics by sector: proximity of goods

k	Ak			Mk		
	mean	sd	Obs.	mean	sd	Obs.
1	0.143	0.047	195	0.184	0.045	489
2	0.147	0.048	222	0.184	0.044	462
3	0.158	0.051	312	0.184	0.044	372

Notes: Proximity as as reported by Hidalgo et al. (2007). For each good, the average proximity with all other products is computed. Then the average of that at the sector level is reported. List of products A_k, with $k = 1, 2, 3$, are as listed in the Appendix and list M_k corresponds to the complementing list after excluding extractive products.

A.8 Stability in the model with exogenous expenditure shares

With values of E_c, v_i and n_i given by history ($\forall c = N, S$ and $i = A, M$), equation (13) gives w_i, which implies p_i is known and therefore the value of α is also known. Firms are able to compute their profits which amount to $\pi_M(t) = \frac{(1-\alpha)(E_S+1)}{\sigma n_M(t)}$ and $\pi_A(t) = \frac{\alpha(E_S+1)}{\sigma n_A(t)}$. Then, the full solution of the model can be expressed in terms

Table A.17: Summary statistics by sector: proximity of goods within a sector

k	Ak			Mk		
	mean	sd	Obs.	mean	sd	Obs.
1	0.159	0.045	195	0.209	0.054	489
2	0.156	0.044	222	0.212	0.055	462
3	0.163	0.046	312	0.216	0.055	372

Notes: Proximity as as reported by Hidalgo et al. (2007). For each good, the average proximity with all other products belonging to the same sector is computed. Then the average of that at the sector level is reported. List of products A_k, with $k = 1, 2, 3$, are as listed in the Appendix and list M_k corresponds to the complementing list after excluding extractive products.

of known variables π_i and v_i. Equation (11) can be rewritten as:

$$g_{v,i} = r_i - \frac{\pi_i}{v_i} \tag{A.6}$$

Using (13) and (15) gives an expression for the diversification rate in each sector:

$$g_i = \frac{L_c}{a_i} - (\sigma - 1)\frac{\pi_i}{v_i} \tag{A.7}$$

where $c = S$ if $i = A$ and $c = N$ if $i = M$. The above solution allows the ratio π_i/v_i to be time variant. In fact, for the North, were $r_N = \rho$ given the choice for the numeraire, I find that:

$$g_{\left[\frac{\pi}{v}\right]_M} = -g_M - g_{v,M} = \frac{\pi_M}{v_M} - g_M - \rho$$

According to this equation, the ratio π_M/v_M can only be constant if

$$g_M = -g_{v,M} = \frac{\pi_M}{v_M} - \rho$$

A similar condition can be derived for the South. I can write:

$$g_{\left[\frac{\pi}{v}\right]_A} = \frac{g_\alpha}{1-\alpha} - g_A - g_{v,A}$$

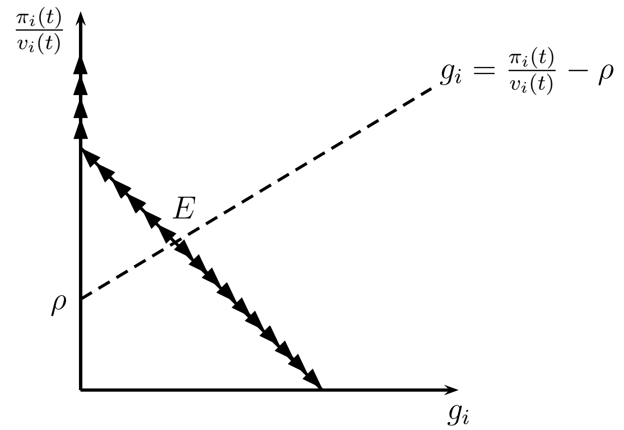
so the ratio π_A/v_A can only be constant if

$$g_A = \frac{g_\alpha}{1-\alpha} - g_{v,A} = \frac{g_\alpha}{1-\alpha} - r_S + \frac{\pi_A}{v_A} = \frac{\pi_A}{v_A} - \rho$$

were the last equality follows by using (2) and (21). Notice the same result would follow in the case in which α is a parameter. Then the ratio π_i/v_i is constant if

$$g_i = \frac{\pi_i}{v_i} - \rho \tag{A.8}$$

Figure A.5: Stability in the equilibrium of the model



The equilibrium for both economies can therefore be represented in Figure A.5. The full line represents equation (A.7) which must hold in equilibrium. The dashed line in the figure represents the locus of points for which condition (A.8) holds. Arrows show the dynamics that the system follows. Notice that for a given value of $\frac{\pi_i}{v_i}$, if $g_i > \frac{\pi_i}{v_i} - \rho$ then $\frac{\pi_i}{v_i}$ falls until it reaches zero, a situation that can be regarded as infeasible since it implies all resources in the economy are devoted to the development of new products (R&D), but no final goods are being produced. If on the contrary $g_i < \frac{\pi_i}{v_i} - \rho$ then $\frac{\pi_i}{v_i}$ grows until $g_i = 0$. Theoretically nothing prevents diversification rates to be zero. If such situation is reached then (A.7) no longer holds and is replaced by $g_i = 0$. Then, as depicted in the figure, the ratio $\frac{\pi_i}{v_i}$ is free to continue growing indefinitely. This possibility is disregarded as is not supported by the empirical evidence presented here.

As a result, stability in this version of the model requires that the economy starts at the intersection of both lines and stays there, meaning the condition in (A.8) must hold.

A.9 Allowing S to follow an unstable trajectory

This section shows that the model is also able to replicate a reverse-TTE in a context when the S follows an unstable path. Again, I impose the stability condition in (18) to N, so the northern economy plays the role of the stable anchor in this model. The full solution for N is exactly the same as that in Section 5.4.1: diversification rate in M is constant and equals that in (19), firm profits and value are reduced by exactly that rate and wages and the return rate are constant.

For the S, equations (21)-(25) still hold, but the fact that the stability condition is not imposed in S, implies that the ratio π_A/v_A is not constant and can follow a divergent trajectory. By (10), the value of any firm in sector A (v_A) depends positively on r_S and π_A. While it was established that profits in A are decreasing over time, the time-path of v_A is also determined by how the return rate evolves over time, a path that is not determined in the model when the stability condition is not present. Indeed notice that the ratio π_A/v_A can rise or fall, depending on the velocity with which firms' profit in that sector fall and the value of individual's discount factor.

How the value of firms in A evolves over time determines the time path of wages in S since, by the free-entry condition, $g_{wS} = g_A + g_{vA}$. I can therefore write a condition for wages in S to follow a decreasing trajectory:

$$\begin{aligned} \frac{\pi_A(t)}{v_A(t)}\left[1+\frac{\sigma_A}{H}\right] &> Z \quad \text{if} \quad \frac{H}{1+H} > 0 \\ \frac{\pi_A(t)}{v_A(t)}\left[1+\frac{\sigma_A}{H}\right] &< Z \quad \text{if} \quad \frac{H}{1+H} < 0 \end{aligned} \tag{A.9}$$

with $Z = \frac{L_S}{a_A}\left[\frac{2-\sigma_A}{\sigma_A-1}+\frac{1+H}{H}\right] - \frac{L_N}{a_M}\left[\frac{2-\sigma_M}{\sigma_M-1}\right] - (\sigma_M-1)\frac{\pi_M}{v_M} + \frac{\rho(1+H)}{H}$. Wages in S rise if the previous condition is not met. Notice that, depending on the time path followed by the ratio $\pi_A(t)/v_A(t)$, an outcome in which the condition is met at some point in time, and not in another, can arise.

With aggregate profits falling in S, then decreasing wages represent a sufficient condition for falling income in that region. Notice that both variables are constant in N. The following result summarizes the findings regarding income divergence in this version of the model and replaces Result 4 in the main text:

Result A.1 *With endogenous expenditure shares, the model is able to reproduce income divergence. Relative aggregate profits unequivocally fall in S and the same is true with wages if condition (A.9) is met. Otherwise, wages in S grow and in that case income divergence follows only if the fall in profits is large enough to compensate for rising wages.*

With endogenous expenditure shares, the model reproduces income divergence since both aggregate profits and wages fall in S with respect to those in N.

Finally, I can establish a condition for terms of trade in S to be decreasing over time. Notice that equation (7) establishes that the only determinant for changes in relative prices are changes in relative wages. Since wages are constant in N the price of products created there are also time invariant. The price of final production in S evolves following wages in that region, and according to the previous result, they can fall when condition (A.9) is met. It is clear that the very requirement for wage divergence is also a necessary and sufficient condition for terms of trade to deteriorate for the South. Result 6 can be replaced by:

Result A.2 *With endogenous expenditure shares, terms of trade can improve or deteriorate for S. They deteriorate if wages in S fall over time, i.e. condition (A.9) is met. They improve if the opposite happens.*

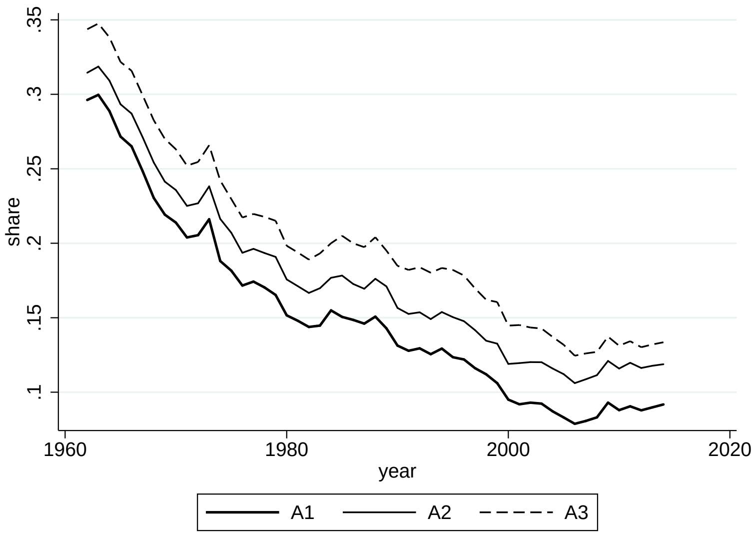
Notice that a situation of terms of trade falling in S is also one in which aggregate income in that region falls with respect to that in N, since it has been already established that aggregate profits fall in S. Such a situation constitutes what is called here a reverse-TTE, i.e. terms of trade enhancing rather than offsetting income divergence. Result A.2 shows that relative prices can improve or deteriorate for the A-sector depending on the speed at which endogenous variables move.

A.10 Declining share of A-products in international trade

As a part of the ongoing process of globalization, international trade has been on the rise. However, trends are differentiated between broad industries. In particular, the importance of land-intensive products in worldwide trade has been declining at least for the last fifty years. Figure A.6 shows the share of A-goods in worldwide exports using all three groups (A1, A2 and A3). The declining share is a consequence of trade in M-products growing more than in A and E goods.

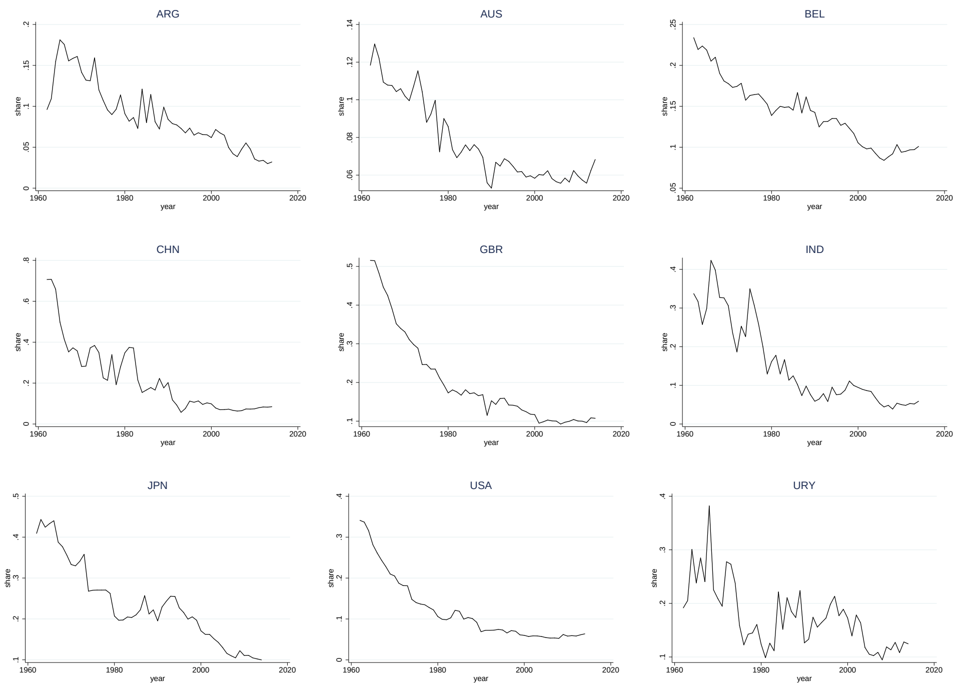
Figure A.7 shows a similar picture for imports of a sample of countries (including some of the largest economies in the world) reflecting how the same phenomenon can be found at the country level for economies with very different characteristics, i.e. large and small, rich and poor, industrialized and specialized in agricultural goods. Overall, it is hard to find cases where a clear negative trend does not show up. A very notable case is that of China. As explained above, the rising importance of China in world trade after 2000 has increased the supply of manufactures in world markets while, at the same time, has dynamized the demand of primary products. What the above graph suggests is that, since the value of A-imports tends to fall even in China, what has constituted good news for primary producers in the last decade and a half, could have been a level effect

Figure A.6: Value share of A-goods in worldwide trade (1962-2015)



Notes: Value share of world trade devoted to Ak-goods with $k = 1, 2, 3$ as listed in the Appendix. Computed using 4-digit data from Feenstra et al. (2005)

Figure A.7: Share of A1-goods in imports for a sample of countries (1962-2015)



Notes: Share of imports devoted to $A1$-goods in Argentina, Australia, Belgium, China, Great Britain, India, Japan, United States of America and Uruguay respectively (check list of A1-goods in Appendix). Computed using 4-digit data from Feenstra et al. (2005)

which might not continue in the future. In terms of Figure A.6, the incursion of China in world markets may explain why the sharp negative trend in the share of A-goods in total trade saw a softening after 2000, but there is nothing preventing the previous trend to resume in the years to come.

While the above trend could be partially driven by an increasing fragmentation of production of M-products, the data on exports of value added (available since 1992) shows that changes in the share that value added represents of total exports for each sector are not large enough to revert the trends as shown above (see for example Francois et al., 2015).

A.11 Relative price index vs terms of trade using a less restrictive approach

This section shows that the results in Section 6 are robust to changes in the way price indexes of imports and exports are constructed. For this, I compute an import price index closely following Broda and Weinstein (2006), which implies assuming preferences are CES, but allowing heterogeneity between varieties and goods.

The formula that obtains under such setting, and replaces (29), is:

$$P_{ct}^{imp} = P_{ct}^{*} \prod_{f} \left[\frac{\lambda_{fct}}{\lambda_{fct-1}} \right]^{\omega_{ft}/(\sigma_f - 1)}$$

Again P_{ct}^{*} is the conventional import price index ignoring product creation, i.e. considering only varieties belonging to the set $I_f = I_{ft} \cap I_{ft-1}$ of varieties sold both at t (belonging to I_{ft}) and $t-1$ (belonging to I_{ft-1}). The rest of the expression represents the correction for product creation. As opposed to (29), this time the product-specific correction terms weight each variety by its relative value in the import basket, i.e.:

$$\lambda_{fct} = \frac{\sum_{f \in I_f} p_{fct} q_{fct}}{\sum_{f \in I_{ft}} p_{fct} q_{fct}} \text{ and } \lambda_{fct-1} = \frac{\sum_{f \in I_f} p_{fct-1} q_{fct-1}}{\sum_{f \in I_{ft-1}} p_{fct-1} q_{fct-1}}$$

Moreover, the index P_{ct}^{*} is composed of different prices for different goods. I compute this index as follows:

$$P_{ct}^{*} = \prod_{f \in F} P_{ct}(I_f)^{\omega_{fct}}$$

with

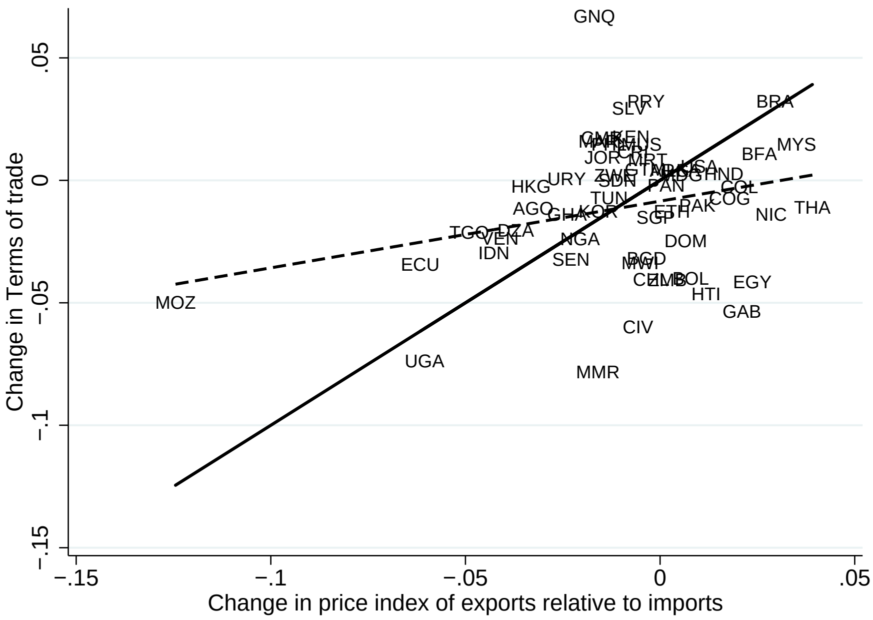
$$\omega_{fct} = \frac{(s_{fct} - s_{fct-1})/(\ln s_{fct} - \ln s_{fct-1})}{\sum_{f\in I_f}((s_{fct} - s_{fct-1})/(\ln s_{fct} - \ln s_{fct-1}))} \text{ and } P_{ct}(I_f) = \prod_{f\in I_f}(p_{fct}/p_{fct-1})^{\omega_{fct}}$$

and with $s_{fct} = p_{fct}q_{fct}/(\sum_{f\in I_f} p_{fct}q_{fct})$ as the cost shares.

This method implies calculating a conventional import price index for the set of products that are traded both in t-1 and t (i.e. ignoring changes in the set of products available to consumers), and then correcting for the bias that is generated by product creation. Weights for each good are based on shares in imports at each period, and elasticities of substitution for each variety (good-country of origin) within a certain good are obtained directly from Broda and Weinstein (2006). That work provides estimates for elasticities of substitution at the 4 digit level SITC Rev2 classification for the US, which can be used for every country. This is in line with assuming that consumers' preferences are the same irrespective of the region, which matches what is assumed in my model. As was done in Section 6, the price index for exports is computed symmetrically considering preferences of the exporting country.

I plot the results for changes in the price index of imports relative to exports against changes in terms of trade in Figure A.8. Besides the fitted line (dashed), I include a line with slope of 1 (full) for reference. Again, the relationship between both variables is less steep than unity. In this exercise, the correlation between deviations from the slope of one and the diversification rate for the period in each country is also negative (-0.12), providing further support for the mechanism put forward in this paper.

Figure A.8: Change in terms of trade vs change in price index of exports relative to imports (1985-2000)



Notes: Change in terms of trade from WDI. Change in price indexes computed following Broda and Weinstein (2006) and using trade flows from Feenstra et al. (2005) and elasticities of substitution from Broda and Weinstein (2006).