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EXPORT VARIETY, PRODUCTIVITY, AND COUNTRY SIZE IN A MULTI-GOOD RICARDIAN MODEL OF EXPORT DIVERSIFICATION[1]

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Abstract

This paper addresses the lack of connection between theory and empirics in most export diversification–economic development studies. We provide a Ricardian-based theoretical explanation of countries' relative export variety as a function of the level of technology and country size assessed with respect to the rest of the world. Relative export diversification is an outcome of two forces: a relative productivity change (technological progress) and a relative country size change (labour force growth). The model predictions are confirmed in a sample of 132 countries (1988–2014), including 53 low-income countries, for which we measure export variety using product-level trade data. The influence of technology differences on export variety is: (i) stronger than is the effect of cross-country differences in size and (ii) non-linear, driving diversification at the beginning of the development process. The results are robust to the measurement of export variety, the inclusion of control variables, and estimation methods.

JEL: F11, F14, F43, O40, O11

Keywords: export variety, export diversification, Ricardian model, economic development

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1. Introduction

Understanding of the factors related to countries' ability to diversify their production and exports is of key importance in the economic development context, as many developing countries are still dependent on a narrow range of primary products (Newfamer et al., 2009). Low-income countries have, on average, 50% fewer diversified exports than do high income economies.[2] Given the possibility of diversification-led growth (Herzer and Nowak-Lehnmann, 2006; Hesse, 2008; Gozgor and Can, 2016), the positive relationship between the extensive margin and total trade growth[3] (Kehoe and Ruhl, 2013), and the role that major export variety plays in reducing risk and volatility related to presence on international markets (Haddad et al., 2013; Balavac and Pugh, 2016), it is crucial to understand what drives the differences in export variety in an economic development context.

The seminal paper of Imbs and Wacziarg (2003, IW hereafter) started the stream of literature on 'stages of development'. IW described an empirical observation on the U-shaped path of diversification of economic structures (they dealt with employment and value added data) accompanying the growth path, followed by re-specialisation at higher levels of income. Since then, given the greater detail of trade statistics, the focus has moved towards the analysis of variety observed in trade patterns. Numerous empirical papers (including Basile et al., 2017; Cadot et al., 2011; de Benedictis et al., 2009; Klinger & Lederman, 2006; Parteka, 2010; Parteka & Tamberi, 2013a,b; and Mau, 2016) have analysed the evolution of variety (diversity) taking place in export structures as countries grow. These papers, with respect to the original IW contribution, extended the set of analysed countries and either added more explanatory variables or modified the methodology of diversification measurement and estimation of the diversification curves. However, there is still one main research gap that we aim to address in this paper: the lack of a solid theoretical explanation of an empirically revealed export diversification phenomenon along the development path.

We address the lack of connection between the theory and empirics in most export diversification–economic development studies that makes the interpretation of their results difficult. Unlike the (few) existing theoretical explanations of export diversification patterns, we deviate from the Heckscher–Ohlin (HO) framework (Regolo, 2013; Cadot et al., 2011) in favour of the approach rooted in the recently revived (mainly due to Eaton and Kortum, 2002; EK

[2] Based on the Theil index of export concentration computed with HS 6-digit export data (source: UN Comtrade), 2014 (see Section 4.1 for details).

[3] Kehoe and Ruhl (2013) find that, over 1995–2005, the extensive margin accounted for 9.9 percent of the trade growth for the NAFTA country pairs and 26.0 percent of trade growth between the United States and Chile, China, and Korea.

hereafter) Ricardian theory of international trade. Thus, this paper studies, both theoretically and empirically, the evolution of export variety (export diversification)[4] along the path of economic growth in a multi-good Ricardian country-level perspective. We provide a testable version of a Ricardian model, in which countries' relative export variety [assessed with respect to the rest of the world (RoW)] is a function of relative technology differences across countries (relative productivity) and relative country size. Using this framework, we develop three main propositions. First, we demonstrate that increased relative productivity of the country with respect to the RoW results in increased export diversification. Second, we show that the increased relative size of the RoW with respect to the size of the country decreases the country's export diversification. The combined effect of these two forces depends on their relative strength.

In addition, trade costs may also affect export diversification. The theoretical model we use predicts that, on the one hand, export diversification of a country increases with declining relative trade costs of the RoW, as it is now easier to export. However, on the other hand, relative wages in the country go up with declining trade costs of the RoW, which negatively affects export diversification, as some goods are no longer competitive and their production in the country must be stopped. Hence, the net effect of the change in trade costs is not clear and must be determined empirically; we find that the wage adjustment effect dominates.

To test empirically the predictions of our model, we use a panel of 132 countries, for which we compute relative export variety measures based on product level (HS 6-digit) trade data over the period 1988–2014. In our sample, we include 53 low-income economies. We find strong empirical support for our theoretical predictions. In particular, we find that, ceteris paribus, a one percent rise in relative (with respect to the RoW) productivity can be associated with a 0.5 percent rise in the number of active export lines.[5] In general, the influence of productivity on export variety is stronger than is the effect exhibited by cross-country differences in relative country size. However, we find that the importance of technology differences is non-linear and depends on the development stage: it drives diversification at the beginning of the development process, whereas, at higher levels of growth, the expansion of the relative country size plays a major role in promoting export variety growth.

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[4] The degree of export diversification (export variety) is a counterpart of the degree of specialisation of the export base. Throughout this paper we will use the expressions 'export variety' and 'export diversification interchangeably. Note the difference between the determinants of the *degree* of export diversification (in the simplest way measured by the number of exported products) and the determinants of export specialization (in the sense of the *characteristics* of products that countries trade intensively). See Shicker (2013) for the recent explanations of specialization and comparative advantage patterns across countries.

[5] See Table 1.

To test the sensitivity of the results with respect to the underlying theoretical framework, we also introduce factor endowment differences between countries (physical capital, human capital, arable land, and petrol abundance), in addition to productivity differentials. As expected, they do influence export variety, although productivity still acts as the main driver of the diversification process.[6] Our results are robust, having controlled for the variety of diversification indices, additional measures of relative country size, and estimation methods. Moreover, while we focus on a setting where each country is assessed with respect to the RoW, we also test the bilateral specification of the panel regressions between country pairs. The results hold.

The paper is structured as follows: in Section 2 we provide the literature review and set up our approach with respect to the existing research. In Section 3, we present the theoretical Ricardian model of relative export variety, used to derive the empirical specification described. The results are in in Section 4. Section 5 summarizes and concludes. The appendix provides a set of complementary materials.

2. How to explain export variety and diversification dynamics in the course of growth? – literature review

Our paper can be located within a vast body of literature on product variety in international trade (Feenstra and Kee, 2004), trade margins (Feenstra and Ma, 2014; Hummels and Klenow, 2005; Besedeš and Prusa, 2011), the link between export diversity and income per capita evolution in the spirit of IW 'stages of diversification' (Cadot et al., 2011; Mau, 2016; Basile et al., 2017; Parteka and Tamberi, 2013a; De Benedictis et al., 2009), and the determinants of export diversification (Agosin et al., 2012; Parteka and Tamberi, 2013b; Regolo, 2013; Jetter and Ramírez Hassan, 2015).

At the country level, the degree of export diversification and the extensive margin of exports have been found to be driven mainly by the level of economic development [typically measured by income per capita, as in Cadot et al. (2011), Mau (2016), Parteka and Tamberi (2013a, 2013b), and De Benedictis et al. (2009)] country size (Parteka, 2010; Parteka and Tamberi, 2013b; Basile et al., 2017), human capital (Agosin et al., 2012; Jetter and Ramírez Hassan, 2015), institutions (Sheng and Yang, 2016), trade costs and trade liberalisation (Dennis and Shepherd, 2011; Regolo, 2013; Mau, 2016; Feenstra and Ma, 2014), geographical factors – mainly the distance from main markets (Agosin et al., 2012; Parteka and Tamberi, 2013b), the participation in Regional and Preferential Trade Agreements (Dutt et al., 2013; Parteka and Tamberi, 2013b), and spatial

[6] This is in line with Shickher (2013).

network effects and the proximity to large countries (Basile et al., 2017). However, there are very few contributions that can be used to explain theoretically the 'diversification curves' revealed from the data and that we briefly summarise below.

Cadot et al.'s (2011) paper is mainly empirical, but they attempted to explain their hump-shaped diversification path within the HO framework. In their view, the existence of multiple cones of diversification (Schott, 2003) means that cross-country differences in factor endowments determine patterns of specialisation: rich countries produce good that are different from those produced by poor countries. The process of economic development (capital accumulation) can be interpreted as a 'travel' across diversification cones. Cadot et al. (2011) explain the inverted U-shaped relationship between diversification and development by slow adjustment in the two phases of this 'travel'. Firstly, as countries accumulate capital, they turn from one cone to another, but old lines still remain active (diversification); then the old lines slowly die, which reduces diversification. Similarly, Regolo (2013) uses the HO setting, but she focuses on the determinants of bilateral differences in export concentration. Specifically, she uses a North–South setting, similar to Romalis (2004), where exports between similarly endowed countries (either South–South or North–North) become more diversified than are exports between countries with different factor endowments (South–North).

The Product Space (PS) framework (i.e., the network of relatedness between products), which is related to the HO approach, was introduced by Hausmann and Klinger (2007) and Hidalgo et al. (2007). Coniglio et al. (2018) check if patterns of diversification observed in a vast sample of countries are in line with the predictions the PS framework, in particular path-dependence of the evolution of export baskets. It takes place when current capabilities (depending on technologies, factors endowments, institutions, etc.) determine the diversification of export structures towards new products because new products originate from a re-combination of the current set of production capabilities. On the contrary, radical changes (path-defying diversification) take place if countries diversify towards areas of the PS that are unrelated to the initial production basket. Minondo (2011), in a study covering 91 economies, builds an index of countries' diversification possibilities based on the commodities with which they have comparative advantage and the proximity of those products to the rest of products. He then shows that such an indicator, which reflects the degree of centrality in the PS, is a strong predictor of countries' diversification levels.

In the Ricardian framework, export diversification is driven mainly by technology differences between countries. Mau (2016) argues that the HO setting cannot explain export diversification at the extensive margin but holds only for the intensive margin; i.e., when the range and type of goods are unaffected, and relative output and factor allocations vary. He also EK's framework to yield a gravity equation for export diversification at the extensive margin. The model predicts that, after controlling for factor costs and geography, a more technologically advanced country exports a wider variety of goods. A dynamic version of the model is presented in Naito (2017), who extends the two-country setting presented in Naito (2012) into a multi-country framework and combines a continuum-good Ricardian model of EK with a multi-country AK model of Acemoglu and Ventura (2002). Naito (2017) focuses on the effects of falling trade costs on countries' growth and extensive margin of trade over time. He shows that trade liberalisation raises the balanced growth rate and provides a theoretical explanation for why fast-growing countries experience a rise in export variety (which is in line with the findings of Hummels and Klenow, 2005 and Kehoe and Ruhl, 2013). Levchenko and Zhang (2016) extend the EK approach to a multi-sector framework and study the role played by relative *sectoral* productivity differences between countries, finding strong evidence of relative productivity convergence. Unlike these researchers, in the subsequent section, we focus on modelling relative country-level differences in diversification, productivity, size, and trade costs. Hence, our research complements the Ricardian-based comparative advantage perspective where relative technology differentials are studied in the presence of multiple industries (Levchenko and Zhang, 2016).

Moreover, our theoretical approach should be considered also as complimentary to the Ricardian-based diversification models presented in Mau (2016) and Naito (2017), and referring to the EK model. However, in contrast to these researchers, we provide a close link between the theoretical model and its empirical validation. In particular, we use a full general equilibrium model with endogenously determined relative wages and take into account the effect of wage adjustments on export diversification associated with trade liberalisation.

3. Theoretical model

3.1 Baseline model

To study the determinants of export diversification we first use the baseline model proposed by Dornbusch, Fisher, and Samuelson (1977, DFS hereafter) as our analytical framework. The DFS model is a traditional neoclassical model that is based on several simplifying assumptions. In its baseline form, it consists of only two countries, called Home and Foreign, each of whom use only one factor of production, called labour, to produce an arbitrary number of goods.[7] Each country has a constant returns to scale technology, but they differ in the relative amounts of

[7] Extensions of the analysis by DFS (1977) with respect to the demand structure and the number of countries are developed in Wilson (1980). He demonstrates that several sharp comparative statics' results are still possible.

labour required to produce different goods. This generates an incentive for each country to specialize in the production of only a certain set of goods, which, in turn, generates the gains from trade. Using this framework, we demonstrate that, according to this model, the extent of export diversification can be related to the relative level of technology and the relative country size.

In the baseline DFS model there are only two countries: Home and Foreign, the latter of which represents the RoW. Rather than working with a finite number of goods, the model assumes a continuum of goods represented by the unit interval [0,1]. This assumption allows direct study of the changes in export diversification. In this case, the z-th good from this interval simply reflects the share of Home country in the total number of tradable goods that are produced in the world economy. This share can be identified as one of the simplest measures of export diversification used in the empirical literature. Therefore, it will be also used in our paper as the measure of relative export diversification.

Relative unit labour requirements for particular goods can be ranked according to the diminishing comparative advantage of the Home country. Production of the z-th good is feasible in Home country if its price, equal to the unit cost, is either equal to or lower than the price in the RoW; i.e., $p(z) = a(z)w \leq a^*(z)w^* = p(z)^*$, where $p(z)$ denotes the price of z-th good at Home, w denotes the wage level at Home, $p(z)^*$ denotes the price of z-th good in the RoW, and w^* the wage level in the RoW.[8] This condition is called the efficient specialization condition. The efficient specialization condition can be written in a shorter form, as $\omega \leq A(z)$, where $\omega = w/w^*$, denotes the relative wage and $A(z) = a^*(z)/a(z)$ denotes the relative unit labour requirement, and $A'(z) < 0$. Given the wage level, it is possible to find the threshold commodity $\tilde{z}$ that will be produced in both countries. However, to find the relative wage we need to derive the trade balance condition. For this, the demand side of the model needs to be specified.

The baseline model assumes homogenous and identical preferences in both countries. In particular, each tradable good receives a fixed fraction of expenditure $b(z)$, which is the same in both countries $b(z) = b(z^*)$. Hence, the fraction of income spent in both countries on goods produced at Home can be defined as $v(\tilde{z}) = \int_0^{\tilde{z}} b(z)dz > 0$, where: $v'(\tilde{z}) = b(\tilde{z}) > 0$, and $0 \leq v(\tilde{z}) \leq 1$. In the same manner the fraction of income spent on goods produced in the RoW

[8] Given the basic assumptions of the model, i.e., perfect competition and one factor of production (labour) only, it can be noted that the wage level is equal to the GDP per capita. Hence, the GDP equals the aggregate wage bill, i.e. the product of the wage level and the total number of workers.

can be expressed as $1-v(\tilde{z})=\int_{\tilde{z}}^{1} b(z)dz$. The trade balance condition requires that the RoW expenditure on goods produced at Home equals the Home expenditure on goods produced in the RoW: $[1-v(\tilde{z})]wL = v(\tilde{z})w^* L^*$.

Therefore, the equilibrium in the baseline DFS model can be described by the set of two conditions: the efficient specialization condition (1) and the trade balance condition (2), respectively.

$$A(z) = \omega \tag{1}$$

$$B(z, L^*/L) = \frac{v(z)}{1-v(z)}\frac{L*}{L} = \omega \tag{2}$$

where ω denotes the relative wage of the Home country with respect to the RoW.

First, we study the effects of technological progress at Home with respect to the RoW on the extent of export diversification and relative wages, assuming that the relative country size remains constant (i.e., at a given allocation of labour across countries, d(L*/L) = 0). By totally differentiating equations (1) and (2), we obtain, respectively:

$$dA(z) = d\omega - A'(z)dz \tag{1'}$$

$$0 = d\omega - \left[\frac{v\prime(z)}{(1-v(z))^2}\frac{L^*}{L}\right]dz \tag{2'}$$

Using the matrix notation, we can write equations (1') and (2') as

$$\begin{bmatrix} 1 & -A(z) \\ 1 & -\frac{v\prime(z)}{(1-v(z))^2} \end{bmatrix}\begin{bmatrix} d\omega \\ dz \end{bmatrix} = \begin{bmatrix} dA(z) \\ 0 \end{bmatrix} \tag{3}$$

Employing Cramer's rule, we can calculate the changes in the extent of export diversification dz and relative wages $d\omega$ resulting from the positive change in the relative productivity $dA(z)$, respectively, as

$$dz = \left(\frac{v'(z)}{(1-v(z))^2}\frac{L^*}{L} - A'(z)\right)^{-1} dA(z) > 0 \tag{4}$$

$$d\omega = \frac{\frac{v'(z)}{(1-v(z))^2}\frac{L^*}{L}}{\frac{v'(z)}{(1-v(z))^2}\frac{L^*}{L} - A'(z)} dA(z) > 0 \tag{5}$$

It can be noted that the change in the extent of export diversification dz resulting from increased relative productivity at Home, dA(z) > 0, is positive, *ceteris paribus*. Also, the change in the relative wage resulting from increased relative productivity at Home $dA(z)$ is positive. This finding can be summarized in proposition 1:

Proposition 1. The increase in the relative productivity in the Home country, given the unchanged relative country size, results in increased export diversification of the Home country with respect to the RoW. This increase is accompanied by an increased relative wage (GDP per capita).[9]

Second, we study the effects of increased size of the RoW with respect to Home on the extent of export diversification and relative wages, assuming that the relative level of productivity remains constant (i.e. at a given unit labour requirements across countries, $dA(z) = 0$). By totally differentiating equations (1) and (2), we now obtain, respectively:

$$0 = d\omega - A'(z)dz \tag{1''}$$

$$d\frac{L^*}{L} = \frac{1-v(z)}{v(z)}d\omega - \left[\frac{v\prime(z)}{v(z)(1-v(z))}\frac{L^*}{L}\right]dz \tag{2''}$$

Using the matrix notation, we can write equations (1") and (2") as:

$$\begin{bmatrix} 1 & -A(z) \\ \frac{1-v(z)}{v(z)} & -\frac{v\prime(z)}{v(z)(1-v(z))} \end{bmatrix} \begin{bmatrix} d\omega \\ dz \end{bmatrix} = \begin{bmatrix} 0 \\ d\frac{L^*}{L} \end{bmatrix} \tag{6}$$

Employing Cramer's rule, we can calculate the resulting changes in the extent of export diversification dz and relative wages $d\omega$, respectively, as

$$dz = \left(A'(z)\frac{1-v(z)}{v(z)} - \frac{v\prime(z)}{v(z)(1-v(z))}\frac{L^*}{L}\right)^{-1} d\left(\frac{L^*}{L}\right) < 0 \tag{7}$$

$$d\omega = \left(\frac{1-v(z)}{v(z)} - \frac{v\prime(z)}{v(z)(1-v(z))A\prime(z)}\frac{L^*}{L}\right)^{-1} d\left(\frac{L^*}{L}\right) > 0 \tag{8}$$

It can be noted that the change in the extent of export diversification dz resulting from increased relative size of the RoW, $d(L^*/L) > 0$, is negative, *ceteris paribus.* However, the change in the relative wage resulting from increased relative size of the RoW $d(L^*/L)$ is positive. This finding can be summarized in proposition 2:

Proposition 2. The increase in the relative size of the RoW (the decrease in the relative size of Home country) results in decreased export diversification of Home country, given the unchanged relative level of technology. This increase is accompanied by increased relative wage (GDP per capita).

Finally, we study the combined effect of the changes in the level of relative productivity and relative country size on the extent of export diversification. Totally differentiating conditions (1) and (2) and assuming that $dA(z) > 0$ and $d(L^*/L) > 0$ we obtain:

$$dA(z) = d\omega - A'(z)dz \tag{1'''}$$

[9] It can be also noted that the relative wage increase is less than proportional to an increase in the relative productivity level.

$$d\frac{L^*}{L} = \frac{1-v(z)}{v(z)}d\omega - \left[\frac{v\prime(z)}{v(z)(1-v(z))}\frac{L^*}{L}\right]dz \qquad (2''')$$

Using the matrix notation we can write equations (1") and (2") as:

$$\begin{bmatrix} 1 & -A(z) \\ \frac{1-v(z)}{v(z)} & -\frac{v\prime(z)}{v(z)(1-v(z))} \end{bmatrix} \begin{bmatrix} d\omega \\ dz \end{bmatrix} = \begin{bmatrix} dA(z) \\ d\frac{L^*}{L} \end{bmatrix} \qquad (9)$$

Employing Cramer's rule we can calculate the resulting changes in the extent of export diversification dz and relative wages $d\omega$, respectively, as:

$$dz = \frac{dA(z) - \frac{v(z)}{1-v}d\frac{L^*}{L}}{\frac{v'(z)}{(1-v(z))^2}\frac{L^*}{L} - A'(z)} \qquad (10)$$

$$d\omega = \frac{\frac{v'(z)}{(1-v(z))^2}\frac{L^*}{L}dA(z) - \frac{v(z)}{1-v}A\prime(z)d\frac{L^*}{L}}{\frac{v'(z)}{(1-v(z))^2}\frac{L^*}{L} - A'(z)} > 0 \qquad (11)$$

This finding can be summarized in proposition 3.

Proposition 3. The combined effect of the increase in the relative productivity in the Home country and the increase in the relative size of the RoW on the extent of export diversification at Home is not clear, as technological progress at Home increases it, while the increased relative size of the RoW decreases it. The extent of export diversification at Home increases only if the effect of increased relative productivity dominates the effect of the increased relative size of the RoW, i.e., $dA(z) > \frac{v(z)}{1-v(z)}d\frac{L^*}{L}$. *At the same time, the combined effect of the increase in relative productivity and the increase in the relative size of the RoW on relative wages (GDP per capita) is positive.*

3.2 Model extensions

Our main extension of the baseline theoretical model is the introduction of asymmetric trade costs. The importance of trade costs is well known from various theoretical and empirical gravity models (Head et al., 2010; Head and Mayer, 2014). Asymmetric trade costs can be relatively easily integrated into the theoretical framework, but their introduction does not affect the key predictions of the baseline model concerning the qualitative effects of relative productivity and relative country size on export variety. Therefore, in this section, we focus on the effects of trade costs on export diversification.

Following Samuelson (1954,) we assume standard "iceberg" trade costs. This means that only a fraction $0 \leq g(z) \leq 1$ of the z-th good sent from the Home country to the Foreign country reaches the destination. In addition, it is assumed, for simplicity, that $g(z) = g$ is the same for all goods. However, the trade cost for the same good does not have to be the same in both countries. In particular, we assume asymmetry in trade costs across countries, i.e., $g(z) \neq g^*(z)$. Hence, the Home country will produce goods for which the unit cost of production is lower compared to the unit cost of production abroad adjusted for the trade cost from the Foreign country, i.e., $a(z)w \leq a^*(z)w^*(1/g)$ or, alternatively, $\omega \leq A(z)/g$. Similarly, the Foreign country will produce goods for which the unit cost of production is lower than is the trade cost adjusted unit cost of production of goods imported from the Home country, i.e., $a^*(z)w^* \leq a(z)w(1/g^*)$ or, alternatively, $A(z)g^* \leq \omega$.

These modified efficient specialisation conditions for both Home and Foreign countries imply that, given the relative wage ω, the Home country will produce and export goods in the range between (0, $\bar{z}^*$), while the Foreign country will produce and export goods in the range between ($\bar{z}$, 1), and both countries will produce goods in the range [$\bar{z}^*$, $\bar{z}$] that are non-tradable goods. To determine the equilibrium relative wage ω we need to use the modified trade balance condition $(1-\lambda)wL = (1-\lambda^*)w^*L^*$, where λ is the fraction of Home country income spent on Home made goods while λ* is the fraction of Foreign country income spent on Foreign made goods.

Both λ and λ* are determined endogenously, as the range of goods produced in each country depends on both relative wage ω and trade cost *g*; i.e., $\lambda(g\omega) \equiv \int_0^{\bar{z}} b(z)dz$, where: $\lambda'(g\omega) < 0$ and $\lambda^*(\omega/g^*) \equiv \int_{\bar{z}^*}^{1} b(z)d(z)$, where $\lambda^{*\prime}(\omega/g^*) > 0$. Both $\bar{z}$ and $\bar{z}^*$ can be derived by inverting modified efficient specialization conditions for Home and Foreign countries, respectively: $\bar{z}^* = A^{-1}(\omega/g^*)$ and $\bar{z} = A^{-1}(g\omega)$, where $\overline{dz}^*/d(\omega/g^*) < 0$ and $\overline{dz}/d(g\omega) < 0$.

These conditions imply that an increase in the relative wage lowers the range of goods produced at Home and increases the share of income spent on Foreign made goods, whereas, in the Foreign country, the range of goods produced increases and the share of income spent on Home made goods decreases. Hence, the increase in the relative wage *ω* decreases export diversification at Home and increases it in the RoW, just as in the baseline model discussed in the previous subsection. At the same time, it can also be noted that, given the relative wage, a decrease in the trade cost in the Home country, i.e., an increase in *g*, causes the increase in export diversification in the RoW. Similarly, given the relative wage, a decrease in the trade cost in the RoW, i.e., an increase in *g**, causes the increase in export diversification in the Home country. These increases are accompanied by a decrease in the range of non-tradable goods as the share of tradable products in the world economy expands.

However, it must be remembered that $\bar{z}$ and $\bar{z}^*$ are determined by interactions between both demand and supply conditions. In particular, it is crucial to note that trade costs in the modified model also affect the relative wage, which, in turn, affects export diversification. In particular, the modified trade balance condition can be expressed as $\overline{\omega}=\frac{1-\lambda^*(\overline{\omega}/g*)}{1-\lambda(\overline{\omega}g)}\frac{L*}{L}=\varphi(\overline{\omega},\frac{L^*}{L},g,g^*)$. Rearranging this condition, we can obtain the relative wage as a function of the relative country size and trade costs: $\overline{\omega}= \overline{\omega}(\frac{L^*}{L},g,g^*)$.[10] This condition, combined with the two previously discussed inverted specialisation conditions, allows us to determine the pattern of international specialisation in production and trade. As the range of non-traded goods $[\bar{z}^*, \bar{z}]$ depends on the relative equilibrium wage, it is clear that the changes in model parameters result in the changes of the range of non-tradable and tradable goods.

In particular, it can be noted that a decrease in trade cost in the Home country (i.e., an increase in *g*) lowers the equilibrium relative wage. This is because the lower trade cost decreases the price of Foreign goods in the Home country and increases the demand for labour in the RoW. In contrast, a decrease in the trade cost in the RoW (i.e., an increase in *g**) implies that the equilibrium relative wage goes up due to an increased demand for Home country labour resulting from the lower price of Home made goods in the RoW.

To summarise, our theoretical framework predicts that, on the one hand, export diversification of the Home country increases with declining relative trade costs of the RoW, as it becomes easier to export. However, on the other hand, the relative wage in the Home country increases with declining trade costs of the RoW, which negatively affects export diversification, as some goods are no longer competitive and their production in the Home country must be dropped. Hence, the overall effect of the change in trade costs is not clear and must be determined empirically.

Given the fact that most of the countries in our sample are relatively small economies, we can expect that the second effect will be stronger than is the first effect. In fact, our estimation results, reported in Table 7, show that the wage adjustment effect dominates.

4. Empirical verification of the model predictions

4.1 The data

To test the model predictions, we use a balanced panel dataset (Table A1 in the Appendix lists the 132 countries in the sample, subsequently classified according to their development level into high, medium-high, medium-low, and low income groups) covering the period 1988–2014.

[10] It can be noted that, similar to the baseline model, the increase in the relative country size must positively affect the relative wage.

To construct our dependent variable,[11] we use the highest degree of detail available for international comparisons in a panel-data setting, namely, HS 6-digit (product-level) mirrored exports from UN Comtrade. With these statistics, we construct country- and time-specific synthetic indices of relative export variety (*REV)*, which, in line with the theoretical model, measure the degree of export diversification with respect to the rest of the world, RoW. To address the presence of the lower bound (export variety cannot be negative) in a relative dimension setting, we follow Regolo (2013) and compute the difference of the logarithms of export variety of a "home" country *i* and the RoW.[12]

$$lnREV_{it}^{k} = ln(k_{it}/k_{t}^{RoW}) = ln(k_{it}) - \ln(k_{t}^{RoW}) \quad (12)$$

where *i* denotes "home" country, *t* – time, and the *RoW* value is computed as the average for all the countries in the sample minus country *i* (the same method will be applied with respect to the explanatory variables).[13] The set of indices *k*={*N, Theil, Gini, HH*} refers to alternative measures of export variety/export diversification (their exact definitions and formulas, along with the comparison to relative diversification measures, can be found in Parteka, 2010). Thus, *REV* is firstly computed on the basis of the number of exported products (REV^{N}) – which is the closest to the theoretical model – or the inverse (for the ease of interpretation) of export concentration indices: the Theil index (REV^{Theil}), the Gini index (REV^{Gini}), and the Herfindahl–Hirschman index (REV^{HH}). Additionally, we consider indices that, per construction, capture the relative aspect of export diversification (namely, the Relative Theil index, $REV^{RelTheil}$, and the Relative Gini index, $REV^{RelGini}$) employed by de Benedictis et al. (2009) and Parteka and Tamberi (2013a).

Concerning the main explanatory variables, directly linked to the theoretical model, we use the data from PWT 9.0 (Feenstra et al., 2015) to measure productivity in terms of output per worker (Y/L) and the number of workers - persons engaged (L) - to proxy the country size.[14] The set of additional explanatory variables (which control for the importance of factor endowments, other than labour, bringing our model closer to the HO view of international trade) includes physical capital stock (K – from PWT 9.0), territory (T - land area from WDI) and fuel

[11] Empirically, export variety and the degree of export diversification have been measured using trade data at various levels of detail: from sector level (Parteka 2010, Parteka and Tamberi, 2013b; De Benedictis et al., 2009) to product level (Dennis and Shepherd, 2007; Hummels and Klenow, 2005; Cadot et al., 2011; Mau, 2016; Parteka and Tamberi 2013a; Basile et al., 2017) to the firm level and the shipment level (Martincus and Carballo, 2008; Hillberry and Hummels, 2008).

[12] Regolo (2013) considers the determinants of bilateral diversification (between country pairs) and focuses on bilateral differences in relative endowments. She is interested in measuring the degree of similarity between trading partners and, thus, adopts the *absolute* differences' measurement. We are interested also in the sign of the differences (for instance, if the productivity of a given country is either lower or higher than that of the RoW), so our *REV* variables are not expressed in absolute terms.

[13] Consequently, we measure the degree of country *i*'s export variety with respect to the average export variety of all the remaining countries.

[14] We use *rgdpo* and *emp* series.

exports (F - expressed as percentage of merchandise exports, also from WDI). To control for the quality of labour, we use the *hc* index from PWT 9.0 (based on Barro and Lee's dataset) to compute human-capital adjusted measure of employment ($L_{HC} = hc*L$). We also combine the education enrolment ratios from the original dataset [2016 update, Barro and Lee (2016)][15] with annual data on the number of persons engaged (in mln, from PWT 9.0) to obtain the number of workers with low (L_{low}), medium (L_{med}), and high education level (L_{high}). Alternatively (as a robustness check),[16] we use the data on employment by education from ILO to split the labour force variable (L) into three components: advanced (L_{adv}) intermediate (L_{int}), and basic (L_{bas}). [17] However, such data are obtainable only since 1990 and for a limited subsample of countries.

To capture the magnitude of trade costs (TC), we employ Cost to export (US$ per container) from the World Bank's WDI,[18] alternated with series on Cost to export, border compliance (US$), and Cost to export, documentary compliance (US$)[19] - TC_{BC} and TC_{DC}, respectively. We also use the updated CEPII gravity dataset (Head et al., 2010) to get information on the participation in trade agreements that is related to the reduction in trade barriers (we use dummies on WTO/GATT membership, participation in RTAs, and EU membership).

In line with the theoretical model, productivity is expressed directly w.r.t. the RoW, $\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$, while all the other explanatory variables are inverted and expressed as RoW w.r.t. the home country, namely $ln(X_t^{RoW}/X_{it}) = ln(X_t^{RoW}) - \ln(X_{it})$ *for* $X \in \{L; K; L_{HC}, L_{high}, L_{med}, L_{low}, L_{adv}, L_{int}, L_{bas}, T, F, TC, TC_{BC}, TC_{DC}\}$. Summary statistics are shown in Table 2A, while pairwise correlation coefficients concerning all the variables (in logs) are reported Table 3A and Table 4A in the Appendix.

4.2 The empirical model and estimation results

To test the crucial Proposition 3 of the theoretical model, we regress the measure of relative export variety of country *i* in year *t* on two main factors – productivity and size:

$$lnREV_{it}^k = \alpha + \beta_1 ln\left(\frac{Y_{it}}{L_{it}}/\frac{Y^{RoW}}{L^{RoW}}\right) + \beta_2 ln(L^{RoW}/L_{it}) + D_t + \varepsilon_{it} \tag{13}$$

[15] We use "Education Attainment for Population Aged 25 and Over" (1950–2010, 5-year averages) from http://www.barrolee.com. We combine their *lu* and *lp* categories into one (low), so our three categories correspond to workers with primary(or less), secondary, and tertiary schooling.

[16] The results are reported in Table 7A in the Appendix.

[17] Specifically, we use information on "Labour force by sex, age and education (thousands)". The categories are as follows. Basic – primary and lower secondary education (ISCED-97 1 and 2), intermediate – upper-secondary and post-secondary non-tertiary education (ISCED-97 3 and 4), and advanced – first and second stage of tertiary education (ISCED-97 3 and 4).

[18] World Development Indicators (https://datacatalog.worldbank.org/dataset/world-development-indicators)

[19] Cost to export in US$ per container is available only from 2005 onwards; the other two variables are available only for 2014.

where REV^k, as in eq. 12 with k={*N, Theil, Gini, HH, RelTheil, RelGini*}, is a function of relative productivity ($\frac{Y_{it}}{L_{it}}/\frac{Y^{RoW}}{L^{RoW}}$) and relative country size (L^{RoW}/L_{it}), with *i* referring to countries and *t* to time period. In Table 1, we report the estimations of the simplest models, related to Proposition 1 and 2, where *REV* is only a function of one of these two factors.

The basic results obtained through OLS[20] (Table 2) with time fixed effects confirm the key model predictions: export variety is positively related to countries' relative productivity and negatively related to the expansion of foreign economies (the growth of the RoW size). As various measures are highly correlated (see Table 3A in the Appendix) and give comparable results (in terms of the sign), we will keep only REV^N and REV^{Theil} for descriptions and regressions in the main text.

To check the robustness of this result, in Table 6A in the appendix, we report the results obtained with alternative estimators that take into account the specificity of the dependent variable. The measures of export variety – in the simplest case, the number of exported products – are bounded from below by zero and from above by the number of classes (e.g., product categories) registered in trade classification schemes[21]; similarly, export concentration measures are bounded. The calculation of export variety with respect to the RoW (see eq. 12) at least partly eliminates the problem of the limited upper bound (theoretically, there is no limit on having the export structure *n* times more diversified than is the RoW). From below the *REV* approaches zero[22] and, thus, we express the dependent variable in logs (Hillberry and Hummels, 2008). Nevertheless, the results obtained through other estimation solutions addressing the problem of the bounded dependent variable, namely Poisson and the *flex* estimates [flexible pseudo maximum likelihood estimation, Silva et al. (2014)], give similar results.

We also check if the results are not driven by specific countries, such as very big economies (China, India), small states, or petrol-abundant countries (typically having highly concentrated exports). Table 3 reports the results of eq.13 estimates performed on limited country sets. The results remain stable.

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[20] The inclusion of country fixed effects clears out all the differences in productivity (Y/L) between countries – see Table 5A in the Appendix – so we decided not to include them into the model and, rather, focus on measurable characteristics of countries. Additionally, we regressed relative productivity on a time trend: $ln\left(\frac{Y_{it}}{L_{it}}/\frac{Y^{RoW}}{L^{RoW}}\right) = \alpha + \beta year + \varepsilon_{it}$. The estimates (coefficient β is close to zero and statistically insignificant) prove that relative productivity differentials remain stable and are, thus, collinear with time fixed effects.

[21] Silva et al. (2014) proposed a 'flexible pseudo maximum likelihood estimation of models for doubly-bounded data method', which may be implemented in Stata using the command *flex*. Their application (a bilateral model for the number of sectors exporting from a given country to a destination, ranging between 0 and 5132 categories) shows that the choice of estimator may lead to significant differences in assessing the role played by different determinants of the extensive margin of trade.

[22] For example, the log of *REV_N* in our sample ranges between -4.7 and 1.63. See the summary statistics presented in Table 2A in the Appendix.

Table 1. Relative export variety and productivity (Proposition 1) vs. relative export variety and country size (Proposition 2)

Panel regression (whole sample: 132 countries, 1988-2014), alternative *REV* measures, log-log

		(1)	(2)	(3)	(4)	(5)	(6)
	Dep.var.: Expected sign	ln(REV^{N})	ln(REV^{Theil})	ln(REV^{Gini})	ln(REV^{HH})	ln$(REV^{RelTheil})$	ln$(REV^{RelGini})$
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.504***	0.155***	0.019***	0.487***	0.172***	0.079***
		[0.049]	[0.026]	[0.003]	[0.094]	[0.027]	[0.015]
R^2		0.358	0.214	0.234	0.165	0.29	0.224
Observations		3564	3564	3564	3564	3564	3564
		(1)	(2)	(3)	(4)	(5)	(6)
	Dep.var.: Expected sign	ln(REV^{N})	ln(REV^{Theil})	ln(REV^{Gini})	ln(REV^{HH})	ln$(REV^{RelTheil})$	ln$(REV^{RelGini})$
$\ln(L^{RoW}/L)$	(-)	-0.327***	-0.101***	-0.012***	-0.317***	-0.100***	-0.051***
		[0.030]	[0.013]	[0.002]	[0.046]	[0.019]	[0.009]
R^2		0.364	0.222	0.234	0.169	0.243	0.225
Observations		3564	3564	3564	3564	3564	3564

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. OLS estimates, robust clustered standard errors in parentheses. Time fixed effects included in all models. Dependent variable based on: the number of active export lines, *N* (column 1), the inverse of export concentration measures, *Theil*, *Gini* and *HH* (columns 2-4), the inverse of relative export diversification measures, *RelTheil* and *RelGini* (columns 5-6). RoW denotes the Rest of the World.

Source: authors' calculations

Table 2. Relative export variety, productivity and country size (Proposition 3)

Panel regression (whole sample: 132 countries, 1988-2014), alternative *REV* measures, log-log

		(1)	(2)	(3)	(4)	(5)	(6)
	Dep.var.: Expected sign	ln(REV^{N})	ln(REV^{Theil})	ln(REV^{Gini})	ln(REV^{HH})	ln$(REV^{RelTheil})$	ln$(REV^{RelGini})$
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.552***	0.170***	0.021***	0.534***	0.187***	0.087***
		[0.031]	[0.021]	[0.003]	[0.080]	[0.022]	[0.013]
$\ln(L^{RoW}/L)$	(-)	-0.358***	-0.111***	-0.013***	-0.347***	-0.111***	-0.056***
		[0.021]	[0.011]	[0.002]	[0.040]	[0.015]	[0.008]
R^2		0.71	0.48	0.51	0.36	0.568	0.477
Observations		3564	3564	3564	3564	3564	3564

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. OLS estimates, robust clustered standard errors in parentheses. Time fixed effects included in all models. Dependent variable based on: the number of active export lines, *N* (column 1), the inverse of export concentration measures, *Theil*, *Gini* and *HH* (columns 2-4), the inverse of relative export diversification measures, *RelTheil* and *RelGini* (columns 5-6). RoW denotes the Rest of the World.

Source: authors' calculations

Table 3. Relative export variety, productivity and country size (Proposition 3)
Panel regression (subsamples of countries, 1988-2014), alternative *REV* measures, log-log

Panel A. Dep.var.: ln(*REV^N*)	Expected sign	(1) Excluding China and India	(2) Excluding small states (<=300'000)	(3) Excluding small states (<=500'000)	(4) Excluding Fuel>90%	(5) Excluding Fuel>80%	(6) Excluding Fuel>60%
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.553***	0.555***	0.555***	0.493***	0.506***	0.516***
		[0.032]	[0.032]	[0.032]	[0.028]	[0.028]	[0.028]
$\ln(L^{RoW}/L)$	(-)	-0.364***	-0.360***	-0.347***	-0.307***	-0.300***	-0.297***
		[0.023]	[0.026]	[0.028]	[0.020]	[0.020]	[0.020]
R^2		0.71	0.698	0.686	0.705	0.718	0.726
Observations		3510	3380	3221	2652	2566	2468
No of countries		130	128	122	125	121	116
Panel B. Dep.var.: ln(*REV^{Theil}*)	**Expected sign**	**(1) Excluding China and India**	**(2) Excluding small states (<=300'000)**	**(3) Excluding small states (<=500'000)**	**(4) Excluding Fuel>90%**	**(5) Excluding Fuel>80%**	**(6) Excluding Fuel>60%**
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.170***	0.172***	0.179***	0.199***	0.215***	0.228***
		[0.021]	[0.021]	[0.022]	[0.019]	[0.017]	[0.016]
$\ln(L^{RoW}/L)$	(-)	-0.107***	-0.121***	-0.122***	-0.119***	-0.117***	-0.114***
		[0.012]	[0.012]	[0.013]	[0.009]	[0.008]	[0.008]
R^2		0.461	0.484	0.487	0.574	0.648	0.702
Observations		3510	3380	3221	2652	2566	2468
No of countries		130	128	122	125	121	116

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time fixed effects included in all models. Countries excluded: (1) China and India, (2) Bahamas, Barbados, Belize, Brunei Darussalam, Iceland, Maldives, Sao Tome and Principe, St. Lucia, St. Vincent and the Grenadines; (3) as in (2) plus Bahrain, Cabo Verde, Comoros, Equatorial Guinea, Malta, Qatar, Suriname; (4) Algeria, Angola, Brunei Darussalam, Congo Rep., Iraq, Kuwait, Nigeria, Oman, Qatar, Saudi Arabia, United Arab Emirates, Venezuela; (5) as in (4) plus Bahrain, Gabon, Iran; (6) as in (5) plus Cameroon, Colombia, Ecuador, Norway, Paraguay, Syrian AR, Trinidad and Tobago.
Source: authors' calculations

In the next step, following the 'stages of diversification' literature (Imbs and Wacziarg, 2003; Cadot et. al., 2011) we explore nonlinearity in the export diversification process. The results reported in Table 4 refer to the eq. (13) estimated in the subgroups of countries defined in line with the World Bank's income class that they belonged to in a particular year (we use country specific classifications to account for the possibility that countries switch between income categories over time). The coefficient associated with $\ln(\mathrm{L}^{\mathrm{RoW}}/\mathrm{L})$ is always negative and statistically significant; *ceteris paribus*, at all levels of economic development, the bigger the RoW size, the lower the relative export variety of the home country. This result holds for both types of *REV* measures (based on *N* – panel A and *Theil* – panel B). At the same time, the relationship between *REV* and relative productivity, $\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$, is not stable along the path of growth. It is positive at low levels of income (column 1), but it then vanishes as countries move to higher levels of development. This suggests that increases in relative labour productivity are associated with increasing diversification of export activity only at the beginning of the growth process. Note that the result of a negative relationship between productivity and export variety at high levels of income (column 4, panel B), which might be interpreted as a sign of re-specialisation, is not robust. It does not hold when export variety is measured in terms of the number of products (column 4, panel A). Additionally, even if it is significant in the case of Theil-based *REV* measure (column 4, panel B), it is evident that this result is driven by rich, petrol-abundant countries (with a clearly very concentrated export basket). Once we exclude from the rich countries group the economies with export structures dependent on fuel (column 5, panel A and B), $\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$ is not among statistically significant determinants of *REV* in high income countries. This finding is in line with the stream of literature that has questioned the U-shaped export diversification pattern and re-specialisation at higher stages of growth, in favour of progressing diversification along the development path (De Benedictis et al., 2009; Parteka and Tamberi, 2013a).

Table 5 reports the estimations results referring to the extended model

$$lnREV_{it}^{k} = \alpha + \beta_1 ln\left(\frac{Y_{it}}{L_{it}}/\frac{Y^{RoW}}{L^{RoW}}\right) + \beta_2 ln(L^{RoW}/L_{it}) + \beta_3 ln(K^{RoW}/K_{it}) + \beta_4 ln(T^{RoW}/T_{it}) + \beta_5 ln(F^{RoW}/F_{it}) + D_t + \varepsilon_{it} \quad (14)$$

where the following additional explanatory variables are added: relative abundance in capital (*K*), land/territory (*T*), and fuel (*F*) – all expressed as RoW with respect to the home country. The number of observations available for such extended estimations is lower due to the limited availability of some of the regressors. The two basic explanatory variables are very robust even if we control for the importance of endowments of the RoW with respect to our country. Relative export variety is positively related to home country relative productivity and negatively related to the size expansion of the RoW.

Moreover, as shown in Table 6, a positive relationship between *REV* and relative productivity and the negative relationship between *REV* and the country size holds once we adjust the country size measure for the quality of human capital. To do so, we first substitute *L* from model (13) with $\ln(L_{HC})$; results are reported in column 1 of Table 6. Then (columns 2–4), instead of an aggregate number of workers, we separately take into account the sizes of the elements of the labour force with three levels of education: low, medium, and high. It turns out that it actually does not matter how we measure relative country size (i.e., either as total labour force or as labour force of only a certain type), and the main model predictions hold.[23]

[23] The robustness check, obtained with alternative indicators of human capital, is reported in Table 7A in the Appendix.

Table 4. Relative export variety, productivity and country size (Proposition 3) – results by income group
Panel regression (132 countries, 1988-2014), log-log

Panel A. Dep.var.: ln(REV^N)		(1)	(2)	(3)	(4)	(5)
	Expected sign	Low income	Low-middle income	Upper-middle income	High income	High income – excluding petrol abundant countries
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	?	0.534***	0.383**	0.069	-0.115	0.225
		[0.092]	[0.150]	[0.116]	[0.180]	[0.148]
$\ln(L^{RoW}/L)$	?	-0.464***	-0.361***	-0.312***	-0.288***	-0.193***
		[0.029]	[0.031]	[0.031]	[0.044]	[0.033]
R^2		0.762	0.631	0.635	0.582	0.6
Observations		1110	940	599	915	743
No of countries		53	68	49	44	37

Panel B. Dep.var.: ln(REV^{Theil})		(1)	(2)	(3)	(4)	(5)
	Expected sign	Low income	Low-middle income	Upper-middle income	High income	High income – excluding petrol abundant countries
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	?	0.140***	0.085	-0.077	-0.408***	-0.13
		[0.029]	[0.072]	[0.114]	[0.070]	[0.140]
$\ln(L^{RoW}/L)$	?	-0.086***	-0.074***	-0.098***	-0.192***	-0.155***
		[0.016]	[0.016]	[0.017]	[0.020]	[0.021]
R^2		0.448	0.248	0.296	0.64	0.563
Observations		1110	940	599	915	743
No of countries		53	68	49	44	37

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time fixed effects included in all models. Division of countries into income groups according to historical (year specific) World Bank's classifications. Column (5) – excluding observations for countries classified as high income but having in a given year over 60% of merchandise exports in fuel products (Bahrain, Brunei Darussalam, Kuwait, Norway, Oman, Qatar, Saudi Arabia, Trinidad and Tobago, United Arab Emirates).
Source: authors' calculations

Table 5. Relative export variety, productivity and country size (Proposition 3)
Panel regression (whole sample: 132 countries, 1988-2014), with additional control variables, log-log

Panel A. Dep.var.: ln(REV^N)		(1)	(2)	(3)	(4)	(5)
	Expected sign	basic	controlled for capital	controlled for capital and territory (land)	controlled for resources (fuel)	controlled for capital, land and resources (fuel)
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.552***	0.393***	0.358***	0.474***	0.331***
		[0.031]	[0.081]	[0.076]	[0.030]	[0.071]
$\ln(L^{RoW}/L)$	(-)	-0.358***	-0.216***	-0.280***	-0.312***	-0.257***
		[0.021]	[0.071]	[0.067]	[0.023]	[0.063]
$\ln(K^{RoW}/K)$			-0.146**	-0.164**		-0.117*
			[0.072]	[0.067]		[0.060]
$\ln(T^{RoW}/T)$				0.091***		0.071***
				[0.023]		[0.022]
$\ln(F^{RoW}/F)$					0.025*	0.016
					[0.013]	[0.013]
R^2		0.71	0.715	0.714	0.642	0.66
Observations		3564	3564	3564	2695	2695
No of countries		132	132	132	127	127
Panel B. Dep.var.: ln(REV^{Theil})		(1)	(2)	(3)	(4)	(5)
	Expected sign	basic	controlled for capital	controlled for capital and territory (land)	controlled for resources (fuel)	controlled for capital, land and resources (fuel)
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.170***	0.134***	0.110**	0.213***	0.107**
		[0.021]	[0.044]	[0.042]	[0.020]	[0.046]
$\ln(L^{RoW}/L)$	(-)	-0.111***	-0.079**	-0.124***	-0.144***	-0.095**
		[0.011]	[0.033]	[0.033]	[0.011]	[0.041]
$\ln(K^{RoW}/K)$			-0.032	-0.045		-0.088**
			[0.035]	[0.033]		[0.042]
$\ln(T^{RoW}/T)$				0.064***		0.045***
				[0.013]		[0.013]
$\ln(F^{RoW}/F)$					0.046***	0.041***
					[0.008]	[0.008]
R^2		0.478	0.479	0.537	0.559	0.595
Observations		3564	3564	3564	2695	2695
No of countries		132	132	132	127	127

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time fixed effects included in all models. K- capital, T- territory (arable land), F- Fuel (as% of merchandise exports)

Source: authors' calculations

Table 6. Relative export variety, productivity and country size (Proposition 3) – labour force adjusted for human capital
Panel regression (whole sample, 1988-2014), log-log

Panel A. Dep.var.: ln(*REV*^{N})	Expected sign	(1) controlled for human capital-adjusted labour	(2) controlled for low skilled labour force	(3) controlled for medium skilled labour force	(4) controlled for high skilled labour force
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.462*** [0.029]	0.611*** [0.034]	0.393*** [0.032]	0.320*** [0.033]
$\ln(L_{HC}^{RoW}/L_{HC})$		-0.314*** [0.022]			
$\ln(L_{low}^{RoW}/L_{low})$			-0.297*** [0.022]		
$\ln(L_{med}^{RoW}/L_{med})$				-0.301*** [0.021]	
$\ln(L_{high}^{RoW}/L_{high})$					-0.262*** [0.020]
R^2		0.693	0.65	0.695	0.679
Observations		3159	3051	3051	3051
No of countries		117	113	113	113
Panel B. Dep.var.: ln(*REV*^{Theil})	Expected sign	(1) controlled for human capital-adjusted labour	(2) controlled for low skilled labour force	(3) controlled for medium skilled labour force	(4) controlled for high skilled labour force
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.153*** [0.021]	0.204*** [0.025]	0.121*** [0.021]	0.095*** [0.023]
$\ln(L_{HC}^{RoW}/L_{HC})$		-0.125*** [0.012]			
$\ln(L_{low}^{RoW}/L_{low})$			-0.106*** [0.014]		
$\ln(L_{med}^{RoW}/L_{med})$				-0.124*** [0.011]	
$\ln(L_{high}^{RoW}/L_{high})$					-0.102*** [0.011]
R^2		0.502	0.412	0.518	0.473
Observations		3159	3051	3051	3051
No of countries		117	113	113	113

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time fixed effects included in all models.
Source: authors' calculations

In Table 7, we also show the results taking into account variables related to trade costs and the participation in trade agreements. The inclusion of the measures of trade costs (TC, TC_{BC}, TC_{DC}) or dummies related to the participation in GATT, RTA, or EU does not alter the previously confirmed relationship between REV, relative productivity, and relative size stemming from the theoretical framework. The relationship between export variety and trade costs predicted by our theoretical framework is more complex and has to take into account the wage adjustment effect resulting from trade liberalisation. As stated in Section 2.2., the relative wage in a country increases with improved access to the RoW, which negatively affects its export diversification, as some goods become no longer competitive and their production must be dropped. Empirically, we find that the wage adjustment effect prevails.

Table 7. Relative export variety, productivity and country size (Proposition 3) – controlling for trade (export) costs (TC) and RTA

Panel regression (whole sample, 1988-2014#), log-log

Panel A. Dep.var.: ln(REV^N)	Expected sign	(1) controlled for trade costs (*TC*)	(2) controlled for trade costs (TC_{BC})	(3) controlled for trade costs (TC_{DC})	(4) controlled for GATT/WTO membership	(5) controlled for RTA participation	(6) controlled for EU membership
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.329***	0.360***	0.347***	0.534***	0.550***	0.548***
		[0.033]	[0.035]	[0.034]	[0.033]	[0.032]	[0.035]
$\ln(L^{RoW}/L)$	(-)	-0.262***	-0.257***	-0.264***	-0.341***	-0.358***	-0.363***
		[0.023]	[0.021]	[0.021]	[0.020]	[0.020]	[0.020]
$\ln(TC^{RoW}/TC)$		0.268***					
		[0.080]					
$\ln(TC_{BC}^{RoW}/TC_{BC})$			0.136***				
			[0.051]				
$\ln(TC_{DC}^{RoW}/TC_{DC})$				0.148***			
				[0.040]			
GATT					0.399***		
					[0.134]		
RTA						0.125	
						[0.098]	
EU							0.137
							[0.102]
R^2		0.73	0.717	0.726	0.727	0.712	0.716
Observations		1290	122	121	3564	3561	3537
No of countries		132	122	121	132	132	131
Time		2005-2014	2014	2014	1988-2014	1988-2014	1988-2014

Panel B. Dep.var.: ln(REV^{Theil})	Expected sign	(1) controlled for trade costs (*TC*)	(2) controlled for trade costs (TC_{BC})	(3) controlled for trade costs (TC_{DC})	(4) controlled for GATT/WTO membership	(5) controlled for RTA participation	(6) controlled for EU membership
$\ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.103***	0.102***	0.095***	0.164***	0.170***	0.118***
		[0.025]	[0.021]	[0.021]	[0.022]	[0.022]	[0.021]
$\ln(L^{RoW}/L)$	(-)	-0.096***	-0.083***	-0.089***	-0.105***	-0.111***	-0.095***
		[0.012]	[0.012]	[0.011]	[0.012]	[0.011]	[0.011]
$\ln(TC^{RoW}/TC)$		0.183***					
		[0.043]					
$\ln(TC_{BC}^{RoW}/TC_{BC})$			0.119***				
			[0.031]				
$\ln(TC_{DC}^{RoW}/TC_{DC})$				0.124***			
				[0.027]			
GATT					0.129*		
					[0.070]		
RTA						-0.036	
						[0.053]	
EU							0.482***
							[0.064]
R^2		0.447	0.419	0.454	0.491	0.477	0.578
Observations		1290	122	121	3564	3561	3537
No of countries		132	122	121	132	132	131
Time		2005-2014	2014	2014	1988-2014	1988-2014	1988-2014

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Data for TC available for 2005-2014. Time fixed effects included in all models (# except columns 2 and 3 – da ta for TC_{BC} and TC_{DC} for 2014 only). Source: authors' calculations

Finally, even though the main focus in this paper is on a setting where each country is assessed with respect to the RoW, we also test the bilateral specification of the panel regressions between country pairs (i.e., instead of RoW in model 13, we have export variety of each country *i* assessed with respect to country *j*: $lnREV_{it}^{k} = ln(k_{it}/k_{jt}) = ln(k_{it}) - \ln(k_{jt})$ for each index of export variety *k*). The empirical results, reported in Table 8A in the Appendix, are very similar to the estimates of baseline specification (13) reported in Table 2, which confirms their robustness.

5. Conclusions

Several contributions have addressed the issue of changes in export variety (export diversification) along the path of economic development. However, they focus on the empirical side of the analysed phenomenon and rarely refer to the theoretical foundations. This makes interpretation of their results difficult.

Consequently, our aim was to address the lack of connection between the theory and empirics in most export diversification–economic development studies. We built a testable multi-good Ricardian model of export diversification with asymmetric trade costs, where countries' relative export variety is a function of the level of technology and country size – all assessed with respect to the rest of the world (RoW). Relative export diversification can be then viewed as an outcome of two forces: a relative productivity change due to technological progress, and a relative country size change due to labour force growth. In addition, we showed that trade costs may affect export diversification; however, the overall effect is not clear. We developed three crucial propositions that show the relationships between export diversification, relative productivity, relative country size, and relative trade costs.

First, we demonstrated that increased relative productivity of the country with respect to the RoW results in increased export diversification. Second, we showed that the increased relative size of the RoW with respect to the size of the country decreases export diversification. The combined effect of these two forces depends on their relative strength. In addition, we tested the robustness of these propositions in the presence of trade costs, which may also affect export diversification. In our model, export diversification of a country increases with declining relative trade costs of the RoW, as it is now easier to export; however, at the same time, relative wages in the country increase with declining relative trade costs of the RoW, which negatively affects export diversification, as some goods are no longer competitive and their production in the country must be stopped. Hence, the net effect of the change in trade costs was not clear and had to be determined empirically. We found that the wage adjustment effect dominated.

The predictions of the model were tested on the sample of 132 countries (1988–2014), for which we measured the degree of export variety using product-level (HS 6-digit) trade data. We computed several measures of the degree of diversification, based both on conventional indices of export concentration and on relative indices of trade diversification. Estimation results confirmed the key model predictions. In particular, we found a robust positive relationship between export variety and countries' relative productivity and a negative relationship between export variety and the expansion of foreign economies (i.e., the growth of the RoW size). The empirical results were robust to changes in the way that export variety was measured, to the inclusion of other control variables (referring to countries endowments, human capital, and trade costs), and to estimation methods (accounting for the doubly-bounded nature of the dependent variable).

In addition, we found that the influence of technology differences on export variety was: (i) stronger than was the effect of cross-country differences in relative size and (ii) non-linear and drove diversification at the beginning of the development process but then disappeared. This suggests that increases in relative labour productivity are associated with increasing diversification of export activity only at the beginning of the growth process. Such a finding has very important policy implications: in order to fight excessive export concentration, developing countries should focus on technology improvements. Technology transfer, which drives productivity change, then dies out and can no longer feed export variety growth; however, it remains a crucial source of diversification in the early development context.

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Appendix

Table 1A List of countries

Albania	Cyprus	Jordan	Poland
Algeria	Denmark	Kenya	Portugal
Angola	Djibouti	Korea, Rep.	Qatar
Argentina	Dominican Republic	Kuwait	Romania
Australia	Ecuador	Lao PDR	Rwanda
Austria	Egypt, Arab Rep.	Lebanon	Sao Tome and Principe
Bahamas, The	El Salvador	Liberia	Saudi Arabia
Bahrain	Equatorial Guinea	Madagascar	Senegal
Bangladesh	Fiji	Malawi	Sierra Leone
Barbados	Finland	Malaysia	Singapore
Belize	France	Maldives	Spain
Benin	Gabon	Mali	Sri Lanka
Bhutan	Gambia, The	Malta	St. Lucia
Bolivia	Germany	Mauritania	St. Vincent and the Grenadines
Brazil	Ghana	Mauritius	Suriname
Brunei Darussalam	Greece	Mexico	Sweden
Bulgaria	Guatemala	Mongolia	Switzerland
Burkina Faso	Guinea	Morocco	Syrian Arab Republic
Burundi	Guinea-Bissau	Mozambique	Tanzania
Cabo Verde	Haiti	Myanmar	Thailand
Cambodia	Honduras	Nepal	Togo
Cameroon	Hong Kong SAR, China	Netherlands	Trinidad and Tobago
Canada	Hungary	New Zealand	Tunisia
Central African Republic	Iceland	Nicaragua	Turkey
Chad	India	Niger	Uganda
Chile	Indonesia	Nigeria	United Arab Emirates
China	Iran, Islamic Rep.	Norway	United Kingdom
Colombia	Iraq	Oman	United States
Comoros	Ireland	Pakistan	Uruguay
Congo, Dem. Rep.	Israel	Panama	Venezuela, RB
Congo, Rep.	Italy	Paraguay	Vietnam
Costa Rica	Jamaica	Peru	Zambia
Cote d'Ivoire	Japan	Philippines	Zimbabwe

Table 2A Summary statistics

		n	mean	st.dev.	min	max
Dependent variable - REV	$\ln(REV^{N})$	3,564	-0.469	1.130867	-4.70486	1.632755
	$\ln(REV^{Theil})$	3,564	-0.0866	0.404169	-0.733	1.125711
	$\ln(REV^{Gini})$	3,564	-0.00115	0.047598	-0.03822	0.228994
	$\ln(REV^{HH})$	3,564	-1.0107	1.473566	-3.66074	2.697653
	$\ln(REV^{RelTheil})$	3,564	0.467759	0.394503	0.106602	2.716888
	$\ln(REV^{RelGini})$	3,564	1.126896	0.207982	1.000014	2.202718
Relative productivity	$ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	3,564	0.597327	1.209355	-2.3087	4.188967
Relative size (labour)	$ln(L^{RoW}/L)$	3,564	1.759584	1.88312	-4.10437	6.283935
Relative capital	$ln(K^{RoW}/K)$	3,564	2.105803	2.229059	-3.63592	7.408419
Relative territory (land)	$ln(T^{RoW}/T)$	3,564	1.732436	2.297397	-2.64491	7.809105
Relative fuel exports	$ln(F^{RoW}/F)$	2,695	1.863281	2.805532	-2.12679	16.87773
Relative human capital-adjusted labor	(lnL_{HC}^{RoW}/L_{HC})	3,159	1.589927	1.707027	-3.88994	6.008731
Relative human capital (1)	$ln(L_{low}^{RoW}/L_{low})$	3,051	1.667498	1.779511	-4.02353	6.661209
	$ln(L_{med}^{RoW}/L_{med})$	3,051	1.910237	1.824288	-4.33484	6.387411
	$ln(L_{high}^{RoW}/L_{high})$	3,051	2.032483	2.126308	-4.21934	8.31246
Relative human capital (2)	$ln(L_{bas}^{RoW}/L_{bas})$	1,029	1.208749	1.672869	-3.4315	9.004905
	$ln(L_{int}^{RoW}/L_{int})$	1,025	1.153711	1.7088	-3.08108	7.628739
	$ln(L_{adv}^{RoW}/L_{adv})$	1,029	1.207467	1.721873	-3.22222	7.097333
Relative trade costs	$ln(TC^{RoW}/TC)$	1,290	0.158431	0.53939	-1.56241	1.677887
	$ln(TC_{BC}^{RoW}/TC_{BC})$	122	0.178393	0.772637	-1.68193	2.663173
	$ln(TC_{DC}^{RoW}/TC_{DC})$	121	0.394555	0.908614	-2.91679	2.736151

Note. *n* varies due to limited availability of some of the variables.
Source: authors' calculations

Table 3A. Pairwise correlations between alternative measures of relative export variety (REV)

(whole sample: 132 countries, 1988-2014, n=3564)

	$\ln(REV^{N})$	$\ln(REV^{Theil})$	$\ln(REV^{Gini})$	$\ln(REV^{HH})$	$\ln(REV^{RelTheil})$	$\ln(REV^{RelGini})$
$\ln(REV^{N})$	1					
$\ln(REV^{Theil})$	0.7368	1				
$\ln(REV^{Gini})$	0.6287	0.9071	1			
$\ln(REV^{HH})$	0.6951	0.9689	0.8013	1		
$\ln(REV^{RelTheil})$	0.8218	0.6906	0.6899	0.6113	1	
$\ln(REV^{RelGini})$	0.6593	0.888	0.9632	0.7881	0.7409	1

Note. REV based on: the number of active export lines, N, the inverse of export concentration measures, *Theil*, *Gini* and *HH*, the inverse of relative export diversification measures, *RelTheil* and *RelGini*.
Source: authors' calculations

Table 4A. Pairwise correlations between explanatory variables (whole sample: 132 countries, 1988-2014, N=3564*)

	$\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(L^{RoW}/L)	(K^{RoW}/K)	(T^{RoW}/T)	(F^{RoW}/F)	(L_{HC}^{RoW}/L_{HC})	(L_{low}^{RoW}/L_{low})	(L_{med}^{RoW}/L_{med})	$(L_{high}^{RoW}/L_{high})$	(L_{bas}^{RoW}/L_{bas})	(L_{int}^{RoW}/L_{int})	(L_{adv}^{RoW}/L_{adv})	(TC^{RoW}/TC)	(TC_{BC}^{RoW}/TC_{BC})	(TC_{DC}^{RoW}/TC_{DC})
$\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	1.00														
(L^{RoW}/L)	-0.09	1.00													
(K^{RoW}/K)	0.52	0.77	1.00												
(T^{RoW}/T)	-0.15	0.74	0.53	1.00											
(F^{RoW}/F)	0.24	0.23	0.37	0.32	1.00										
(L_{HC}^{RoW}/L_{HC})	0.02	0.98	0.81	0.67	0.21	1.00									
(L_{low}^{RoW}/L_{low})	-0.33	0.94	0.55	0.67	0.14	0.88	1.00								
(L_{med}^{RoW}/L_{med})	0.17	0.91	0.86	0.58	0.22	0.96	0.76	1.00							
$(L_{high}^{RoW}/L_{high})$	0.33	0.83	0.90	0.58	0.25	0.90	0.66	0.92	1.00						
(L_{bas}^{RoW}/L_{bas})	-0.18	0.90	0.71	0.58	0.25	0.86	0.90	0.83	0.69	1.00					
(L_{int}^{RoW}/L_{int})	0.17	0.91	0.87	0.59	0.27	0.94	0.71	0.95	0.89	0.77	1.00				
(L_{adv}^{RoW}/L_{adv})	0.24	0.89	0.90	0.61	0.29	0.93	0.68	0.92	0.94	0.76	0.93	1.00			
(TC^{RoW}/TC)	-0.42	-0.10	-0.35	0.19	-0.01	-0.25	-0.06	-0.31	-0.36	-0.13	-0.23	-0.20	1.00		
(TC_{BC}^{RoW}/TC_{BC})	-0.14	-0.02	-0.10	0.08	0.09	0.01	0.16	-0.03	-0.07	0.17	-0.03	-0.03	0.18	1.00	
(TC_{DC}^{RoW}/TC_{DC})	-0.22	0.09	-0.08	0.13	0.06	0.06	0.25	0.01	-0.08	0.26	0.16	0.10	0.31	0.50	1.00

Note. * *n* varies due to limited availability of some of the variables. All variables in logs.
Source: authors' calculations

Table 5A. Relative export variety, productivity and country size (Proposition 3) – robustness check (FE estimates)

Panel regression (whole sample: 132 countries, 1988-2014), alternative *REV* measures, log-log

	Dep.var.: Expected sign	(1) $\ln(REV^{N})$	(2) $\ln(REV^{Theil})$	(3) $\ln(REV^{Gini})$	(4) $\ln(REV^{HH})$	(5) $\ln(REV^{RelTheil})$	(6) $\ln(REV^{RelGini})$
$ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.053	0.004	0.003**	-0.023	0.058***	0.014*
		[0.085]	[0.020]	[0.002]	[0.095]	[0.011]	[0.008]
$ln(L^{RoW}/L)$	(-)	-1.175***	-0.124***	-0.008	-0.572***	0.03	0.061***
		[0.251]	[0.041]	[0.006]	[0.169]	[0.048]	[0.021]
R^2		0.46	0.037	0.022	0.076	0.287	0.275
Observations		3564	3564	3564	3564	3564	3564

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time and country fixed effects included in all models. Dependent variables based on: the number of active export lines (column 1), the inverse of export concentration measures (columns 2-4), the inverse of relative export diversification (5)-(6)

Source: authors' calculations

Table 6A. Relative export variety, productivity and country size (Proposition 3)- robustness check (Flex and Poisson estimates)

Panel regression (whole sample: 132 countries, 1988-2014)

	Dep.var.: Expected sign	(1) flex (REV^{N})	(2) flex (REV^{N})	(3) flex (REV^{N})	(4) poisson (REV^{N})	(5) poisson (REV^{N})	(6) poisson (REV^{N})
$ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.148***		0.152***	0.393***		0.419***
		[0.015]		[0.007]	[0.042]		[0.028]
$ln(L^{RoW}/L)$	(-)		-0.101***	-0.100***		-0.226***	-0.244***
			[0.008]	[0.004]		[0.022]	[0.019]
R^2							
Observations		3564	3564	3564	3564	3564	3564

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time fixed effects included in all models. Dependent variable: relative number of active export lines (theoretical max=5016, rescaled 0-1). Flex- Flexible pseudo maximum likelihood estimation. Poisson - Poisson regression.

Source: authors' calculations

Table 7A. Relative export variety, productivity and country size (Proposition 3)– robustness check - labour force adjusted for human capital
Panel regression (whole sample, 1988-2014), log-log

Panel A. Dep.var.: *(REV^N)*	Expected sign	(1) controlled for basic labour	(2) controlled for intermediate labour	(3) controlled for advanced labour
$ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.389*** [0.031]	0.268*** [0.031]	0.246*** [0.031]
$ln(L_{bas}^{RoW}/L_{bas})$		-0.155*** [0.021]		
$ln(L_{int}^{RoW}/L_{int})$			-0.156*** [0.020]	
$ln(L_{adv}^{RoW}/L_{adv})$				-0.156*** [0.021]
R^2		0.667	0.706	0.688
Observations		1029	1025	1029
No of countries		110	109	110

Panel B. Dep.var.: *(REV^{Theil})*	Expected sign	(1) controlled for low skilled labour	(2) controlled for medium skilled labour	(3) controlled for high skilled labour
$ln\left(\frac{Y}{L}/\frac{Y^{RoW}}{L^{RoW}}\right)$	(+)	0.246*** [0.030]	0.161*** [0.031]	0.151*** [0.034]
$ln(L_{bas}^{RoW}/L_{bas})$		-0.106*** [0.016]		
$ln(L_{int}^{RoW}/L_{int})$			-0.116*** [0.012]	
$ln(L_{adv}^{RoW}/L_{adv})$				-0.102*** [0.013]
R^2		0.495	0.564	0.493
Observations		1029	1025	1029
No of countries		110	109	110

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. Robust clustered standard errors in parentheses. Time fixed effects included in all models.
Source: authors' calculations

Table 8A. Relative export variety, productivity and country size (Proposition 3) – bilateral specification

Bilateral panel regression (whole sample: 132 country pairs, 1988-2014), alternative *REV* measures, log-log

		(1)	(2)	(3)	(4)
	Dep.var.: Expected sign	ln(REV^{N})	ln(REV^{Theil})	ln(REV^{Gini})	ln(REV^{HH})
$\ln\left(\frac{Y^i}{L^i}/\frac{Y^j}{L^j}\right)$	(+)	0.551*** [0.003]	0.167*** [0.002]	0.021*** [0.000]	0.527*** [0.007]
$\ln(L^j/L^i)$	(-)	-0.359*** [0.002]	-0.110*** [0.001]	-0.013*** [0.000]	-0.344*** [0.004]
R^2		0.69	0.474	0.509	0.353
Observations		452790	452790	452790	452790

Note. *, ** and *** denote significance at 10%, 5% and 1% level, respectively. OLS estimates, robust clustered standard errors in parentheses. Time fixed effects included in all models. Dependent variable based on: the number of active export lines, *N* (column 1), the inverse of export concentration measures, *Theil*, *Gini* and *HH* (columns 2-4), the inverse of relative export diversification measures, *RelTheil* and *RelGini* (columns 5-6).

Source: authors' calculations

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