

# Tax Reform, Trade Openness and Export Product Diversification in Developing Countries

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## Abstract

This article considers the effect of tax reform on export product diversification in developing countries, including through the trade openness channel. Tax reform involves the convergence of a developing country's tax structure towards the tax structure of developed countries. The analysis uses a sample of 112 developing countries over the period 1980–2014 and shows that tax reform exerts a positive effect on export product diversification, with least developed countries enjoying a higher positive effect than other countries in the full sample. Furthermore, the higher the degree of trade openness, the greater is the magnitude of the positive effect of tax reform on export product diversification. These outcomes have important policy implications. (JEL codes: H20, O11, O14).

**Key words:** tax reform, export product diversification, trade openness

## 1. Introduction

Despite the well-established benefits of trade openness, developing countries face major public revenue mobilization challenges when further opening up their economies to international trade. This is because in these countries, the share of international trade tax revenue in total public revenue remains significant, which makes their public revenue to rely on trade tax revenue at the expense of domestic tax revenue, whose mobilization is challenging. Policymakers in developing countries are, therefore, reluctant to further promote trade openness, fear which has been confirmed by empirical works (e.g., [Khattry and Rao 2002](#); [Khattry 2003](#); [Cagé and Gadenne 2018](#)) on the adverse effects of greater trade openness (or trade policy liberalization) on public revenue, including tax revenue in developing countries. Therefore, the issue that arises is how could developing countries raise public revenue, notably tax revenue in a context of growing inter-connected world, where economies might have no other choice than to further opening up their economies to international trade. It is also particularly important for these countries to ensure fiscal viability, in light of their huge financial resources needs for realizing development objectives. In that

regard, the International Monetary Fund (IMF) and the World Bank have made to developing countries, a reform proposal referred to as ‘proportional tariff-tax reform’, ‘point-for-point reforms’, ‘revenue neutral tariff-tax reform’ or ‘tax transition reform’. This proposal involves a proportional tariff reduction combined with a point-by-point consumption tax increase. It ultimately aims to reduce, in the medium to long term, countries’ public revenue dependence on international trade tax revenue at the benefit of domestic tax revenue. The rationale for this policy movement is that taxing trade, in particular imports (through, e.g., higher tariffs) is relatively inefficient and distorts production much more than taxing domestic consumption

Many studies<sup>1</sup> in the literature have used static and dynamic general equilibrium models to examine theoretically the implications of the proportional tariff-tax reform in terms of public revenue, welfare, economic growth and market access. From an empirical perspective, some studies (e.g., [Baunsgaard and Keen 2010](#); [Waglé 2011](#); [Crivelli 2016](#); [Moller 2016](#)) have shown that developing countries have been able to recoup the losses trade tax revenue—related to trade liberalization—from other sources (including domestic tax revenue). Recently, [Gnangnon and Brun \(2019a\)](#) have proposed an indicator of tax reform, in the spirit of the proposed reform by the IMF and the World Bank, which captures the convergence of a developing country’s tax structure towards the tax structure of developed countries. The rationale underlying this indicator is that in contrast with developing countries, the structure of tax revenue in developed countries is heavily dependent on domestic tax revenue, with international trade tax revenue representing a minuscule share of total tax revenue. The authors have then investigated empirically the effect of tax reform on fiscal space in developing countries and reported that tax reform generates a rise in fiscal space, including in the context of greater trade openness. [Gnangnon and Brun \(2019b\)](#) have also shown that such a tax reform generates higher tax revenue in developing countries, particularly when countries further open-up their economies to international trade. [Gnangnon and Brun \(2019c\)](#) have also used the same indicator to demonstrate empirically that tax reform reduces tax revenue instability. [Gnangnon \(2020\)](#) has uncovered that development aid (i.e., the so-called official development aid) promotes tax reform in developing countries, and this positive effect rises as countries enjoy a higher openness to international trade. Using the same indicator, [Gnangnon \(2019a\)](#) has demonstrated empirically that tax reform leads to a greater trade openness in developing countries, with least developed countries (LDCs) benefiting from a higher positive trade openness effect of this reform than non-LDCs do. However, to the best of our knowledge, there is no study on the effect of tax (transition) reform on export product diversification in developing countries. Exports diversification involves the increase in the variety of goods exported and the shift towards goods of higher quality and new markets (e.g., [Bernard et al. 2007](#); [Hausmann et al. 2007](#); [Brenton and Newfarmer 2009](#); [Tran et al. 2017](#)). The importance of export product diversification in developing countries has been well emphasized in the international trade literature. [Herzer and Nowak-Lehmann \(2006\)](#) and [Naudé et al. \(2010\)](#) have underlined the

1 These studies include for example [Abe \(1995\)](#); [Anderson \(1997, 1999\)](#); [Anderson and Neary \(2016\)](#); [Boadway and Sato \(2009\)](#); [Emran and Stiglitz \(2005\)](#); [Fujiwara \(2013\)](#); [Ganelli and Tervala \(2015\)](#); [Haibara \(2012\)](#); [Hatzipanayotou et al. \(1994\)](#); [Karakosta and Tsakiris \(2014\)](#); [Keen and Ligthart \(2002, 2005\)](#); [Kreickemeier and Raimondos-Møller \(2008\)](#); [Lahiri and Nasim \(2005\)](#); [Ligthart and van der Meijden \(2011\)](#); [Michael et al. \(1991, 1993\)](#); [Munk \(2008\)](#); [Naito \(2006\)](#); and [Naito and Abe \(2008\)](#).

existence of positive spill-overs associated with the movement from primary commodities into high-skilled, high-technology goods. According to Hausmann and Rodrik (2003), rather than comparative advantage, it is countries' investments into new activities, and the entrepreneurial cost-discovery process that matter for economic growth. Export diversification could contribute to the stabilization of export earnings in the long run.<sup>2</sup> It could also be positively associated with economic growth,<sup>3</sup> and help reduce countries' vulnerability to shocks, including through lower aggregate output volatility (e.g., Malik and Temple 2009; Neto and Romeu 2011; Haddad et al. 2013; Balavac and Pugh 2016) and firms' output/export volatility (e.g., Hirsch and Lev 1971; Juvenal and Monteiro 2013; Vannoorenbergh et al. 2016; Kramarz et al. 2020).

On another note, the determinants of export product diversification have been the subject of many studies in the literature (e.g., Imbs and Wacziarg 2003; Hausmann et al. 2007; Agosin et al. 2012; Harding and Javorcik 2012; Parteka and Tamberi 2013; Zhu and Fu 2013; Amighini and Sanfilippo 2014; Aditya and Acharyya 2015; Ali 2017; Gngangnon and Roberts 2017; Bahar and Santos 2018; Osakwe et al. 2018; Gngangnon 2019b,c; Vardanyan 2019; Bos et al. 2020). However, none of these studies has explored the effect of tax reform on export product diversification. The current article aims to contribute to the literature on the determinants of export product diversification by investigating the effect of tax transition reform—henceforth referred to as tax reform—on export product diversification in developing countries, notably through the trade openness channel. Here, tax reform involves the convergence of a developing country's tax structure towards the tax structure of developed countries. The analysis covers a sample of 112 countries (including 34 LDCs) over the period 1980–2014. Results, based primarily on the two-step system Generalized Methods of Moments (GMM) approach, show that tax reform influences positively export product diversification, with the magnitude of this positive effect increasing as countries' level of trade openness rises.

In the remaining part of the analysis, Section 2 lays out the discussion on how tax reform can affect export product diversification path in developing countries through the market access, notably the trade openness channel. Section 3 presents the model specification to address empirically the question under analysis. Section 4 presents some data analysis. Section 5 presents the econometric approach used to estimate the model laid down in Section 3. Section 6 interprets results and Section 7 concludes.

## 2. Theoretical Discussion on the Effect of Tax Reform on Export Product Diversification

In this analysis, we postulate that tax reform could affect export product diversification through its effect on market access, including trade openness.

Among studies (see Section 1, in particular footnote 1 for the list of some of those studies) that have examined theoretically the implications of the proportional tariff-tax reform

2 See for example Athukorola (2000); Bleaney and Greenaway (2001); Dawe (1996); Ghosh and Ostry (1994); and Stanley and Bunnag (2001).

3 Studies in this regard include for example Aditya and Acharyya (2013); Al-Marhubi (2000); Can and Gozgor (2017); De Pineres and Ferrantino (1997); Gutierrez-de-Pineros and Ferrantino (2000); Hausmann et al. (2007); Hess (2008); Hummels and Klenow (2005); Mania and Rieber (2019); and Sannasse et al. (2014).

(or the point-by-point policy reform) i.e., a one-unit tariff reduction combined with an increase in consumption tax by the same unit, only few (e.g., [Kreickemeier and Raimondos-Møller, 2008](#); [Fujiwara 2013](#)) have looked at the market access effect of this reform. According to [Kreickemeier and Raimondos-Møller \(2008\)](#), the proportional tariff-tax reform leads to a more efficient allocation of resources in the production sector (and generate welfare gains): it does not affect consumer prices, but only influences the production sector of the economy, including in the form of lower implicit production subsidies (due to declining tariffs)—as consumption taxes are less distortionary than tariffs, and the latter act as an equivalent to a net subsidy to producers. This is a direct application of the [Diamond and Mirlees \(1971\)](#) theorem<sup>4</sup> on the desirability of production efficiency (see also [Dixit 1985](#)), whereby in the absence of a lump-sum taxation, the optimal policy for the government in a small open economy entails the implementation of taxes on the net demand of households rather than on border taxes to finance its resource requirements. Along the same lines, many studies (e.g., [De Long and Summers 1991](#); [Lee 1993](#); [Eaton and Kortum 2001](#)) have provided empirical evidence that changes in trade barriers affect the relative price of imported capital goods—which are essential for producing higher valued products in developing countries—to consumption goods, discourage investment and ultimately hurt economic growth. Nevertheless, [Kreickemeier and Raimondos-Møller \(2008\)](#) have used a static general equilibrium model to show theoretically that this point-for-point policy reform does not necessarily result in greater market access (i.e. higher import value, i.e. at world market prices) under perfectly competitive conditions (i.e., at constant marginal costs). The authors have also reported that there exists a (non-linear) tariff-tax reform that unambiguously increases trade through market access, even though such a rise in trade is lower than the one that would be associated with only tariffs reform. [Fujiwara \(2013\)](#) has investigated theoretically, under imperfect competition (in particular decreasing marginal costs), the effect of the point-by-point policy reform on market access (among other outcomes). The author has obtained that, in contrast, with the findings of [Kreickemeier and Raimondos-Møller \(2008\)](#)—which are based on perfect competition—the point-by-point policy reform improves market access in a competitive small open economy, even though it is not easy to implement. On the empirical side, [Gnangnon \(2019a\)](#) has used an indicator of tax reform, in the spirit of the proposed reform by the IMF and the World Bank, which captures the convergence of a developing country's tax structure towards the tax structure of developed countries [see also [Gnangnon and Brun \(2019a,b,c,d\)](#) who have used the same indicator in their analyses]. The rationale for this indicator is that in contrast with developing countries, the structure of tax revenue in developed countries is heavily dependent on domestic tax revenue, with international trade tax revenue representing a minuscule share of total tax revenue. [Gnangnon \(2019a\)](#) has obtained empirically that tax reform has led to greater trade openness in developing countries, with LDCs benefiting from a higher positive trade openness effect of this reform than non-LDCs do. The effects of tax reform on trade openness would operate through the public revenue channel, and eventually through the trade policy channel (see [Gnangnon and Brun 2019b](#)): higher public revenue in countries that have undertaken tax reform would help promote international trade not only (as noted

4 Nonetheless, [Munk \(2008\)](#) has shown that this theorem might not be valid under when taxation is associated with administrative costs. Similarly, [Stiglitz \(2003\)](#) has criticized the recommendation to developing countries by the IMF and the World Bank to replace border taxes with the value-added tax.

above) through a more efficient allocation of resources in the production sector, but also through investment in factors that contribute to enhancing international trade flows, notably infrastructure, human capital and institutional quality. Furthermore, countries engaging in tax reform and enjoy higher public revenue would be less reluctant to implement trade policy liberalization, even though the latter erodes international trade tax revenue. This is because by reducing their production costs, notably the costs of imported intermediate inputs used in their production process, greater trade policy liberalization could be associated with higher value addition to production, which itself generates higher domestic tax revenue (e.g., [Khattry and Rao 2002](#); [Baunsgaard and Keen 2010](#); [Crivelli 2016](#)).

Against this background, we argue that the tax reform that involves lower trade tax revenue and higher domestic tax revenue in the public revenue structure (including in the context of declining tariffs, and hence greater trade policy liberalization/greater trade openness) would generate less production distortions and promote a better efficiency in resources allocation in the production sector. In turn, this could enhance export product specialization in the country's sector of comparative advantage or induce greater export product diversification.<sup>5</sup> Furthermore, by enhancing market access, notably trade openness, tax reform could affect positively or negatively export product diversification. As a matter of fact, the effect of trade openness (or trade policy liberalization, which is a policy that affects the degree of trade openness) on export product diversification is theoretically ambiguous (e.g., [Cadot et al. 2013](#)). While recent theoretical international trade models have indicated that trade liberalization can promote export product diversification, traditional models have suggested that trade liberalization promotes export product concentration (or specialization) through the efficient reallocation of factors such as employment, capital and resources across sectors, including in line with a country's comparative advantage. [Aditya and Acharyya \(2015\)](#) have used a synthesis framework of analytical structures of [Dornbusch et al. \(1977\)](#) and [Krugman \(1979\)](#) to establish, *inter alia*, that unilateral tariff reduction may make the liberalizing country's exports diversified both across and within sectors. According to [Teignier \(2018\)](#), changes in productivity and lower trade barriers induce a sectoral reallocation, economic growth and transformation. [Dessy et al. \(2010\)](#) have relied on a general equilibrium framework to show that trade can promote diversification and transformation in developing countries. Greater trade openness could also help expand the market and hence promote export product diversification (e.g., [Krugman and Venables 1990](#); [Dennis and Shepherd 2011](#)). Trade openness is associated with higher imports of goods, which in turn, generates positive spill-overs in the local economy through the knowledge and technology embodied in these goods (e.g., [Grossman and Helpman 1991](#); [Coe and Helpman 1995](#); [Barro and Sala-i-Martin 1997](#); [Baldwin et al. 2005](#)). This could encourage investment in new products and activities, and hence promote export product diversification. Goods imports, in particular, import of new varieties could contribute to enhancing the development of new domestic varieties ([Romer 1994](#); [Goldberg et al. 2010](#); [Puga and Trefler 2010](#); [Bas and Strauss-Kahn 2015](#); see [Amighini and Sanfilippo \(2014\)](#) for a literature review on the effects of imports of goods on export upgrading, including export

5 Even though tax reform could affect export product diversification or specialization through the resource allocation channel, the present article does not intend to explicitly test this channel. Rather, it tests the effect of tax reform on export product diversification through the trade openness channel, although the latter can also be potentially affected by an efficient resource allocation.

product diversification) and induce the exportation of a wide range of products. According to Agosin et al. (2012), trade reforms can enhance export specialization or concentration by increasing the profitability of traditional (commodities) sectors in countries dependent on exports of primary commodities. These ambiguous theoretical effects of trade openness (or trade liberalization) on export product diversification have led researchers (e.g., Osakwe et al. 2018) to conclude that this issue is ultimately an empirical question. In this context, tax reform would be associated with greater export product diversification if its induced trade openness results in greater export product diversification, and tax reform would be associated with export product specialization if its positive effect on trade openness leads the country to further specialize on activities in its sectors of comparative advantage.

### 3. Model Specification

Many studies have examined the macroeconomic determinants of export product diversification (e.g., Imbs and Wacziarg 2003; Hausmann et al. 2007; Agosin et al. 2012; Harding and Javorcik 2012; Parteka and Tamberi 2013; Zhu and Fu 2013; Amighini and Sanfilippo 2014; Aditya and Acharyya 2015; Ali 2017; Gnanon and Roberts 2017; Bahar and Santos 2018; Osakwe et al. 2018; Gnanon 2019b,c; Vardanyan 2019; Bos et al. 2020). In the absence of a theoretical framework on the relationship between tax reform and export product diversification, we adopt a pragmatic approach to estimate empirically the effect of tax reform on export product diversification in developing countries. Specifically, we draw from these studies, we postulate a model where in addition to the key variable of interest, namely ‘TAXREF’, we have added the following control variables: the real per capita income (denoted ‘GDPC’), which acts as a proxy for the development level; the educational attainment (‘EDU’), which acts as a proxy for human capital accumulation; the depth of domestic financial development (denoted ‘FINDEV’); the real effective exchange rate (denoted ‘REER’); the share of total natural resource rents in percentage of Gross Domestic Product (GDP) (denoted ‘RENT’), which is a proxy for country’s factor endowment, and the population size (denoted ‘POP’) to reflect the country’s size. All these variables have been described in Table A1.

We postulate the following model:

$$ECI_{it} = \alpha_0 + \alpha_1 ECI_{it-1} + \alpha_2 TAXREF_{it} + \alpha_3 GDPC_{it} + \alpha_4 GDPC_{it}^2 + \alpha_5 FINDEV_{it} + \alpha_6 EDU_{it} + \alpha_7 RENT_{it} + \alpha_8 REER_{it} + \alpha_9 TERMS_{it} + \alpha_{10} POP_{it} + \mu_i + \gamma_t + \omega_{it} \quad (1)$$

The dependent variable ‘ECI’ is the Theil index of overall export product concentration computed by the IMF, using the definitions and methods employed by Cadot et al. (2011) (see details on the computation of this index in Table A1). Higher values of this index reflect greater export product concentration, while declining values of this index indicate higher degree of export product diversification, i.e., exports are more homogeneously distributed among a series of products. The analysis uses an unbalanced panel dataset of 112 countries over the period 1980–2014, based on the availability of data on the variables of model (1). Following the literature, we have used non-overlapping sub-periods of 5-year average data (1980–1984; 1985–1989; 1990–1994; 1995–1999; 2000–2004; 2005–2009; and 2010–2014) to smooth out the effect of business cycles on variables. The construction

of the dataset has been dictated by data availability. The subscript  $i$  in model (1) refers to a given country, while the subscript  $t$  stands for each of the aforementioned seven time-periods.  $\alpha_0$  to  $\alpha_{10}$  are parameters to be estimated.  $\mu_i$  is countries' fixed effects;  $\gamma_t$  is time dummies, which represent global shocks that affect simultaneously all countries' export product diversification path.  $\omega_{it}$  is a well-behaving error term.

As noted above, the computation of the key regressor of interest ('TAXREF') is drawn from Gngnon (2019, 2020) and Gngnon and Brun (2019a,b,c). Therefore, tax reform reflects the convergence of the tax structure of a given developing country towards developed countries' tax structure, and the indicator of tax reform has been computed using the semi-metric Bray-Curtis dissimilarity index (Bray and Curtis 1957) as follows:  $TAXREF_{it} = (1 - d_{it})$  (2) with

$$d_{it} = \frac{\text{DIRTAX}_{it} - \text{DIRTAXAve}_t + \text{INDIRTAX}_{it} - \text{INDIRTAXAve}_t + \text{TRTAX}_{it} - \text{TRTAXAve}_t}{[(\text{DIRTAX}_{it} + \text{DIRTAXAve}_t) + (\text{INDIRTAX}_{it} + \text{INDIRTAXAve}_t) + (\text{TRTAX}_{it} + \text{TRTAXAve}_t)]} \quad (3)$$

where  $d_{it}$  represents the dissimilarity index between a given developing country's tax structure (for a given year) and the tax structure of developed countries.  $TAXREF_{it}$  represents the indicator of tax reform for a given developing country in a given year. The tax revenue variables used in formula (2) do not include natural resource revenue (for further details, see Gngnon 2019a, 2020; Gngnon and Brun 2019a,b,c). These tax revenue variables, i.e., DIRTAX, INDIRTAX and TRTAX stand, respectively, for the direct tax revenue ratio, the indirect tax revenue ratio and the trade tax revenue ratio for a given developing country in a year  $t$ . For developed countries, DIRTAXAve, INDIRTAXAve and TRTAXAve are the average (over all developed countries, in a given year), respectively, of the direct tax revenue ratio; the indirect tax revenue ratio; and the trade tax revenue ratio. Values of  $TAXREF_{it}$  range between 0 and 1, with a rise in these values reflecting greater convergence of tax structure, i.e., a greater extent of tax reform. Lower values of this index show a lower extent of tax reform, that is, a divergence between the tax structure of developing countries and the tax structure of developed countries.<sup>6</sup>

All variables in model (1) have been standardized before running the regressions so as to avoid encountering concerns about units of measurement of variables, when comparing estimates arising from regressions. Each variable has been standardized by computing the ratio of the difference between the concerned variable and its mean (average), to the standard deviation of this variable. The standardized coefficients obtained from regressions allow identifying the variables that contribute the most to export product diversification, and in particular, help assess how the tax reform indicator is ranked among regressors in terms of its contribution to explaining export product diversification. It is important to note that the regressions based on the standardized variables do not contain time dummies, as the standardized values of the latter amount to zero. Table A2a presents descriptive

6 The list of developed countries (qualified here as 'Old Industrialized countries') used to calculate the index of convergence in tax structure index for developing countries in the analysis includes: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden Switzerland, UK and the USA.



statistics on unstandardized variables used in model (1), while [Table A2b](#) shows descriptive statistics on standardized variables used in the model. In [Table A3](#), we report the list of countries used in the analysis. At this stage of the analysis, we would like to mention that an institutional quality variable [in particular the degree of democratization, i.e., 'POLITY2' developed by [Marshall et al. \(2018\)](#)] has been introduced in model (1). However, it appeared that it (i.e., in the standardized form) does not affect significantly export product diversification in the present model setting, but its introduction in the model significantly reduces the size of the sample. Therefore, we decide to remove it from the analysis, although results associated with the inclusion of this variable in the regressions could be obtained upon request.

As for the effects of control variables, we expect the real per capita income (a proxy for the development level) to be non-linearly associated with export product diversification (e.g., [Imbs and Wacziarg 2003](#); [Klinger and Lederman 2011](#), [Cadot et al. 2011](#); [Parteka and Tamberi 2013](#)), whereby at their earlier stages of development, countries tend to diversify their export product basket and increase export product specialization as they further develop. For this reason, we have included in model (1) both the real per capita income and its squared term. The development of domestic financial markets could lead countries to specialize in financially intensive goods and services (e.g., [Kletzer and Bardhan 1987](#); [Rajan and Zingales 1998](#); [Manova 2013](#)), which could promote export product diversification ([Agosin et al. 2012](#)). Nevertheless, [Agosin et al. \(2012\)](#) have argued that the financing of activities in which the economy has already a comparative advantage would lead financial development to be associated with greater export product concentration.

Improvements in terms of trade (measured as the ratio of export prices to import prices) in developing countries usually reflect a rise in commodity prices, which could lock countries into the trap of promoting exports of unprocessed raw materials or of low-value-added products (see also [Vardanyan 2019](#)). In this scenario, terms of trade improvements would be associated with export product concentration. On the other hand, the export revenue associated with terms of trade improvements could be used to increase investments in the goods sector, including for developing new activities and products in this sector. This could result in a greater export product diversification. All in all, it is difficult to predict, at this stage of the analysis, the direction in which terms of trade improvement could affect export product diversification.

Concerning the expected effect of the real exchange rate on export product diversification, it has usually been argued that a competitive real exchange rate is key for promoting production and export diversification (e.g. [Sekkat and Varoudakis 2000](#); [Rodrik 2008, 2009](#); [Nouira et al. 2011](#); [Freund and Pierola 2012](#); [Sekkat 2016](#); [Guzman et al. 2018](#)). We expect an appreciation of the real exchange rate to be associated with a higher degree of export product concentration, while a depreciation of the real exchange rate would lead to greater export product diversification. The effect of human capital accumulation on export product diversification depends on whether the educated workforce arising from the improvement in human capital accumulation is employed in the sectors in which the country has a comparative advantage—in which case it would result in greater export product concentration—or whether this workforce is utilized to produce and export a wide variety of goods, in which case, it would be associated with export product diversification (e.g., [Agosin et al. 2012](#)). Incidentally, we expect a rise in the share of total natural resource rents in GDP to be positively associated with export product specialization. On another note,



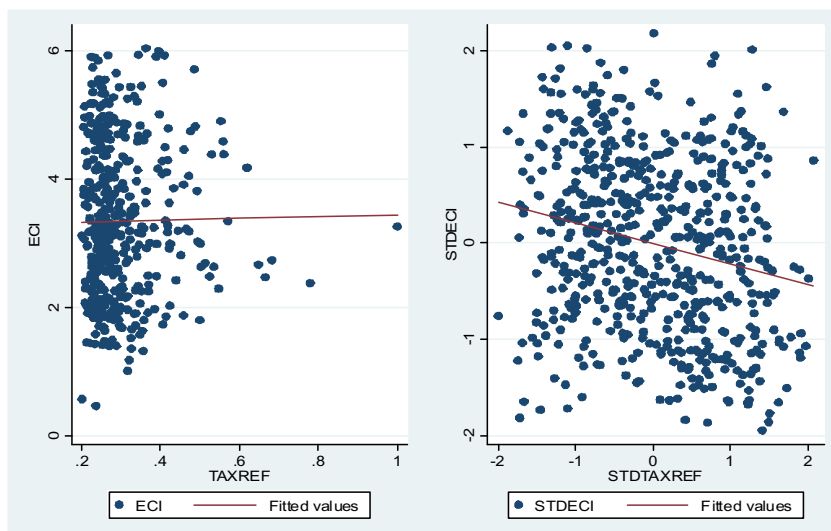
greater export product diversification could arise from an increase in the population size that could induce a higher demand and production of a wider variety of products (e.g., Ali 2017).

#### 4. Data Analysis

Using the dataset over non-overlapping periods, we present in Figure 1 the correlation pattern between 'ECI' and 'TAXREF' based on unstandardized (i.e., normal) variables (see the left-hand side graph), and the correlation pattern between 'ECI' and 'TAXREF' using standardized variables (see the right-hand side graph). While the left-hand side graph does not show a clear-cut correlation pattern between these two variables, the right-hand side graph indicates that tax reform is negatively correlated with export product concentration, i.e., it is positively correlated with export product diversification.

We also present in Figures 2 and 3, the developments of these two indicators, respectively, over the full sample, and the sub-samples of LDCs and non-LDCs.

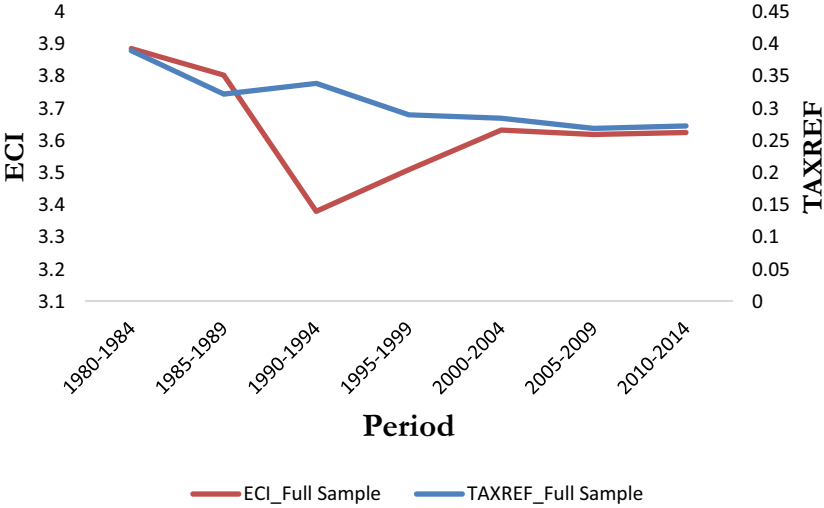
Over the full sample, the indicator of export product concentration has declined from 3.9 in 1980–1984 to 3.4 in 1990–1994 (thereby reflecting a tendency for greater export product diversification), and then rebounded to reach 3.63 in 2000–2004 (this reflects a tendency for export product specialization). From 2000–2004 to 2010–2014, the degree of export product concentration (diversification) has remained relatively stable. In contrast with the fluctuations in the development of the indicator of export product concentration, the index of tax reform has steadily declined from 0.39 in 1980–1984 to 0.34 in 1990–1994 and has then remained relatively stable around 0.28 over the rest of the period.



**Figure 1.** Correlation pattern between tax reform and export product concentration.

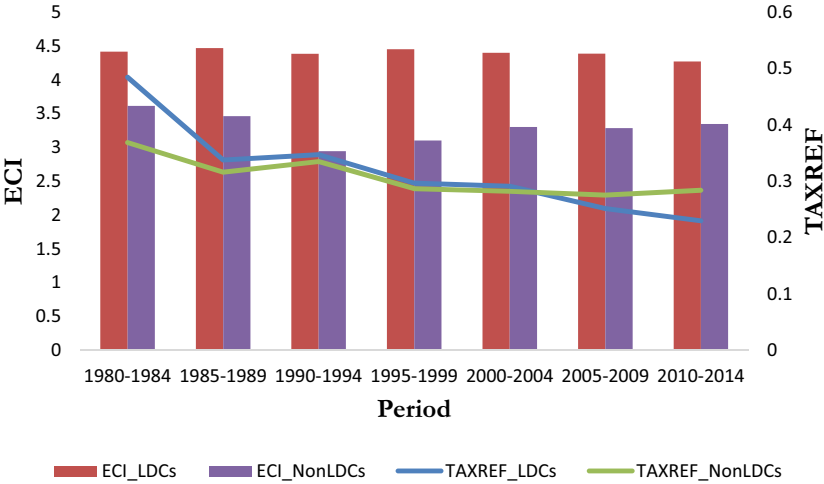
Source: Author.

*Notes:* The variables 'ECI' and 'TAXREF' represent the unstandardized measures, respectively, of export product concentration and tax reform, while the variables 'STDECI' and 'STD TAXREF' are the standardized measures, respectively, of export product concentration and tax reform.



**Figure 2.** Development of tax reform and export product concentration over the full sample.

Source: Author.



**Figure 3.** Development of tax reform and export product concentration over the sub-samples of LDCs and non-LDCs.

Source: Author.

The pattern concerning the development of the index of export product concentration for the full sample is also observed for non-LDCs. However, values of the index of export product concentration in LDCs have not changed significantly over the entire period, with the average value being 4.4 over the full period. At the same time, the index of tax reform has shown a downward trend for both LDCs and non-LDCs: even though at the start of the period (1980–1984), it amounted to 0.37 in non-LDCs against 0.48 in LDCs (i.e., the

extent of tax reform was higher in LDCs than in non-LDCs), it has steadily declined in both sub-samples, and at the end of the period (2010–2014), this tendency has progressively reversed, and at the end of the period (i.e., in 2010–2014), the level of tax reform was higher in non-LDCs (the value of the TAXREF index amounts to 0.28) than in LDCs (the value of the TAXREF index amounts to 0.23).

## 5. Econometric Strategy

Following a number of previous studies on the determinants of export product diversification, including in developing countries (e.g., Agosin et al. 2012; Zhu and Fu 2013; Amighini and Sanfilippo 2014; Ali 2017; Gnanon and Roberts 2017; Osakwe et al. 2018; Gnanon 2019b,c; Vardanyan 2019), we employ the two-step system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998) to estimate model (1). The two-step system GMM approach is employed to estimate a system of equations in level and in differences, where lagged values are used as instruments for the first-differenced regressors, and first-differences as instruments for the equation levels. This estimator is appropriate for dynamic panel models (including with the lag of the dependent variable as regressor) with small time dimension and large cross-section, and where series exhibit a strong persistence over time, which is the case in the current analysis. This estimator has the advantage of addressing the endogeneity bias (Nickell bias—Nickell 1981) induced by the correlation between the one-period lag of the dependent variable and countries' specific effects in the regression based on the within fixed effects estimator, and the endogeneity concern that could arise from the bi-directional causality between a number of regressors and the export product concentration variable. These regressors include variables 'TAXREF', 'FINDEV', 'REER', 'EDU' and 'RENT'. For example, countries that endeavour to diversify their export product basket might be willing to enhance the tax reform process so as to reap the tax reform's benefits in terms of public revenue, notably thanks to a greater performance of exporting firms (higher corporate income, eventually higher firms employees' wages and their domestic consumption and imports). Similarly, countries with export product diversification could influence financial development (e.g., Gnanon 2019d) and real exchange rate (e.g., Tran 2017). Countries that aim to diversify their export product basket could develop educational policies to further accumulate human capital. Finally, by diversifying their export product basket, countries could reduce reliance on natural resources for promoting economic development and expanding the opportunities of economic growth and development. Therefore, the regressions have considered as endogenous the variables 'TAXREF', 'FINDEV', 'REER', 'EDU' and 'RENT'. Three diagnostic tests have been used to assess the validity of the two-step system GMM estimator. These include the Arellano-Bond (AB) test of presence of first-order serial correlation in the error term (denoted AR(1)) and no second-order autocorrelation in the residuals (denoted AR(2)), and the Sargan/Hansen test of over-identifying restrictions (OID). Failure to reject the null hypotheses of these tests would give support to the validity of the two-step system GMM estimator. Incidentally, the GMM approach allows researchers to have some freedom in specifying the lag structure for the instruments, that is, in using the second (or third) lag of the instrumented variables up to the  $n$ th lag ( $n \geq 2$ ). At the same time, we need to make sure that the number of instruments should be lower than the number of countries,

otherwise estimations’ results would be biased towards outcomes based on the ordinary least squares estimations (Roodman 2009), and the diagnostic tests may lose power (e.g., Ziliak 1997; Bowsher 2002; Roodman 2009). To meet this rule, we have used three lags of the dependent variable as instruments and three lags of endogenous variables as instruments in the regressions. In addition, the Windmeijer (2005) technique has been applied to correct standard errors of estimates, in light of the small size nature of our sample.

Even though the two-step system GMM estimator is our main estimator in the analysis, we also present the estimations’ outcomes related to the estimation of model (1) without the one-period lag of the dependent variable as a regressor, using the within fixed effect estimator (denoted ‘FE’) and the cross-section weighted feasible generalized least squares (FGLS) estimator of Zellner (1962) (where standard errors have been corrected, *inter alia*, for the presence of autocorrelation and heteroscedasticity in the dataset). These estimators

Table 1. Effect of tax reform on export product diversification

Estimators: FE and FGLS		
Variables	FE ECI	FGLS with panel-specific AR(1) ECI
	(1)	(2)
TAXREF	−0.156*** (0.0117)	−0.157*** (0.0129)
GDPC	−0.00550 (0.0264)	0.0238* (0.0129)
GDPC <sup>2</sup>	0.0384 (0.0409)	0.000836 (0.0234)
FINDEV	−0.175*** (0.0374)	−0.177*** (0.0111)
EDU	0.0282* (0.0146)	0.0256* (0.0149)
RENT	0.178*** (0.0185)	0.185*** (0.0120)
REER	0.172*** (0.0394)	0.176*** (0.0143)
TERMS	0.0208 (0.0371)	0.0395*** (0.0126)
POP	−0.0783 (0.0512)	−0.0977*** (0.0145)
Constant	0.0127 (0.0361)	0.0396** (0.0159)
Observations—Countries	483—112	480—109
Within R-squared	0.1408	
Pseudo R-squared		0.3587

Notes: \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. For the random effects estimator, standard errors are clustered at the country level. The Pseudo R<sup>2</sup> has been computed for the regression based on the FGLS estimator as the correlation coefficient between the dependent variable and its predicted values. The regressions have used standardized variables.

**Table 2.** Effect of tax reform on export product diversification

Estimators: FE and FGLS

Variables	ECI	ECI
	(1)	(2)
ECI <sub>t-1</sub>	0.537*** (0.0230)	0.570*** (0.0328)
TAXREF	-0.209*** (0.0338)	-0.149*** (0.0528)
TAXREF*LDC		-0.421*** (0.0957)
LDC		-0.279*** (0.0724)
GDPG	-0.0880** (0.0411)	-0.103* (0.0584)
GDPG <sup>2</sup>	0.0649** (0.0330)	0.179*** (0.0401)
FINDEV	-0.156*** (0.0428)	-0.150*** (0.0523)
EDU	0.209*** (0.0402)	0.273*** (0.0399)
RENT	0.117*** (0.0256)	0.121*** (0.0437)
REER	0.0996** (0.0395)	0.0444 (0.0482)
TERMS	0.128*** (0.0334)	0.0525 (0.0356)
POP	0.0740* (0.0413)	0.0958* (0.0525)
Constant	-0.0862*** (0.0280)	-0.136*** (0.0398)
Observations—Countries	452—112	452—112
Number of instruments	89	82
AR1 ( <i>p</i> -value)	0.0001	0.0001
AR2 ( <i>p</i> -value)	0.3145	0.2298
AR3 ( <i>p</i> -value)	0.9890	0.8370
OID ( <i>p</i> -value)	0.2862	0.2384

Notes: \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. All variables used in the regressions have been standardized. The variables 'TAXREF', 'FINDEV', 'REER', 'EDU', 'RENT' and the interaction variable have been considered as endogenous. The regressions have used a maximum of three lags of the dependent variable as instruments, and three lags of endogenous variables as instruments.

have the limits of not allowing to address the endogeneity concerns highlighted above. The outcome of the estimations based on these two estimators is provided in Table 1.

Concerning the estimations based on the two-step system GMM approach, the analysis is conducted as follows. Column [1] of Table 2 presents the outcome of the estimation of model (1). Column [2] of the same Table contains results of the estimation of model (1) that allow examining the net effect of tax reform on export product diversification in LDCs and non-LDCs (that is countries not classified as LDCs in the full sample)—the list of

LDCs<sup>7</sup> contained in the full sample is displayed in Table A3. To perform this analysis, we estimate a variant of model (1) that includes both a dummy capturing LDCs (and denoted 'LDC') as well as its interaction with the variable 'TAXREF'. The 'LDC' dummy takes the value '1' when a country is considered as an LDC, and '0', otherwise.

In Table 3, we present the estimations' outcomes that allow assessing the extent to which the effect of tax reform on export product diversification depends on the degree of trade openness, i.e., how the effect of tax reform on export product diversification passes through the trade openness channel. To that end, we use three different indicators of trade openness. The first one is the standard measure of de facto trade openness, i.e., the sum of exports and imports, in percentage of GDP (denoted 'OPEN'). The second measure is the de facto indicator of trade openness proposed by Squalli and Wilson (2011), and denoted 'OPENSW'. It has been calculated as the standard measure of trade openness (i.e., 'OPEN') adjusted by the proportion of a country's trade level relative to the average world trade (see Squalli and Wilson, 2011, p. 1758). The third measure is a de jure measure of trade openness (denoted 'TRJURE'), which is in fact one component of the KOF Globalization index developed by Dreher (2006): this de Jure measure of trade openness is computed as the average of two subcomponents, namely the prevalence of non-tariff barriers, and compliance costs of importing and exporting. Therefore, we estimate three variants of model (1) that include, respectively, each indicator of trade openness along with its interaction with the 'TAXREF' variable. Results are reported with only the trade openness variables on the one hand, and with the inclusion of both the trade openness variable and the interaction variable in the model specification, on the other hand. It is important to underline that in each model specification, both the trade openness variable and the interaction variable have been considered as endogenous.

## 6. Empirical Results

The estimation's outcomes displayed in Table 1 show negative and significant (at the 1% level) coefficients of 'TAXREF' with similar magnitudes (amounting to—0.16) in Columns [1] and [2]. These suggest that tax reform is negatively and significantly associated with export product concentration, i.e., it is positively associated with export product diversification. The estimates of control variables across the two columns indicate the absence of a non-linear effect of real per capita income on export product concentration. At the same time, we note across the two columns that at the 5% level, a higher depth of financial development, and a real exchange rate depreciation, and lower dependence on natural resources are positively associated with export product diversification. Meanwhile, as per results in Column [2], a higher population size is associated with export product diversification, while in Column [1], the coefficient associated with this variable is not statistically significant at the conventional levels.

7 LDCs are considered and designated as such by the United Nations as the poorest and most vulnerable countries in the world to economic and environmental shocks. Criteria used to select LDCs include: Income, human assets index (a composite index of nutrition, health, and education), and an economic vulnerability index (a composite index of population size; remoteness; merchandise export concentration; share of agriculture, forestry and fisheries; share of population in low elevated coastal zones; instability of exports of goods and services; victims of natural disasters; and instability of agricultural production). For further information on the LDC category, see online at: <http://unohrrls.org/>

**Table 3.** Effect of tax reform on export product diversification through the trade openness channel

Estimator: Two-Step System GMM						
Variables	ECI	ECI	ECI	ECI	ECI	ECI
	(1)	(2)	(3)	(4)	(5)	(6)
ECI <sub>t-1</sub>	0.585*** (0.0349)	0.561*** (0.0278)	0.485*** (0.0318)	0.509*** (0.0240)	0.635*** (0.0300)	0.619*** (0.0213)
TAXREF	-0.115** (0.0488)	-0.0980** (0.0389)	-0.206*** (0.0538)	-0.194*** (0.0440)	-0.182*** (0.0394)	0.0198 (0.0423)
OPEN	0.405*** (0.0511)	0.289*** (0.0390)				
TAXREF*OPEN		-0.140*** (0.0454)				
OPENSW			0.407*** (0.0439)	0.416*** (0.0321)		
TAXREF*OPENSW				-0.210*** (0.0473)		
TRJURE					0.208*** (0.0373)	0.148*** (0.0397)
TAXREF* TRJURE						-0.303*** (0.0504)
GDPC	-0.272*** (0.0469)	-0.210*** (0.0322)	-0.337*** (0.0508)	-0.341*** (0.0387)	-0.255*** (0.0585)	-0.306*** (0.0380)
GDPC <sup>2</sup>	0.135*** (0.0316)	0.119*** (0.0201)	0.113*** (0.0335)	0.172*** (0.0345)	0.163*** (0.0398)	0.254*** (0.0402)
FINDEV	-0.185*** (0.0421)	-0.172*** (0.0363)	-0.184*** (0.0467)	-0.163*** (0.0390)	-0.144*** (0.0372)	-0.144*** (0.0379)
EDU	0.143*** (0.0309)	0.164*** (0.0236)	0.217*** (0.0355)	0.176*** (0.0279)	0.193*** (0.0366)	0.209*** (0.0223)
RENT	0.00107 (0.0436)	0.0420 (0.0342)	0.0738* (0.0414)	0.0798** (0.0323)	0.0968** (0.0458)	0.152*** (0.0305)
REER	0.331*** (0.0499)	0.284*** (0.0429)	0.173*** (0.0433)	0.162*** (0.0344)	0.0661 (0.0466)	0.0468 (0.0487)
TERMS	-0.0116 (0.0418)	0.0267 (0.0365)	-0.0246 (0.0392)	-0.00687 (0.0310)	0.114*** (0.0294)	0.147*** (0.0279)
POP	-0.0240 (0.0554)	0.00290 (0.0399)	0.0728 (0.0609)	0.0406 (0.0518)	0.0429 (0.0389)	-0.0355 (0.0449)
Constant	-0.120*** (0.0349)	-0.0811*** (0.0229)	-0.0997*** (0.0355)	-0.0831*** (0.0293)	-0.189*** (0.0343)	-0.165*** (0.0306)
Observations—Countries	431—108	431—108	431—108	431—108	442—109	442—109
Number of instruments	82	92	82	92	82	92
AR1 ( <i>p</i> -value)	0.0001	0.0001	0.0003	0.0002	0.0001	0.0001
AR2 ( <i>p</i> -value)	0.5468	0.7421	0.4528	0.5601	0.11	0.10
AR3 ( <i>p</i> -value)	0.4807	0.6108	0.5960	0.4774	0.9088	0.8362
OID ( <i>p</i> -value)	0.2906	0.4565	0.1315	0.2966	0.2291	0.2818

Notes: \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. All variables used in the regressions have been standardized. The variables ‘TAXREF’, ‘FINDEV’, ‘REER’, ‘EDU’, ‘RENT’, ‘OPEN’, ‘OPENSW’, ‘TRJURE’ and the interaction variable have been considered as endogenous. The regressions have used a maximum of three lags of the dependent variable as instruments, and three lags of endogenous variables as instruments.



Turning now to results in [Tables 2](#) and [3](#), we note that the results of the diagnostic tests (see the bottom of [Tables 2](#) and [3](#)) that allow assessing the consistency of the two-step GMM estimator confirm the appropriateness of this estimator for undertaking the empirical exercise. As a matter of fact, we observe across all columns of these tables that the estimates associated with the one-period lag of the dependent variable are always positive and statistically significant at the 1% level. These confirm the persistence of export product concentration over time and highlight the need for considering a dynamic specification of model (1) in the analysis. Additionally, across all columns of these tables, the  $p$ -values of the statistic related to the OID test are higher than 0.10, and the number of instruments is consistently lower than the number of countries.

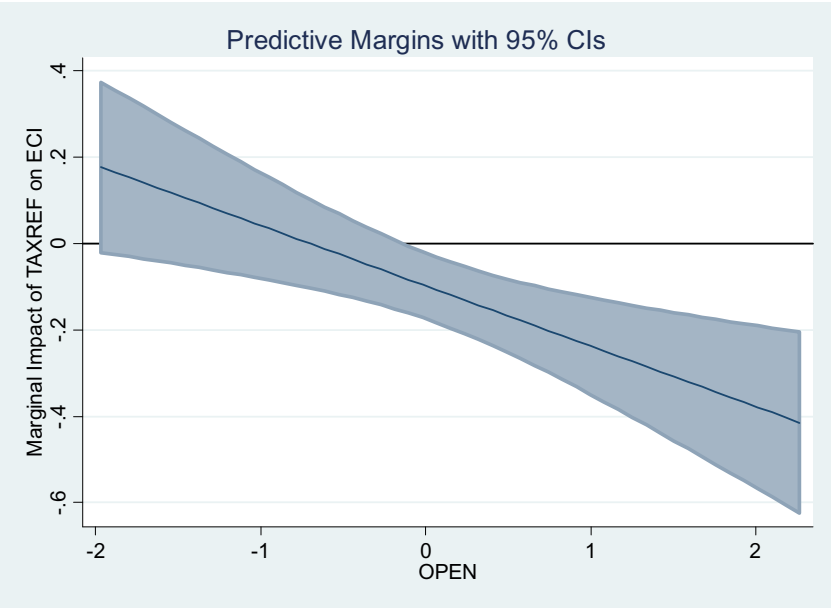
Considering now the estimates in [Table 2](#), we obtain in Column [1] that tax reform exerts a negative and significant (at the 1% level) effect on export product concentration, with the magnitude of the coefficient amounting to  $-0.21$ , which is slightly different from the estimates obtained in [Table 1](#) (i.e.,  $-0.16$  for the regression based on the FE and FGLS approaches). Thus, an increase in the index of tax reform by a 1 standard deviation induces a 0.21 standard deviation decrease in the index of export product concentration. Likewise, in Column [2] of [Table 2](#), the estimate of the variable 'TAXREF' is negative and significant at the 1% level, and the interaction term related to the interaction variable [TAXREF\*LDC] is also negative and significant at the 1% level. The negative and significant interaction term suggests that tax reform exerts a higher positive effect on export product diversification in LDCs than in non-LDCs. Moreover, the net effects of tax reform on export product concentration in LDCs and non-LDCs amount, respectively, to  $-0.57$  ( $= -0.149 - 0.421$ ) and  $-0.149$ . Thus, in both LDCs and non-LDCs, tax reform exerts a positive effect on export product diversification: a 1 standard deviation increase in the index of tax reform leads to a 0.57 standard deviation decrease in the index of export product concentration in LDCs, and a 0.15 standard deviation decrease in the index of export product concentration in non-LDCs. Results associated with control variables are broadly similar across the two columns of [Table 2](#). Focusing on results in Column [1] of [Table 2](#), we note that all variables (except for the population size) exhibit a significant coefficient at least at the 5% level. Specifically, we obtain as expected, the existence of a non-linear effect of the real per capita income on export product concentration, whereby for lower levels of real per capita income, countries tend to diversify their export product baskets, but as their development level increases, they tend to enhance their export product specialization. Export product diversification also appears to be driven by the development of domestic financial markets, the real exchange rate depreciation and a lower dependence on natural resources. However, a higher education level is positively and significantly associated with export product concentration, thereby suggesting the resulting educated workforce is employed in activities in which countries enjoy a comparative advantage. Finally, the rise in the population size induces a greater export product concentration, but this effect is significant only at the 10% level. As noted in Section 3, the standardization procedure does not only help address unit of measurements problems of variables, but it also allows to compare and rank regressors in terms of their contribution to explaining export product concentration. Specifically, we obtain that among all control variables, the variable 'TAXREF' and 'EDU' exhibit the highest same coefficient, followed in the descending order by the financial development variable, the terms of trade variable, the natural resource rents variable, the real exchange rate variable, the real per capita income variables and the variable capturing the population size. These outcomes are interesting as they highlight the leading role played by

tax reform compared to many other variables in explaining export product diversification in developing countries.

Now, considering results in Table 3, we find from Columns [1], [3] and [5] that trade openness measured by the indicators 'OPEN', 'OPENSW' and 'TRJURE' hold a positive and statistically significant coefficient at the 1% level. These show that greater trade openness enhance countries' export product specialization. Similarly, the coefficient of the tax reform variable is negative and statistically significant at least at the 5% level in Columns [1] to [5], whereas in Column [6], it is not statistically significant at the 10%. At the same time, results in Columns [2], [4] and [6] indicate that the interaction terms associated, respectively, with the interaction variables ['TAXREF\*OPEN'], ['TAXREF\*OPENSW'] and ['TAXREF\*TRJURE'] are all negative and significant at the 1% level. If we combine the outcomes related to these interaction variables with the estimates of 'TAXREF' in Columns [2], [4] and [6], we can conclude that irrespective of the degree of trade openness (and the measure of trade openness), tax reform always induces greater export product diversification. Additionally, the magnitude of the positive impact of tax reform on export product diversification increases as the degree of trade openness rises. Results of control variables across the six columns of Table 3 are in line with those in Table 2.

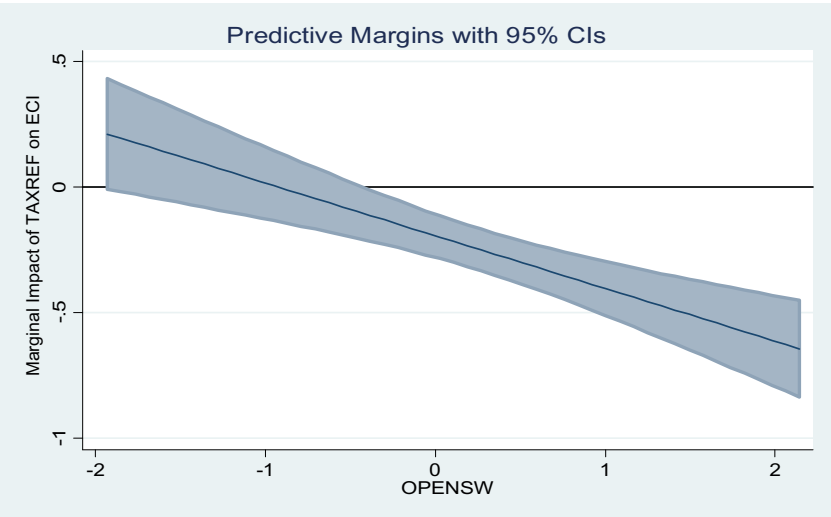
Given that results in Table 3 concerning the effect of tax reform on export product diversification for varying levels of trade openness represent averages across the full sample, they may hide different effects of tax reform on export product diversification across countries in the full sample, both in terms of magnitude of the effect, and also in terms of the sign and the statistical significance of the effects. Therefore, we find useful to examine graphically—using our different measures of trade openness—how tax reform affects export product diversification for different degrees of trade openness. In particular, we display in Figure 4, at the 95% confidence intervals, how the marginal impact of tax reform on export product concentration evolves for varying countries' levels of trade openness (measured by the variable 'OPEN'). The statistically significant marginal impacts at the 95% confidence intervals are those encompassing only the upper and lower bounds of the confidence interval that are either above or below the zero line in Figure 4. The marginal impact of tax reform on export product concentration decreases as the level of trade openness rises, and takes positive and negative values. However, only positive values of this marginal impact are statistically significant. Specifically, for standardized values of trade openness lower than  $-0.1882$  (this is equivalent to an unstandardized value of trade openness amounting to 67.5% [=  $37.868 \cdot (-0.1882) + 74.639$ ]), tax reform does not significantly affect export product diversification. However, for levels of trade openness higher than 67.5%, tax reform is positively and significantly associated with export product diversification, and the greater the degree of trade openness, the higher is the magnitude of the positive effect of tax reform on export product diversification. Note that the standardized value ' $-0.1882$ ' of trade openness is extracted from the Stata software when generating Figure 4.

Figure 5 presents at the 95% confidence intervals, the development of the marginal impact of tax reform on export product concentration evolves for varying countries' levels of trade openness (measured by the variable 'OPENSW'). The pattern observed in this figure is quite similar to the one contained in Figure 4. In particular, the marginal impact of tax reform on export product concentration decreases as the level of trade openness rises, and takes positive and negative values. However, it is statistically significant only for positive values of this marginal. Here, tax reform does not significantly affect export product



**Figure 4.** Marginal impact of ‘TAXREF’ on ‘ECI’, for varying levels of trade openness (‘OPEN’).

Source: Author.



**Figure 5.** Marginal impact of ‘TAXREF’ on ‘ECI’, for varying levels of trade openness (‘OPNSW’).

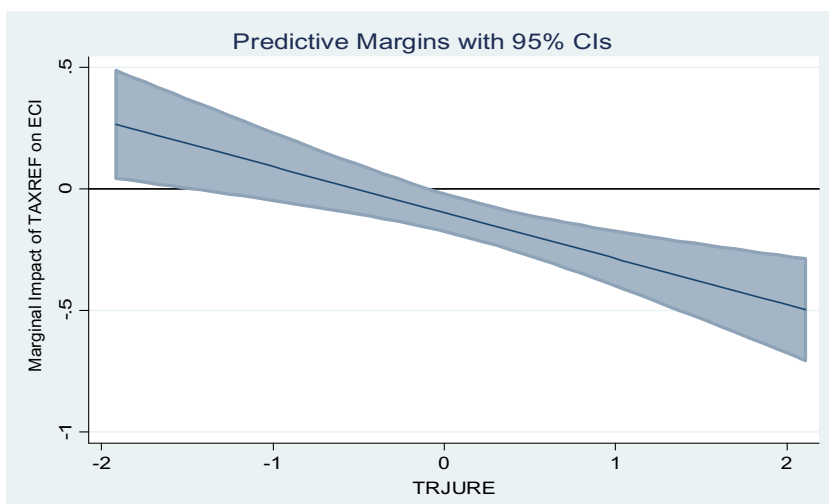
Source: Author.

diversification when standardized values of trade openness are lower than  $-0.3824$  (which is equivalent to an unstandardized value of trade openness amounting to  $0.0003 [=0.0045 \cdot (-0.3824) + 0.002006]$ ). Note that the standardized value ‘ $-0.3824$ ’ of trade openness is extracted from the Stata software when generating Figure 5. Tax reform

influences positively and significantly export product diversification for degrees of trade openness ('OPENSW') higher than the threshold amounting to 0.0003: the greater the level of trade openness, the higher is the magnitude of the positive effect of tax reform on export product diversification.

In Figure 6, we show at the 95% confidence intervals, the development of the marginal impact of tax reform on export product concentration evolves for varying countries' levels of trade openness (measured by the variable 'TRJURE'). The pattern observed in this figure is also similar to the ones observed in Figures 2 and 3. The marginal impact of tax reform on export product concentration decreases as the level of trade openness increases, and takes positive and negative values. However, this marginal impact is not statistically significant for level of (standardized values of) trade openness ranging between  $-1.4245$  and  $-0.1088$ , which correspond to unstandardized values of trade openness ('TRJURE') amounting, respectively, to  $11.46$  [ $=21.5331*(-1.4245) + 42.13351$ ] and  $39.8$  [ $=21.5331*(-0.1088) + 42.13351$ ]. Note that the values of the standardized TRJURE indicator amounting to  $-1.4245$  and  $-0.1088$  are extracted from the Stata software when generating Figure 6. Thus, for (unstandardized) levels of de jure trade openness lower than  $11.46$ , tax reform leads to greater export product concentration, with the magnitude of this positive effect diminishing as the degree of de jure trade openness decreases. In contrast, for (unstandardized) levels of de jure trade openness lower than  $39.8$ , tax reform leads to greater export product diversification, and the magnitude of this positive effect increases as the degree of the de jure trade openness rises. Finally, tax reform exerts no significant effect on export product concentration (diversification) for levels of trade openness ranging between  $11.46$  and  $39.8$ .

Overall, results in Tables 3 and 4 show that the export product diversification effect of tax reform genuinely translates through the trade openness channel, and the magnitude of its positive effect on export product diversification increasing with the rise in the degree of trade openness (in particular if the latter exceeds a certain threshold).



**Figure 6.** Marginal impact of 'TAXREF' on 'ECI', for varying levels of trade openness ('TRJURE').

Source: Author.

## 7. Conclusion

The current paper has examined the effect of tax reform on export product diversification using a sample of 112 developing countries over the period 1980–2014. Empirical findings indicate that tax reform exerts a positive effect on export product diversification, with LDCs enjoying a higher positive effect than non-LDCs. Additionally, the export product diversification effect of tax reform translates through the trade openness and terms of trade channels. In particular, countries that enjoy a greater level of trade openness or an improvement in terms of trade experience a higher positive effect of tax reform on export product diversification than countries with a lower level of trade openness or a deterioration in terms of trade. Interestingly, among all regressors considered in the analysis, tax reform appears to exhibit the highest positive effect on export product diversification. This highlights the leading role played by tax reform in supporting export product diversification.

From a policy perspective, these findings underline the important role of tax reform in developing countries, not only for enhancing fiscal space, raising public revenue, reducing tax revenue instability, promoting welfare and economic growth, but also for enhancing export product diversification. With the assistance of international financial institutions and regional development banks, policymakers in developing countries should, therefore, pursue their tax reform process, in particular as they wish to diversify their export product basket while reaping the other above-mentioned benefits associated with such a reform.

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## References

- Abe, K. (1995), “The Target Rates of Tariff and Tax Reform”, *International Economic Review* 36, 875–85.
- Aditya, A. and R. Acharyya (2013), “Export Diversification, Composition, and Economic Growth: Evidence from Cross-Country Analysis”, *Journal of International Trade and Economic Development* 22, 959–92.
- Aditya, A. and R. Acharyya (2015), “Trade Liberalization and Export Diversification”, *International Review of Economics & Finance* 39, 390–410.
- Agosin, R., R. Alvarez, and C. Bravo-Ortega (2012), “Determinants of Export Diversification around the World: 1962–2000”, *The World Economy* 35, 295–315.
- Al-Marhubi, F. (2000), “Export Diversification and Growth: An Empirical Investigation”, *Applied Economics Letters* 7, 559–62.
- Ali, M. (2017), “Determinants of Related and Unrelated Export Diversification”, *Economies* 5, 50.
- Amighini, A. and M. Sanfilippo (2014), “Impact of South-South FDI and Trade on the Export Upgrading of African Economies”, *World Development* 64, 1–17.
- Anderson, J. and P. Neary (2016), “Sufficient Statistics for Tariff Reform When Revenue Matters”, *Journal of International Economics* 98, 150–9.
- Anderson, J. E. (1997), “Revenue Neutral Trade Reform with Many Households, Quotas, and Tariffs”, NBER Working Paper No. 6181, National Bureau of Economic Research, Cambridge.
- Anderson, J. E. (1999), “Trade Reform with a Government Budget Constraint”, in J. Piggott and A. Woodland, eds, *International Trade Policy and the Pacific Rim*, Macmillan Press, London, pp 217–44.

- Arellano, M. and O. Bover (1995), "Another Look at the Instrumental Variable Estimation of Error-Components Models", *Journal of Econometrics* 68, 29–51.
- Athukorola, P. C. (2000), "Manufacturing Exports and Terms of Trade of Developing Countries: Evidence from Sri Lanka", *Journal of Development Studies* 36, 89–104.
- Bahar, D. and M. A. Santos (2018), "One More Resource Curse: Dutch Disease and Export Concentration", *Journal of Development Economics* 132, 102–14.
- Baldwin, R. E., H. Braconier, and R. Forslid (2005), "Multinationals, Endogenous Growth, and Technological Spillovers: Theory and Evidence", *Review of International Economics* 13, 945–63.
- Barro, R. J. and X. Sala-I-Martin (1997), "Technological Diffusion, Convergence, and Growth", *Journal of Economic Growth* 2, 1–26.
- Bas, M. and V. Strauss-Kahn (2015), "Input-Trade Liberalization, Export Prices and Quality Upgrading", *Journal of International Economics* 95, 250–62.
- Baunsgaard, T. and M. Keen (2010), "Tax Revenue and (or?) Trade Liberalization", *Journal of Public Economics* 94, 563–77.
- Balavac, M. and G. Pugh (2016), "The Link between Trade Openness, Export Diversification, Institutions and Output Volatility in Transition Countries", *Economic Systems* 40, 273–87.
- Bernard, A., S. J. Redding, and P. K. Schott (2007), "Comparative Advantage and Heterogeneous Firms", *Review of Economic Studies* 74, 31–66.
- Bleaney, M. and D. Greenaway (2001), "The Impact of Terms of Trade and Real Exchange Volatility on Investment and Growth in Sub-Saharan Africa", *Journal of Development Economics* 65, 491–500.
- Blundell, R. and S. Bond (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics* 87, 115–43.
- Boadway, R. and M. Sato (2009), "Optimal Tax Design and Enforcement with an Informal Sector", *American Economic Journal: Economic Policy* 1, 1–27.
- Bos, J. W. B., C. Economidou, and L. Zhang (2020), "Specialization in the Presence of Trade and Financial Openness", *Empirical Economics* 58, 2783–816.
- Bowsher, C. G. (2002), "On Testing Overidentifying Restrictions in Dynamic Panel Data Models", *Economics Letters* 77, 211–20.
- Brenton, P. and R. Newfarmer (2009), "Watching More Than the Discovery Channel to Diversify Exports", in R. Newfarmer, W. Shaw, and P. Walkenhorst, eds, *Breaking into New Markets: Emerging Lesson for Export Diversification*, World Bank, Washington, DC, pp. 111–26.
- Cadot, O., C. Carrere, and V. Strauss-Kahn (2011), "Export Diversification: What's behind the Hump?", *Review of Economics and Statistics* 93, 590–605.
- Cadot, O., C. Carrere, and V. Strauss-Kahn (2013), "Trade Diversification, Income, and Growth: What Do We Know?", *Journal of Economic Surveys* 27, 790–812.
- Cagé, J. and L. Gadenne (2018), "Tax Revenues and the Fiscal Cost of Trade Liberalization, 1792–2006, 1792–2006", *Explorations in Economic History* 70, 1–24.
- Can, M. and G. Gozgor (2017), "Causal Linkages among the Product Diversification of Exports, Economic Globalization and Economic Growth", *Review of Development Economics* 21, 888–908.
- Coe, D. T. and E. Helpman (1995), "International R and D Spillovers", *European Economic Review* 39, 859–87.
- Crivelli, E. (2016), "Trade Liberalization and Tax Revenue in Transition: An Empirical Analysis of the Replacement Strategy", *Eurasian Economic Review* 6, 1–25.
- Darvas, Z. (2012a), "Real Effective Exchange Rates for 178 Countries: A New Database", Working Paper 2012/06, Bruegel, Belgium.
- Darvas, Z. (2012b), "Compositional Effects on Productivity, Labour Cost and Export Adjustment", Policy Contribution 2012/11, Bruegel, Belgium.
- Dawe, D. (1996), "A New Look at the Effects of Export Instability on Investment and Growth", *World Development* 24, 1905–14.

- De Long, J. B. and L. H. Summers (1991), "Equipment Investment and Economic Growth", *Quarterly Journal of Economics* 106, 445–502.
- De Pineres, S. and M. Ferrantino (1997), "Export Diversification and Structural Dynamics in the Growth Process: The Case of Chile", *Journal of Development Economics* 52, 375–91.
- Dennis, A. and Shepherd B. (2011), "Trade Facilitation and Export Diversification", *The World Economy*, 34, 101–22.
- Dessy, S., F. Mbiekop, and S. Pallage (2010), "On the Mechanics of Trade-Induced Structural Transformation", *Journal of Macroeconomics* 32, 251–64.
- Diamond, P. A. and J. Mirlees (1971), "Optimal Taxation and Public Production I–II", *American Economic Review* 61, 8–27.
- Dixit, A. K. (1985), "Tax Policy in Open Economies", in A. J. Auerbach and M. Feldstein, eds, *Handbook of Public Economics* Vol. 1, North-Holland, Amsterdam, pp. 313–79.
- Dornbusch, R., S. Fischer, and P. A. Samuelson (1977), "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods", *American Economic Review* 67, 823–39.
- Dreher, A. (2006), "Does Globalisation Affect Growth? Evidence from a New Index of Globalisation", *Applied Economics* 38, 1091–110.
- Eaton, J. and S. Kortum (2001), "Trade in Capital Goods", *European Economic Review* 45, 1195–235.
- Emran, M. S. and J. E. Stiglitz (2005), "On Selective Indirect Tax Reform in Developing Countries", *Journal of Public Economics* 89, 599–623.
- Freund, C. and M. D. Pierola (2012), "Export Surges", *Journal of Development Economics* 97, 387–95.
- Fujiwara, K. (2013), "A Win–Win–Win Tariff–Tax Reform under Imperfect Competition", *Review of International Economics* 21, 857–67.
- Ganelli, G. and J. Tervala (2015), "Tariff–Tax Reforms in Large Economies", *The World Economy* 38, 1990–2012.
- Gnangnon, S. K. (2019a), "Tax Reform and Trade Openness in Developing Countries", *Journal of Economic Integration* 34, 498–519.
- Gnangnon, S. K. (2019b), "Aid for Trade and Export Diversification in Recipient-Countries", *The World Economy* 42, 396–418.
- Gnangnon, S. K. (2019c), "Does the Impact of Aid for Trade on Export Product Diversification Depend on Structural Economic Policies in Recipient-Countries?", *Economic Issues* 24, 59–87.
- Gnangnon, S. K. (2019d), "Effect of Export Upgrading on Financial Development", *Journal of International Commerce, Economics and Policy* 10, 1950012–37.
- Gnangnon, S. K. (2020), "Effect of Development Aid on Tax Reform in Recipient-Countries: Does Trade Openness Matter?", *Journal of International Commerce, Economics and Policy* 11, 2050001–23.
- Gnangnon, S. K. and J.-F. Brun (2019a), "Tax Reform and Fiscal Space in Developing Countries", *Eurasian Economic Review* 10, 237–65.
- Gnangnon, S. K. and J.-F. Brun (2019b), "Trade Openness, Tax Reform and Tax Revenue in Developing Countries", *The World Economy, Special Issue: Global Policy Review* 42, 3515–36.
- Gnangnon, S. K. and J.-F. Brun (2019c), "Tax Reform and Public Revenue Instability in Developing Countries: Does the Volatility of Development Aid Matter?", *Journal of International Development* 31, 764–85.
- Gnangnon, S. K. and M. Roberts (2017), "Aid for Trade, Foreign Direct Investment and Export Upgrading in Recipient Countries", *Journal of International Commerce, Economics and Policy* 8, 1750010.
- Ghosh, A. R. and J. Ostry (1994), "Export Instability and the External Balance in Developing Countries", *IMF Staff Papers* 41, 214–35.



- Goldberg, P., Khandelwal, A., Pavcnik, N., and Topalova, P. (2010), "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India", *The Quarterly Journal of Economics*, **125**, 1727–1767.
- Grossman, G. M. and E. Helpman (1991), *Innovation and Growth in the Global Economy*. MIT Press, Cambridge, MA, London, UK.
- Gutierrez-de-Pineres, S. A. and M. Ferrantino (2000), *Export Dynamic and Economic Growth in Latin America: A Comparative Perspective*. Ashgate, Burlington, VT.
- Guzman, M., A. J. Ocampo, and J. E. Stiglitz (2018), "Real Exchange Rate Policies for Economic Development", *World Development* **110**, 51–62.
- Gygli, S., F. Haelg, N. Potrafke, and J.-E. Sturm (2019), "The KOF Globalisation Index—Revisited", *Review of International Organizations* **14**, 543–74.
- Haddad, M., J. J. Lim, C. Pancaro, and C. Saborowski (2013), "Trade Openness Reduces Growth Volatility When Countries Are Well Diversified", *Canadian Journal of Economics* **46**, 765–90.
- Haibara, T. (2012), "Alternative Approaches to Tax Reform", *Economics Letters* **117**, 408–10.
- Harding, T. and B. S. Javorcik (2012), "Foreign Direct Investment and Export Upgrading", *The Review of Economics and Statistics* **94**, 964–80.
- Hatzipanayotou, P., M. S. Michael, and S. M. Miller (1994), "Win-Win Indirect Tax Reform: A Modest Proposal", *Economics Letters* **44**, 147–51.
- Hausmann, R., and Rodrik, D. (2003) "Economic development as self-discovery", *Journal of Development Economics*, **72**, 603–633.
- Hausmann, R., J. Hwang, and D. Rodrik (2007), "What You Export Matters", *Journal of Economic Growth* **12**, 1–25.
- Herzer, D., and Nowak-Lehmann F. D. (2006), "What Does Export Diversification Do for Growth? an Econometric Analysis", *Applied Economics*. **38**, 1825–38.
- Hirsch, S. and B. Lev (1971), "Sales Stabilization through Export Diversification", *The Review of Economics and Statistics* **53**, 270–7.
- Hummels, D. and P. J. Klenow (2005), "The Variety and Quality of a Nation's Exports", *American Economic Review* **95**, 704–23.
- Imbs, J. and R. Wacziarg (2003), "Stages of Diversification", *American Economic Review* **93**, 63–86.
- Juvenal, L. and P. Monteiro (2013), "Export Market Diversification and Productivity Improvement: Theory and Evidence from Argentinian Firms", Federal Reserve Bank of Saint Louis, Working Paper 2013-015A.
- Karakosta, O. and N. Tsakiris (2014), "Can Tariff and Tax Reforms Deliver Welfare Improvements under Imperfect Competition?", *The Journal of International Trade & Economic Development* **23**, 315–28.
- Keen, M. and J. E. Ligthart (2002), "Coordinating Tariff Reduction and Domestic Tax Reform", *Journal of International Economics* **56**, 489–507.
- Keen, M. and J. E. Ligthart (2005), "Coordinating Tariff Reduction and Domestic Tax Reform under Imperfect Competition", *Review of International Economics* **13**, 385–90.
- Khattry, B. (2003), "Trade Liberalization and the Fiscal Squeeze: Implications for Public Investment", *Development and Change* **34**, 401–24.
- Khattry, B. and J. M. Rao (2002), "Fiscal Faux Pas?: An Analysis of the Revenue Implications of Trade Liberalization", *World Development* **30**, 1431–44.
- Kletzer, K. and P. Bardhan (1987), "Credit Markets and Patterns of International Trade", *Journal of Development Economics* **27**, 57–70.
- Klinger, B. and D. Lederman (2011), "Export Discoveries, Diversification and Barriers to Entry", *Economic Systems* **35**, 64–83.
- Kramarz, F., J. Martin, and I. Mejean (2020), "Volatility in the Small and in the Large: The Lack of Diversification in International Trade", *Journal of International Economics* **122**, Article 103276.

- Kreickemeier, U. and Raimondos-Møller P.(2008), “Tari-tax Reforms and Market Access”, *Journal of Development Economics* 87, 85–91.
- Krugman, P. and A. J. Venables(1990), “Integrationand the Competitiveness of Peripheral Industry” in C. Bliss and J. Braga deMacedo eds, *Unity with Diversity in the European Economy: The Community’s Southern Frontier*, Cambridge University Press, Cambridge, pp. 56–75.
- Krugman, P. (1979), “Increasing Returns, Monopolistic Competition, and International Trade”, *Journal of International Economics* 9, 469–79.
- Lahiri, S. and A. Nasim (2005), “Commercial Policy Reform in Pakistan: Opening Up the Economy under Revenue Constraints”, *International Tax and Public Finance* 12, 723–39.
- Lee, J.-W. (1993), “International Trade, Distortions, and Long-Run Economic Growth”, *IMF Staff Papers* 40, 299–328.
- Ligthart, J. E. and G. C. van der Meijden (2011), “The Dynamics of Revenue-Neutral Trade Liberalization in Developing Countries”, Center Discussion Paper No. 2011-14, Tilburg University, Tilburg.
- Malik, A. and J. R. W. Temple (2009), “The Geography of Output Volatility”, *Journal of Development Economics* 90, 163–78.
- Mania, E. and A. Rieber (2019), “Product Export Diversification and Sustainable Economic Growth in Developing Countries”, *Structural Change and Economic Dynamics* 51, 138–51.
- Manova, K. (2013), “Credit Constraints, Heterogeneous Firms, and International Trade”, *The Review of Economic Studies* 80, 711–44.
- Marshall, M. G., T. R. Gurr, and K. Jagers (2018), *Polity IV Project: Political Regime Characteristics and Transitions, 1800-2017*, Centre for Systemic Peace, Vienna, VA.
- Michael, S., P. Hatzipanayotou, and S. M. Miller (1993), “Integrated Reforms of Tariffs and Consumption Taxes”, *Journal of Public Economics* 52, 417–28.
- Moller, L. (2016), “Tax Revenue Implications of Trade Liberalization in Low-Income Countries”, WIDER Working Paper 2016/173, United Nations University World Institute for Development Economics Research (UNU-WIDER), Finland.
- Munk, K. J. (2008), “Tax-Tariff Reform with Costs of Tax Administration”, *International Tax and Public Finance* 15, 647–67.
- Naito, T. (2006), “Growth, Revenue, and Welfare Effects of Tariff and Tax Reform: Win-Win-Win Strategies”, *Journal of Public Economics* 90, 1263–80.
- Naito, T. and K. Abe (2008), “Welfare- and Revenue-Enhancing Tariff and Tax Reform under Imperfect Competition”, *Journal of Public Economic Theory* 10, 1085–94.
- Naudé, W., Bosker M., and Matthee M. (2010), “Export Specialization and Local Economic Growth”, *World Economy*, 33, 552–572.
- Neto, N. C. C. and R. Romeu (2011), “Did Export Diversification Soften the Impact of the Global Financial Crisis?” IMF Working Paper, WP/11/99, International Monetary Fund, Washington, DC.
- Nickell, S. (1981), “Biases in Dynamic Models with Fixed Effects”, *Econometrica* 49, 1417–26.
- Nouira, R., P. Plane, and K. Sekkat (2011), “Exchange Rate Undervaluation and Manufactured Exports: A Deliberate Strategy?”, *Journal of Comparative Economics* 39, 584–601.
- Osakwe, P. N., A. U. Santos-Paulino, and B. Dogan (2018), “Trade Dependence, Liberalization, and Exports Diversification in Developing Countries”, *Journal of African Trade* 5, 19–34.
- Parteka, A. and M. Tamberi (2013), “What Determines Export Diversification in the Development Process? Empirical Assessment”, *The World Economy* 36, 807–26.
- Puga, D. and D. Treffer (2010), “Wake Up and Smell the Ginseng: International Trade and the Rise of Incremental Innovation in Low Wage Countries”, *Journal of Development Economics* 91, 64–76.
- Rajan, R. and L. Zingales (1998), “Financial Dependence and Growth”, *American Economic Review* 88, 559–86.

- Rodrik, D. (2008), “The Real Exchange Rate and Economic Growth”, *Brookings Papers on Economic Activity* 39, 365–439.
- Rodrik, D. (2009), “Industrial Policy: Don’t Ask Why”, *Ask How. Middle East Development Journal* 1, 1–29.
- Romer, P. (1994), “New Goods, Old Theory, and the Welfare Costs of Trade Restrictions”, *Journal of Development Economics* 43, 5–38.
- Roodman, D. M. (2009), “A Note on the Theme of Too Many Instruments”, *Oxford Bulletin of Economic and Statistics* 71, 135–58.
- Sannassee, R. V., B. Seetanah, and M. J. Lampton (2014), “Export Diversification and Economic Growth: The Case of Mauritius”, Chapter 1 in: M. Jansen, M. S. Jallab, M. Smeets, eds, *Connecting to Global Markets—Challenges and Opportunities: Case Studies Presented by WTO Chair-Holders*, Switzerland, World Trade Organization, 11–23.
- Sekkat, K. (2016), “Exchange Rate Misalignment and Export Diversification in Developing Countries”, *The Quarterly Review of Economics and Finance* 59, 1–14.
- Sekkat, K. and A. Varoudakis (2000), “Exchange Rate Management and Manufactured Exports in Sub-Saharan Africa”, *Journal of Development Economics* 61, 237–53.
- Squalli, J. and K. Wilson (2011), “A New Measure of Trade Openness”, *The World Economy* 34, 1745–70.
- Stanley, D. L. and S. Bunnag (2001), “A New Look at the Benefits of Diversification: Lessons from Central America”, *Applied Economics* 33, 1369–83.
- Stiglitz, J. E. (2003), “Development Oriented Tax Policy”, Presentation to Congress of International Institute of Public Finance, Prague.
- Teignier, M. (2018), “The Role of Trade in Structural Transformation”, *Journal of Development Economics* 130, 45–65.
- Tran, T. A.-D., M. H. Phi, and D. Diaw (2017), “Export Diversification and Real Exchange Rate in Emerging Latin America and Asia: A South–North vs. South–South Decomposition”, *The Journal of International Trade & Economic Development* 26, 649–76.
- Vannoorenbergh, G., Wang, Z., and Yu, Z. (2016), “Volatility and diversification of exports: Firm-level theory and evidence”, *European Economic Review*, 89, 216–247.
- Vardanyan, E. (2019), “Do Remittances Worsen Export Diversification?”, Economics Discussion Papers, No 2019-46, Kiel Institute for the World Economy. <http://www.economics-ejournal.org/economics/discussionpapers/2019-46> (last accessed 12 August 2019).
- Waglé, S. (2011), “Coordinating Tax Reforms in the Poorest Countries: Can Lost Tariffs be Recouped?”, Policy Research Working Paper 5919. The World Bank, Washington, DC.
- Windmeijer, F. (2005), “A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators”, *Journal of Econometrics* 126, 25–51.
- Zellner, A. (1962), “An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias”, *Journal of the American Statistical Association* 57, 348–68.
- Zhu, S. and X. Fu (2013), “Drivers of Export Upgrading”, *World Development* 51, 221–33.
- Ziliak, J. P. (1997), “Efficient Estimation with Panel Data When Instruments Are Predetermined: An Empirical Comparison of Moment-Condition Estimators”, *Journal of Business and Economic Statistics* 15, 419–31.

## Appendix

**Table A1.** Definition and source of variables

Variables	Definition	Source
ECI	This is the first variable capturing export product upgrading. This is the index of overall export product concentration. It is calculated using the Theil Index and following the definitions and methods used in Cadot et al. (2011). The overall	Details on the calculation of this Index could be found online: IMF’s Diversification Toolkit—see data online at: <a href="https://data.imf.org/">https://data.imf.org/</a>

Table A1. (continued)

Variables	Definition	Source
	Theil index of export product concentration is the sum of the intensive and extensive components of the ‘ECI’ variable. Indeed, export product diversification can occur over either product narrowly defined or trading partners. It can be broken down into the extensive and intensive margins of diversification. Extensive export diversification reflects an increase in the number of export products or trading partners, while intensive export diversification considers the shares of export volumes across active products or trading partners. The computation of the index has been based on a classification of products into ‘Traditional’, ‘New’ or ‘Non-Traded’ products categories. A rise in the values of ‘ECI’ index signifies an increase in the degree of overall export product concentration, while a decrease in the values of the index indicates a rise in the degree of overall export product concentration (i.e., greater export product diversification).	sk=3567E911-4282-4427-98F9-2B8A6F83C3B6
TAXREF	This is the index of convergence of the tax structure of a given developing country towards the developed countries’ tax structure. Its values range between 0 and 1, with a rise in these values reflecting greater tax structure convergence, i.e., greater tax reforms.	Author’s computation (see Section 3) based on data extracted from the ICTD Public Revenue Dataset. See online: <a href="http://www.ictd.ac/index.php/dataset#core-dataset">http://www.ictd.ac/index.php/dataset#core-dataset</a>
OPEN	This is the measure of trade openness (de facto trade openness). It is calculated as the sum of exports and imports, in % GDP	WDI
OPENSW	This is the measure of trade openness suggested by Squalli and Wilson (2011). It is calculated as the measure of trade openness (the variable ‘OPEN’ previously described) adjusted by the proportion of a country’s trade level relative to the average world trade (see Squalli and Wilson, 2011, p. 1758).	Authors’ calculation based on data from the World Development Indicators (WDI) of the World Bank.
TRJURE	This is the de Jure measure of trade openness used as one component of the KOF Globalization index developed by Dreher (2006) (see also Gygli et al. 2019). It is computed as the average of two subcomponents, namely the prevalence of non-tariff trade barriers, and compliance costs of importing and exporting. Higher values of this index reflect greater trade policy liberalization.	See the database and other information online at: <a href="https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html">https://www.kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html</a>
TERMS	This is the measure of terms of trade. Terms of trade represent the ratio of the export price index to import price index.	Authors’ calculation based on data extracted from the WDI

**Table A1.** (continued)

Variables	Definition	Source
REER	This is the measure of the REER. It is computed using a nominal effective exchange rate based on 66 trading partners. An increase in the index indicates an appreciation of the REER, i.e., an appreciation of the home currency against the basket of currencies of trading partners.	Bruegel Datasets (see <a href="#">Darvas 2012a,b</a> ). The dataset could be found online at: <a href="http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/">http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/</a>
FINDEV	Domestic credit to private sector (% of GDP)	WDI
GDPC	Per capita Gross Domestic Product (constant 2010 US\$)	WDI
EDU	This is the measure of the education level. It is calculated as the sum of the gross primary school enrolment rate (in percentage), secondary school enrolment rate (in percentage) and tertiary school enrolment rate (in percentage).	WDI
RENT	Total natural resources rents (% of GDP)	WDI
POP	Total population	WDI

**Table A2a.** Descriptive statistics on unstandardized variables used in the model

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
ECI	736	3.626	1.225	0.462	6.269
TAXREF	606	0.589	0.181	0.045	0.976
OPEN	674	74.638	37.868	9.106	229.638
OPENSOW	673	0.002	0.005	0.000	0.044
TRJURE	731	42.134	21.533	6.814	95.017
TERMS	606	118.246	43.066	35.549	482.975
GDPC	727	5631.298	9477.570	153.903	101,387.000
FINDEV	688	30.439	28.896	0.186	246.576
REER	747	154.134	570.892	2.152	14,144.000
EDU	757	150.325	63.400	1.946	297.769
RENT	729	9.370	11.417	0.001	84.240
POP	782	3.96e+07	1.50e+08	246,533.6	1.35e+09

**Table A2b.** Descriptive statistics on standardized variables used in the model

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
ECI	736	4.09e−08	0.921	−1.946	2.180
TAXREF	606	−2.80e−08	0.904	−1.998	2.076
OPEN	673	3.10e−08	0.917	−1.967	2.268
OPENSOW	672	−1.35e−08	0.917	−1.932	2.145
TRJURE	731	1.48e−08	0.923	−1.918	2.194
TERMS	606	−6.60e−08	0.904	−1.965	2.247
GDPC	727	1.30e−08	0.920	−1.688	2.112
FINDEV	688	5.45e−09	0.916	−2.031	2.145
REER	747	9.01e−09	0.923	−1.789	2.262
EDU	757	−1.95e−08	0.924	−2.254	2.221
RENT	729	9.69e−09	0.921	−1.737	2.184
POP	782	−5.95e−08	0.926	−2.090	2.049

**Table A3.** List of countries contained in the full sample

Full sample				LDCs	
Albania	Czech Republic	Kenya	Philippines	Angola	Solomon Islands
Algeria	Dominican Republic	Korea, Rep.	Poland	Bangladesh	Sudan
Angola	Ecuador	Kuwait	Romania	Benin	Tanzania
Armenia	El Salvador	Kyrgyz Republic	Rwanda	Burkina Faso	Uganda
Azerbaijan	Equatorial Guinea	Lao PDR	Saudi Arabia	Burundi	Yemen, Rep.
Bahrain	Eritrea	Lesotho	Senegal	Cambodia	Zambia
Bangladesh	Estonia	Liberia	Serbia	Central African Republic	
Belarus	Eswatini	Libya	Sierra Leone	Chad	
Benin	Ethiopia	Madagascar	Slovak Republic	Comoros	
Bolivia	Fiji	Malawi	Slovenia	Congo, Dem. Rep.	
Botswana	Gabon	Malaysia	Solomon Islands	Eritrea	
Brazil	Gambia, The	Mauritania	South Africa	Ethiopia	
Bulgaria	Georgia	Mauritius	Sri Lanka	Gambia, The	
Burkina Faso	Guatemala	Mexico	Sudan	Guinea	
Burundi	Guinea	Moldova	Suriname	Guinea-Bissau	
Cambodia	Guinea-Bissau	Mongolia	Tajikistan	Haiti	
Cameroon	Guyana	Morocco	Tanzania	Lao PDR	
Central African Republic	Haiti	Mozambique	Thailand	Lesotho	
Chad	Honduras	Nepal	Trinidad and Tobago	Liberia	
Chile	Hungary	Nicaragua	Tunisia	Madagascar	
China	India	Niger	Turkey	Malawi	
Comoros	Indonesia	Nigeria	Uganda	Mauritania	
Congo, Dem. Rep.	Iran, Islamic Rep.	North Macedonia	Ukraine	Mozambique	
Congo, Rep.	Ireland	Pakistan	United Arab Emirates	Nepal	
Costa Rica	Israel	Panama	Uruguay	Niger	
Cote d'Ivoire	Italy	Papua New Guinea	Venezuela, RB	Rwanda	
Croatia	Jordan	Paraguay	Yemen, Rep.	Senegal	
Cyprus	Kazakhstan	Peru	Zambia	Sierra Leone	