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Tariff Volatility and Tariff Policy in Developed and Developing Countries

Sèna Kimm GNANGNON¹

Abstract

In this paper, we investigate 'at the aggregate level', the effect of tariff volatility on tariff rates, using three groups of products, including 'all products', 'manufactured products' and 'primary products', and a large panel dataset covering 163 countries over the period 1995-2017. Results, based on the feasible generalized least squares estimator, have shown for the full sample that tariff volatility leads to a greater extent of tariff liberalization. This finding holds for each of the three groups of products highlighted above, as well as for three sub-samples, including lower-middle income countries, upper-middle income countries and high-income countries. However, for Low-income countries, tariff volatility influences significantly (although negatively) tariff rates only for primary products. Additionally, for recipient-countries of Aid for Trade related to trade policy and regulation (AfTPOL), the effect of tariff volatility on tariff rates is conditional upon the amounts of AfTPOL flows only for primary products. Specially, there exists a substitutability between tariff volatility and AfTPOL flows in influencing tariffs applied on primary products. For lower amounts of AfTPOL flows, tariff volatility induces a greater extent of tariff liberalization, while for higher amounts of these aid flows, tariff volatility results in higher tariff rates. Alternatively, the higher the amounts of AfTPOL flows, the greater is the positive effect of tariff volatility on the extent of liberalization of tariff on primary products.

Keywords: Tariffs; Tariff volatility; Primary products; Manufactured products.

JEL Classification: F14; F35.

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1. Introduction

Recent years have witnessed criticisms of globalization, which result in a crisis of international trade (e.g., Cox, 2017; Flew, 2020; Gruszczynski and Lawrence, 2019; Harrison, 2018; Rodrik, 2006, 2011). Nevertheless, there is still a large consensus among economists that international trade needs to be free (e.g., Furceri et al., 2018; Siles-Brügge, 2014). In the absence of market failures, trade barriers (including tariffs) distort the efficient allocation of resources, reduce competition and encourage the deflection of trade to inefficient producers, encourage rent-seeking activities, and are ultimately welfare-reducing. Even in the context of market imperfections, trade barriers (including tariffs) are not the optimal policies, and remain a second-best option. Additionally, protectionism can trigger retaliation by trading partners, and potentially lead to a trade war. Berthou et al. (2018) have briefly discussed the costs and consequences of a trade war, and emphasized the adverse short-term direct consequences of trade war (i.e., for example, the rise in the price of imported goods, which deteriorates consumers' welfare and raise production costs, in particular in the absence of substitutable good; the reduction of investment; possible adverse effects on inflation); the short term indirect effects (for example, the fall in productivity; the tightening of financing conditions; and an increase in uncertainty about future conditions, leading to the fall in investment demand, and prompting firms to adopt a "wait-and-see" behaviour). The authors have found empirical evidence that a global and generalized increase in tariffs by 10 percentage points could result in a fall of the global gross domestic product (GDP) by 2%, reaching possibly 3% after two years.

In the same vein, Furceri et al. (2019) have used a large panel dataset, including macroeconomic and industry-level data (on 151 countries over the period 1963-2014) to demonstrate empirically that tariffs increases are associated with lower domestic output and productivity, as well as higher unemployment, inequality, and real exchange appreciation. At the same time, tariffs rises do not affect significantly the trade balance. Lindé and Pescatori (2019) have shown that a trade war can generate substantial macroeconomic costs, including a permanent decrease in income and trade volumes. Nevertheless, they have reported that a fully symmetric retaliation to a unilaterally imposed border adjustment tax can prevent any sizable adverse real or nominal effects.

On the other hand, the volatility of trade policy, notably the volatility of tariffs can also exert adverse effects on the domestic economy. The present paper examines the effect of tariffs volatility on tariffs. The volatility of trade policy (which can also be considered as an uncertainty of trade policy – see for example, Sudsawasd and Moore, 2006) generally induces trade policy uncertainty, and possibly economic policy uncertainty. According to Rodrik (1991), even moderate amounts of policy uncertainty can act as a hefty tax on private investment, and deter private investment, notably if there are doubts about the permanent nature of the policy reform. Furthermore, Rodrik (1995a) has noted that the credibility of trade policy reform is eroded when the private sector believes that trade policy reform will not be sustainable. This can lead formerly protected firms to invest in lobbying efforts so as to restore the protectionist policy. Trade policy uncertainty acts as a strong trade barrier, and affects firms' export decisions. Therefore, reducing it would make market conditions more transparent and predictable (including for example, by facilitating firm entry into the export market - see for example Handley, 2014), and induce a strong positive effect on trade, including exports, and welfare (e.g., Crowley et al., 2018; Feng et al., 2017; Handley, 2014;

Handley and Limão, 2014, 2015; 2017; Pierce and Schott, 2016). Van Wijnbergen (1985) has found that trade policy uncertainty is negatively associated with domestic investment. Along the same lines, Sudsawasd and Moore (2006) have obtained empirically that trade policy volatility (as a proxy for trade policy uncertainty) has deterred domestic investment. However, Bhattacharya (1999) has reported that trade policy uncertainty may not lead to a reduction in investment. Anderson and Nelgen (2012) have underlined the adverse consequences of restrictive agricultural trade policies for domestic prices. They have shown that both agricultural-importing and agricultural-exporting countries substantially use restrictive trade policies on agricultural trade in order to insulate their respective domestic markets from international price variability, in particular following a sudden spike. The resulting volatility in trade barriers ends up weakening the domestic price-stabilizing effect of these countries' interventions.

Using a sample of 149 exporters at the HS6 digit level, Osnago et al. (2015) have uncovered empirically that trade policy uncertainty (measured by tariffs' water, i.e., the gap between binding tariff commitments under multilateral and regional agreements, and applied tariffs) influences negatively the extensive and the intensive margins of trade. Moreover, these adverse consequences of trade policy uncertainty on exports are particularly stronger in the presence of global value chains, as well as when institutions quality is low. By relying on newspaper coverage frequency, Baker et al. (2016) have developed a new index of economic policy uncertainty, and provided strong empirical support of the adverse economic effects of economic policy uncertainty. Specially, at the firm-level, economic policy uncertainty generates greater stock price volatility and reduces investment and employment in policy-sensitive sectors like defense, health care, finance, and infrastructure construction. At the macroeconomic level, economic policy uncertainty has discouraged innovation, and hence reduced investment, output, and employment in the United States as well as in a set of twelve major economies. Caldara et al. (2019) have found that an increase in uncertainty about trade policy adversely affects industrial production, and other macroeconomic aggregates, both in advanced economies and emerging market economies. Steinberg (2019) has demonstrated empirically that the trade policy uncertainty introduced by the withdrawal of the United Kingdom (UK) from the European Union (i.e., the Brexit) has led to a welfare cost for U.K. households. Quantitatively, the total consumption-equivalent of this welfare cost range between 0.4% and 1.2%, and a less than a quarter of a percent of this cost is attributed to the trade policy uncertainty arising from the Brexit. Matteo et al. (2020) have shown that greater trade policy uncertainty discourages investment both at the aggregate and firm-levels, and induces precautionary increase in markups. These effects are particularly stronger in the presence of nominal rigidities (that impede large adjustments in prices and wages), as firms adopt a 'wait and see' attitude in the context of uncertainty about future demand.

Overall, this brief literature review tends to show that trade policy volatility (and the likely resulting trade policy uncertainty) undermines international trade, hurts domestic investment, affects several other macroeconomic indicators such as output, employment, prices..etc, and ultimately result in a fall in overall economic activity. These negative effects of trade policy volatility would lead policymakers to, sooner or later, reduce the extent of trade barriers (e.g., tariffs), because a prolonged period of such a volatility would be detrimental to international trade and economic activities, and generates high political costs. In this context, and given the potential economic benefits of trade policy liberalization (e.g., Bhagwati, 1964, 2004; Fukuda, 2019; Hallaert, 2006; Sapsford and Garikipati, 2006; Singh, 2010), we postulate that trade policy volatility would

ultimately result in trade policy liberalization, given the political costs and the trade and economic activity losses that would be associated with such a volatility of trade policy. The present analysis is essentially empirical. It tests the effect of the volatility aggregate tariffs on aggregate tariffs (i.e., tariff policy). The analysis² focuses exclusively on tariffs because they remain an important protectionism trade policy instrument used by policymakers across countries in the world. Additionally, tariffs are more transparent and much easier to measure, in aggregate, than non-tariff barriers.

The empirical analysis uses a dataset that contains 163 countries (both developed and developing countries) over the period 1995-2017. It has considered several indicators of tariffs, namely an indicator of tariffs on 'all products', an indicator of tariffs on 'manufactured products', and an indicator of tariffs on 'primary products'. Using the feasible generalized least squares, the empirical analysis has shown that over the full sample as well as over sub-samples of lower-middle income countries, upper-middle income countries, and high-income countries, tariff volatility has led to a greater extent of tariff liberalization, regardless of the group of products considered. This outcome applies to categories of 'all products', but also to 'manufactured products', and 'primary products', although the extent of tariffs liberalization that stems from greater tariff volatility varies across the three sub-samples, and depends on the sub-sample under analysis. However, for low-income countries, we obtain that only the volatility of tariffs on primary products influences negatively tariffs on primary products. For the groups of 'all products' and 'manufactured products', there is no significant effect of tariff volatility on tariffs rates.

The remainder part of the paper contains six sections. Section 2 presents the model specification that allows examining the effect of tariff volatility on tariff rates. Section 3 presents some data analysis. Section 4 discusses the econometric approach used to conduct the empirical exercise. Section 5 interprets empirical outcomes, and Section 6 deepens the analysis by investigating whether Aid for Trade (AfT) flows matter for the effect of tariff volatility on tariff rates in AfT recipient-countries. Section 7 concludes.

2. Model specification

Building on previous works on the macroeconomic determinants of trade policy (e.g., Ancharaz, 2003; Aggarwal, 2004; Esfahani and Squire, 2006; Gnanangnon, 2018; Milner and Kubota, 2005; Svaleryd and Vlachos, 2002; Rose, 2013), we consider a model specification that includes variables that are potentially deemed to be both the determinants of trade policy, and concurrently influencing the effect of tariff volatility on tariff rates. Therefore, our model includes as control variables the real per capita income ("GDPC"), which aims to account for the development level, the economic growth rate ("GROWTH"), the institutional and governance quality ("INST"), the population size ("POP") and the terms of trade ("TERMS"). Our main variable of interest is the volatility of tariffs at the aggregate level. In the present analysis, the dependent variable is the

² The creation of the World Trade Organization (WTO) - that succeeded to the General Agreement on Tariffs and Trade (GATT)- in 1995, has led to tariff liberalization, while non-tariff barriers have concomitantly risen. Thus, costs associated with non-tariff barriers tend to be higher than those arising from implementing tariffs. This makes the costs of tariffs a lower bound for the costs of protectionism (e.g., Furceri et al., 2018). Nevertheless, like Furceri et al. (2018), we attempt to be more conservative in the present study, by relying exclusively on tariffs given that data on the latter is much more available (at least at the aggregate level) than data on non-tariffs barriers.

indicator of tariff policy. The latter are tariff rates, expressed in percentage, and can either be the applied tariff rate (weighted mean) for all products ("TARIFFALL"); the applied tariff rate (weighted mean) for manufactured products ("TARIFFMAN"); and the applied tariff rate (weighted mean) for primary products ("TARIFFPRIM"). As the result, the indicators of tariff policy volatility are the volatility of each of these three indicators of tariffs.

In terms of theoretical expectations concerning the control variables, we would note that countries that enjoy a higher economic development level are likely to reduce much more their trade barriers than relatively less developed countries (e.g., Rodrik, 1995b; Svaleryd and Vlachos, 2002; Milner and Kubota, 2005). However, this argument might not apply consistently across all sectors of the economy, as policymakers of a given country may wish to protect some industries in this sector for many reasons, including for example, for food security, national security, and political reasons. Thus, we expect a rise in the real per capita income (that acts as a proxy for the economic development level, and concurrently measures countries' population size) to be associated with the liberalization of 'aggregate' tariffs (i.e., over all products), although this expected effect may not hold for sectoral tariffs (such as for primary products versus manufactured products). The population size variable has also been introduced in the analysis so as to supplement the real per capita income as a measure of countries' size. For example, Gnanngnon (2018) has obtained a positive trade policy liberalization effect of the real per capita income, and the population size.

On another note, higher economic growth can lead countries to further liberalize their trade policies (including greater tariffs reduction) so as to further spur economic growth, given the potential for trade liberalization in this regard (e.g., Singh, 2010). Meanwhile, policymakers (including those in developing countries) might wish to take advantage of the rise in economic growth to impose higher trade barriers (including higher tariffs) so as to collect higher tariffs revenue and finance their spending needs. Well, the rise in tariffs may, in turn, hurt consumers and producers that use imported inputs in their production processes, and ultimately hurt economic growth.

Likewise, countries that experience an improvement in terms of trade might also liberalize their trade regimes so as to enhance the positive effect of the terms of trade improvement on exports. At the same time, deterioration of terms of trade can result in higher tariffs, or more broadly in the adoption by governments of restrictive trade measures if such governments aim to take advantage of the rise in imports to collect higher tariff revenues. In the context of terms of trade deterioration, policymakers may also opt for liberalizing their trade regime so as to offset the negative exports effect of the decline in export prices (relatively to import prices), and hence encourage exporters in their activities (trade policy liberalization can particularly apply to inputs used by exporters in their process of production of final exportable goods) (see Gnanngnon, 2018). Finally, improvements in the quality of institutions and governance is likely to promote trade liberalization, and particularly tariffs reduction.

Against this background, we consider the following model:

The model estimated is as follows:

$$\text{TARIFF}_{it} = \alpha_0 + \alpha_1 \text{TARIFFVOL}_{it-1} + \alpha_2 \text{Log(GDPC)}_{it-5} + \alpha_3 \text{GROWTH}_{it-5} + \alpha_4 \text{INST}_{it-5} + \alpha_5 \text{Log(POP)}_{it} + \alpha_6 \text{TERMS}_{it} + \mu_i + \gamma_t + \omega_{it} \quad (1)$$

i and t stand respectively for a country, and the time-period. The analysis has used an unbalanced panel dataset of 163 countries, including both developed and developing countries, and covering the period 1995-2017. α_0 to α_6 are coefficients that would be estimated. μ_i are countries' time invariant specific effects; γ_t captures shocks that affected together all countries' tariffs, and induced them to modify their tariff levels. ω_{it} is an error term. All variables have been described in Appendix 1. Their related standard descriptive statistics have been reported in Appendix 2. Appendix 3a shows the list of the 163 countries.

The variable "TARIFF" is the indicator of tariff, which can be "TARIFFALL", "TARIFFMAN" or "TARIFFPRIM", as described above. "TARIFFVOL" is the key variable of interest, and represents the indicator of tariff volatility: it can be "TARIFFALLVOL" (volatility of the applied tariff rate (weighted mean) on all products); "TARIFFMANVOL" (volatility of the applied tariff rate (weighted mean) on manufactured products) or "TARIFFPRIMVOL" (volatility of the applied tariff rate (weighted mean) on primary products). The data on tariff rates are extracted from the World Development Indicators (WDI) of the World Bank. We compute the indicators of tariff volatility by using the approach proposed by Bekaert et al. (2006), and also used, for example, by Bayraktar (2019), Ebeke and Ehrhart (2012) and Museru et al. (2014). This approach entails computing the volatility of each tariff indicator, as the rolling standard deviation (of the growth rate of the tariff indicator) over 5-year rolling windows (that is, from $t-4$, ..., $t-1$, t). In model (1), the tariff volatility indicator is lagged by one year with a view to mitigate its eventual endogeneity (i.e., bi-directional causality). This, therefore, suggests that in this model, we will be exploring the effect of tariff volatility over the period running from $t-4$, to $t-1$ on applied tariff rates in year t . To ensure the exogeneity of some control variables (in particular the real per capita income, economic growth rate, and the institutional and governance quality), we consider their values at $t-4$. The variables "POP" and "TERMS" have been considered as exogenous.

It is worth noting that all indicators of tariffs and tariff volatility contain zero values (see Appendix 2) and are skewed (see Figures 1 to 6 below). As we cannot apply the natural logarithm to these variables (as they contain zero values), we use the transformation technique proposed by Yeyati et al. (2007) in order to reduce their skewness, while conserving zero values in the variable. This approach involves transforming each of the six indicators using the following formula $Y = \text{sign}(X) * \log(1 + |X|)$, where $|X|$ refers to the absolute value of the variable " X "; " Y " is the transformed variable; and " X " is the variable to be transformed. Thus for example, our transformed dependent variable "TARIFF" in model (1) is obtained as follows: $\text{TARIFF} = \text{sign}(\text{TARIFF1}) * \log(1 + |\text{TARIFF1}|)$, where $|\text{TARIFF1}|$ refers to the absolute value of the variable " TARIFF1 ", the latter being the tariff data collected from the WDI (see Appendix 1). We apply this formula to each of the three indicators of tariff rates. Similarly, the regressor of interest "TARIFFVOL" in model (1) is obtained as follows: $\text{TARIFFVOL} = \text{sign}(\text{TARIFFVOL1}) * \log(1 + |\text{TARIFFVOL1}|)$, where $|\text{TARIFFVOL1}|$ refers to the absolute value of the variable " TARIFFVOL1 ", which is in fact the tariff volatility indicator computed using the approach proposed by Bekaert et al. (2006). We apply this formula to each of the three indicators of tariff volatility. Note that we have applied the natural logarithm to the real per capita income and the population size variables, in order to reduce their skewness.

3. Data analysis

Statistics reported in Appendix 2a show that, over the full sample of 163 countries, the minimum values of all tariffs indicators and tariff volatility variables are 0. The average tariffs on all products range between 0 and 40.7%, while the average tariffs on manufactured products on the one hand, and primary products on the other hand, range respectively between 0 and 44.4%, and 0 and 62%. It, therefore, appears that on average, tariffs on primary products are higher than tariffs on manufactured products. Tariffs volatility is, on average, much higher for primary products than for manufactured products. We present in Figures 1 to 6 an insight into the correlation between tariffs volatility indicators, and tariffs rates over all products, as well as over manufactured products (as a group), and primary products (as another group). Figure 1 shows the correlation pattern (in the form of scatter plot) between tariff volatility and tariff variables when these variables have not been transformed using the Yeyati et al. (2007) method. It clearly appears that while the correlation is negative for manufactured products, it remains unclear for the group of 'all products' and the group of 'primary products'. Additionally, the distribution of data is highly skewed. Figures 2 to 6 present the correlation pattern between transformed variables over the full sample (see Figure 2) as well as over four sub-samples (see Figures 3 to 6). These sub-samples are constructed, using the classification of countries by the World Bank. They include respectively for Figures 2 to 6, low-income countries (LICs), lower-middle income countries (LMICs), upper-middle income countries (UMICs) and high-income countries (HICs). The list of countries included in each of these sub-samples is provided in Appendix 3b. Figure 2 shows clearly a negative correlation pattern between tariff volatility and tariff, including for the 'all products' as well as for the two other groups of products. Similar negative correlation patterns are observed in Figure 4 (for LMICs), Figure 5 (for UMICs) and Figure 6 (for HICs) with the caveat that in Figure 6, the correlation pattern between tariff and tariff volatility for primary products is unclear (i.e., it is neither positive nor negative). However, for LICs, there is no clear pattern for the correlation between tariff volatility and tariff, regardless of the group of products considered.

4. Econometric approach

We start by presenting in Appendix 3 the within variation and between variation for all variables contained in model (1). It appears that the dependent variable, i.e., variables measuring tariffs exhibit a higher between variation compared to the within variation. Many other regressors (such as the real per capita income, the institutional and governance quality, the population size and the terms of trade) also display a higher between variation than the within variation. Even though other regressors, including the indicators of tariff volatility show a within variation higher than the between variation, the estimation of model (1) using the fixed effects estimator would capture the association between the within-country variations in countries' characteristics with the within-country changes in tariffs. This approach would disregard the between-country variations of many variables (of which the dependent variable). As a result, the use of the fixed effects estimator would result in a substantial efficiency loss of the estimates (e.g., Cameron and Trivedi, 2010). Alternatively, the random effects estimator can be a valuable candidate (compared to the pooled ordinary least squares that does not take into account countries' time invariant specific effects). However, this estimator suffers from not being able to address cross-sectional dependence along with heteroscedasticity and autocorrelation in the error term. In this context,

we follow authors such as Can and Gozgor (2018), Meinhard and Portrafke (2012) and Gnangnon (2020), and use the Feasible Generalized Least Squares (FGLS) estimator with panel-specific AR(1) (i.e., autocorrelation of order 1 for each panel) which helps overcome the limits of the random effects estimator. Overall, our primary estimator is the FGLS estimator. Nonetheless, we also present the results of the estimation of model (1) (where the dependent variable is "TARIFFALL") over the full sample³ using the within fixed effect estimator ("FE"), where standard errors have been corrected using the Driscoll and Kraay (1998) technique.

As our dataset covers 23 years (i.e., the period 1995-2017), one could argue that the estimated relationship (using the FGLS and the FE estimators) between regressors, in particular our variable of interest (i.e., tariff volatility), and the dependent variable might be spurious. However, Phillips and Moon (1999) have noted that when there is no cointegration relationship between two variables (a regressor and a dependent variable) in a panel dataset, and when the error term is integrated of order 1 (i.e., it is $I(1)$), the fixed effects estimator can consistently estimate the relationship between these two variables. This is because averaging over all countries in the panel dataset will attenuate the noise in the relationship, as well as the noise in the coefficient of the regressor. The estimated coefficient of the regressor, also dubbed the "long-run average (LRA) regression coefficient", represents the ratio of the average across countries of the long-run covariance between the regressor and the dependent variable to the average across countries of the long-run variance of the regressor. This coefficient (LRA) is different from what is also referred to as the "average long-run regression (ALR) coefficient", which is the estimated coefficient obtained by the average across groups of the individual (each country) regression coefficients. In the present analysis, our regressor of key interest (i.e., the tariff volatility indicator) is de facto stationary, i.e., it does not contain a unit root. Thus, even though the dependent variable (i.e., the tariff variable) and other regressors in the model might be non-stationary (i.e., $I(1)$) so that the error term is $I(1)$, there would not be any cointegration relationship between tariff volatility and tariffs. In light of the foregoing, the use of the FGLS (or FE) estimator will consistently estimate the coefficient of the tariff volatility variable in the relationship between tariff volatility and tariff rates.

Unless otherwise stated, Tables 1 to 3 present the outcomes of the estimations of different specifications of model (1) where each of the three indicators of tariff rates, and each of the three indicators of tariff volatility are used. Column [1] of Table 1 reports the estimates arising from the estimation of model (1) (where the dependent variable is "TARIFFALL") over the full sample using the FE estimator. Columns [2] to [4] of Table 1 report the estimations' outcomes of model (1) over the full sample. For robustness check of these outcomes, we estimate three other specifications of model (1) that include "TARIFFVOL" as the tariff volatility indicator (measured by each of the three indicators described above), but where the dependent variable "TARIFF" is replaced with the variable "TP", which represents the trade freedom score of a given country. "TP" acts here as an indicator of overall trade policy that includes both tariffs and non-tariff barriers. As noted in Appendix 1, this indicator is a component of the Economic Freedom Index developed by the Heritage Foundation: it is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. Values of "TP" range between 0 to

³ Results based on the FE estimator over the different sub-samples considered below could be obtained upon request.

100, with higher values indicating lower trade barriers, i.e., higher trade liberalization, and lower values reflecting rising trade protectionism. As this variable contains zero values, it has also been transformed using the approach described above: $TP = \text{sign}(TP1) * \log(1 + |TP1|)$, where $|TP1|$ refers to the absolute value of the variable "TP1", with "TP1" being the overall trade policy indicator extracted from the Heritage Foundation⁴. Columns [5] to [7] of Table 1 report the outcomes of the estimation of the three specifications of model (1) over the full sample, using "TP" as the dependent variable.

In Tables 2 and 3, we present for different sub-samples (LICs, LMICs, UMICs and HICs), the estimates stemming from the estimation of three model specifications where the variable "TARIFF" and "TARIFFVOL" are measured by their respective three indicators. Columns [1] to [3], and columns [4] to [6] of Table 2 present these estimations' results respectively over the sub-samples LICs and LMICs. Similarly, columns [1] to [3], and columns [4] to [6] of Table 3 report the estimates respectively over the sub-samples UMICs and HICs.

5. Estimations' outcomes

Estimates provided in columns [1] to [4] of Table 1 show negative and significant coefficients (at the 1% level) for all tariff volatility variables. Interestingly the coefficients of the variable "TARIFFALL" in column [1] (that shows results based on the FE estimator) and in column [2] (that shows results based on the FGLS) of Table 1 are similar. We deduce that tariff volatility over years t-5 to t-1 induces greater tariff liberalization in year t. Focusing on the FGLS-based outcomes, we conclude that a one percent increase in the volatility of tariffs on all products is associated with a fall in tariff rates on all products by 0.3 percent (see results in column [2]). Considering results in column [3] of Table 1 concerning manufactured products, we find that a one percent increase in the volatility of tariffs induces a decline in tariff rates by 0.5 per cent. Finally results in column [4] of Table 1 concerning primary products show that a one percent increase in the volatility of tariffs is associated with a decline in tariff rates by 0.31 per cent. It appears from these outcomes that tariff volatility induces a greater extent of tariff liberalization for manufactured products than for primary products.

Results in columns [5] to [7] (which are based on the variable "TP" as the measure of overall trade policy) indicate that tariff volatility (irrespective of whether it is related to all products, manufactured products, or primary products) always induces greater trade policy liberalization: the coefficients of the tariff volatility variables are all significant at least at the 5% level. A one percent increase in the volatility of tariffs on all products generates a rise in the index of trade policy by 0.023 percent (see results in column [5] of Table 1). A one percent increase in the volatility of tariffs on manufactured products induces a rise in the index of trade policy by 0.014 percent (see results in column [5] of Table 1). Finally, a one percent increase in the volatility of tariffs on primary products induces a rise in the index of trade policy by 0.0346 percent (see results in column [6] of Table 2). Here, the volatility of tariffs on primary products generates a greater extent of trade policy liberalization than the volatility of tariffs on manufactured products. Results concerning control variables across columns [2] to [7] are quite similar, and in particular go in the same direction, although the magnitudes of the coefficients are different across columns of the Table. We observe that higher real per capita income induces greater tariff liberalization (or greater overall trade policy

⁴ See the dataset on trade freedom score online at: <https://www.heritage.org/index/explore>

liberalization). At the same time, better institutional quality, the rise in the population size and improvements in terms of trade are associated with greater tariff liberalization (or greater overall trade policy liberalization). However, economic growth rates do not appear to be significantly associated with tariff liberalization.

Results in Table 1 focus on LICs and LMICs. It is observed for LICs that neither the volatility of tariffs on all products, nor the volatility of tariffs on manufactured products exerts a significant effect (at the 10% level) on tariff rates applied respectively on all products, and manufactured products. Conversely, the volatility of tariffs on primary products influences negatively and significantly (at the 1% level) tariffs on primary products. A one percent increase in the volatility of tariffs on primary products is associated with a decline in tariff rates on these products by 0.357 percent (see results in column [3] of Table 2). Among control variables, we find that as their real per capita income rises, countries tend to increase their tariff rates on all products. However, a rise in the real per capita income is associated with liberalization of tariffs on primary products, but does not significantly influence tariffs on manufactured products. While economic growth rate and the terms of trade do not affect significantly tariff rates across columns [1] to [3] of Table 2, we obtain that an improvement in the institutional and governance quality, and the rise in the population size contribute to lowering tariffs on all products, as well as on manufactured products and primary products in LICs.

For LMICs, regardless of the group of products considered, tariff volatility is always associated with a greater extent of tariff liberalization. Interestingly, the extent of liberalization of tariffs on manufactured products is more than the triple that of tariffs on primary products, further to a rise in the volatility of the relevant tariffs. A one percent increase in the volatility of tariffs on all products is associated with a fall in tariff rates on these products by 0.18 percent (see results in column [4] of Table 2). Likewise, a one percent increase in the volatility of tariffs on manufactured products induces a 0.79 percent decline in tariff rates on these products (see results in column [5] of Table 2). Finally, a one percent increase in the volatility of tariffs on primary products leads to a 0.22 percent decline in tariff rates on these products (see results in column [6] of Table 2). As for control variables, the improvement in the real per capita income induces countries to liberalize tariffs on all products, and particularly on manufactured products, but not on primary products (as here the coefficient of the real per capita income is not significant at the 10% level). In contrast with the population size that is significantly associated with higher tariff rates, the economic growth does not exert a significant effect (at the conventional level) on tariff rate, regardless of the group of products considered. Finally, the terms of trade exert no significant influence on tariffs on all products, or tariffs on primary products, but are associated with a greater extent of liberalization of tariffs on manufactured products.

The volatility of tariff rates is associated with a greater extent of tariff liberalization in UMICs and HICs, regardless of the group of products to which the tariff rates apply. For UMICs, the magnitude of the negative tariff rates effect (-0.420) of the volatility of tariffs on manufactured products more than triple the magnitude of the negative effect (-0.125) of tariff volatility on tariff rates for primary products. On another note, a one percent increase in the volatility of tariffs on all products is associated with liberalization of tariffs on all products by 0.395 percent (see results in column [1] of Table 3).

For HICs, the magnitude of the negative tariff rates effect (-0.655) of the volatility of tariffs on manufactured products more than double the magnitude of the negative effect (-0.273) of tariff

volatility on tariff rates for primary products. Incidentally, a one percent increase in the volatility of tariffs on all products is associated with liberalization of tariffs on all products by 0.524 percent (see results in column [4] of Table 3).

Regarding control variables across all columns of Table 3, we observe that tariff rates increase as the real per capita income rises. This means that among UMICs and HICs, countries tend to increase their tariff rates on imported products as they enjoy a higher real per capita income. In UMICs, higher economic growth rates generate a higher extent of tariff liberalization on all products, as well as manufactured products, but exerts no significant effect (at the conventional levels) on tariffs on primary products. Conversely, for HICs, a higher economic growth tends to be associated with higher tariff rates only for manufactured products, but not for the groups of all products, and primary products. In both UMICs and HICs, an increase in the population size induces a greater extent of tariff liberalization regardless of the group of products to which the tariff rates apply. Finally, terms of trade improvements are significantly (at the 5% level) associated with an increase in tariff rates on all products, but do not affect tariff rates on manufactured products, or on primary products. At the same time, in HICs, terms of trade improvements result in a higher extent of tariff liberalization, be the latter on all products, manufactured products, and primary products.

Finally, considering the case of all products, we find that tariff volatility induces the highest extent of tariff liberalization in HICs, followed in the descending order by UMICs, and LMICs.

6. Further analysis

Developing countries face serious challenges in their effort to integrate into the global trading system. To help them in this effort, the Members of the WTO have set up the AfT Initiative (at the 2005 WTO Hong Kong Ministerial Conference. Paragraph 57 of the Hong Kong Ministerial Declaration (see WTO, 2005) states clearly the objective of this initiative. The latter aims to "help developing countries, particularly LDCs build the supply-side capacity and trade-related infrastructure that they need to assist them to implement and benefit from WTO Agreements and more broadly to expand their trade". AfT flows are an important part of the overall development aid (i.e., official development aid - ODA) flows traditionally supplied by developed countries (the so-called donor-countries) to developing countries with a view to helping them to promote economic growth and development (e.g., Gnangnon, 2019a). One component of AfT flows that is worth introducing in the present analysis is the AfT flows allocated to trade policy and regulation. This type of AfT flows purports to facilitate the movement of cross-border trade flows, by enhancing the border and transport efficiency⁵. More importantly, these capital flows are used to enhance the capacity of policymakers in recipient-countries to negotiate and implement multilateral trade agreements, as well as to elaborate and implement trade policies that help their economies better integrate into the global trading system, while being also consistent with the countries' commitments at the WTO (and more generally to WTO rules). Finally, AfT flows for trade policy and regulation help to compensate domestic losers from trade policy liberalization of the adverse effects of trade liberalization. Several studies have noted the effectiveness of this type of AfT flows in enhancing recipient-countries' exports (e.g., Busse et al.,

⁵ This involves the streamlining of time, costs, and number of documents required for export and import procedures.

2012; Calì and TeVelde, 2011; Limao and Venables, 2001; Portugal-Perez and Wilson, 2012; Wilson et al., 2003, 2005). In a recent study, Gnangnon (2019b) has shown that AfT related to trade policy and regulation reduces tariff policy volatility in recipient-countries, and the size of this effect is stronger in countries with better institutional and governance quality. Building on this work, we investigate in the present analysis, whether AfT flows for trade policy and regulation matter for the effect of tariff volatility on tariff policy. To respond to this question, we estimate three different specifications of model (1) - that is, with each indicators of tariffs rates and the associated relevant tariff volatility - in which we introduce both the variable capturing AfT flows for trade policy and regulation (denoted "AfTPOL") along with its interaction with the relevant indicator of tariff volatility. Note that the "AfTPOL" variable has also been transformed using the method of Yeyati et al. (2007), given that it is highly skewed, and contains negative values (see Appendix 1 for further details). The list of AfT recipient-countries in this analysis is reported in Appendix 3b. The outcomes of the estimation of these specifications of model (1) by the FGLS estimator are presented in Table 4. Results in column [1] of Table 4 suggest that at the conventional levels, the coefficient of the interaction variable is not significant. This suggests that, on average over the sub-sample of AfT recipient-countries, the effect of the volatility of tariff on all products on the tariff policy concerning all products does not depend on the amount of AfT related to trade policy and regulation that accrues to recipient-countries. Likewise, on average over the sub-sample of AfT recipient-countries, the coefficient of the interaction variable in column [2] of Table 4 is not statistically significant at the 10% level, while the coefficient of the relevant tariff volatility variable is statistically significant only at the 10% level. On the basis of this result, we will be tempted to deduce that, at the 5% level, the effect of the volatility of tariff on manufactured products on the tariff policy concerning such products does not depend on the amount of AfT flows for trade policy and regulation that accrue to recipient-countries. For the rest of the analysis, and for the sake of simplicity, we use sometimes the expression "tariff volatility" to refer to "volatility of tariff on primary products", and the word "tariffs" to refer to "tariff rates on primary products". The outcomes in column [3] of Table 4 indicate that the interaction variable "[TARIFFPRIMVOL_{t-1}]*[AfTPOL_{t-5}]" holds a positive and significant coefficient at the 1% level, while the coefficient of the variable [TARIFFPRIMVOL_{t-1}] is negative and significant at the 1% level. The combination of the two results in column [3] of Table 4 show that the effect of tariff volatility on tariff rates is positive, and increases with the amount of AfT for trade policy and regulation only when the such AfT flows exceed a certain amount. Thus, tariff volatility leads to a greater extent of tariff liberalization for lower amounts of AfT flows related to trade policy and regulation: the extent of tariff liberalization increases as the amount of AfT for trade policy and regulation declines. In the meantime, for higher amounts of AfT flows related to trade policy and regulation, tariff volatility induces higher tariffs, and the extent of the rises in tariff rates goes up as the amount of AfT for trade policy and regulation rises. In other words, over AfT recipient-countries, tariff volatility and AfT flows related to trade policy and regulation are substitutable in influencing tariffs for lower AfT flows, but they are complementary for higher amounts of this type of AfT flows.

As this analysis of results in column [3] of Table 4 relies on the 'average effects' across AfT recipient-countries, we find useful to perform a graphical analysis on the extent to which AfT flows for trade policy and regulation matters for the effect of tariff volatility on tariffs. To that effect, Figure 7 shows, at the 95 per cent confidence intervals, the marginal impact of the volatility

of tariff on primary products on tariffs on these products, for various amounts of AfT allocated to trade policy and regulation. It shows that this marginal impact is always negative, and increases as the amount of AfT allocated to trade policy and regulation rises. This suggests at least that whatever the amount of AfT for trade policy and regulation, tariff volatility is always associated lower tariffs on primary products. Additionally, the extent of reduction on these tariffs varies with the amount of AfT allocated to trade policy and regulation that benefit countries. However, this marginal impact is not always statistically significant, notably for amounts of AfT allocated to trade policy and regulation higher than US\$30.334 million [= exponential (17.22779⁶)]. Note that this threshold of AfT flows related to trade policy and regulation falls within the range of values of these AfT flows (values of the latter range between US\$ -28781 and US\$ 235 million - see Appendix 2a). We conclude that tariff volatility induces greater tariff liberalization (i.e., a greater extent of tariff reduction) for AfT amounts lower than US\$30.334 million: the lower the amounts of AfT flows, the higher is the extent of tariff liberalization induced by tariff volatility. The latter exerts no significant effect on tariff rates applied on primary products for amounts of these AfT flows higher than US\$30.334 million. These outcomes confirm our previous findings, but at the same time, prompt us to examine the extent to which the effect of AfT allocated to trade policy and regulation on tariffs applied on primary products varies with the degree of the volatility of tariffs on these products. Therefore, we display in Figure 8, the development of the marginal impact of AfT allocated to trade policy and regulation on the tariffs applied on primary products, for varying levels of the volatility of tariffs on primary products. Figure 8 shows that this marginal impact is always statistically significant, takes positive as well as negative values, and rises as the level of tariff volatility increases. In particular, it becomes positive for degrees of tariff volatility higher than 1.43 [= exponential (0.3610384⁷)] (note that values of volatility of tariffs on primary products range between 0 and 12.3). As a result, in countries that experience a tariff volatility level lower than 1.43, AfT flows are associated with a greater extent of tariff liberalization, and for these countries, the lower the degree of tariff volatility, the greater is the extent of tariff liberalization due to AfT flows allocated to trade policy and regulation. On the other hand, AfT flows related to trade policy and regulation are associated with a rise in tariffs on primary products in countries that face a tariff volatility level higher than 1.43. In this group of countries, the higher the degree of tariff volatility, the greater is the extent of the positive effect of AfT flows on tariffs applied on primary products. Thus, for low levels of tariff volatility, AfT for trade policy and regulation leads to a greater extent of tariff liberalization, while for higher degrees of volatility of tariffs on primary products, AfT allocated to trade policy and regulation results in higher tariffs on these products. Overall, if AfT flows for trade policy and regulation were to achieve tariff liberalization of primary products, such an objective was not fully reached because of the high levels of the volatility of tariffs applied to primary products.

⁶ Note that this number is extracted from the Stata software when constructing Figure 7.

⁷ Note that this number is extracted from the Stata software when constructing Figure 8.

7. Conclusion

This article has investigated the effect of tariff volatility on tariff rates over three groups of products, including 'all products', 'manufactured products' and 'primary products'. The analysis has been conducted using a large panel dataset (although unbalanced) covering 163 countries over the period 1995-2017. The feasible generalized least squares approach has been used, and findings suggest that regardless of the group of products considered, tariff volatility is negatively and significantly associated with tariffs over the full sample, as well as over the sub-samples of LMICs, UMICs, and HICs. However, the magnitude of these negative effects varies across groups of products, as well as over sub-samples. Interestingly, the highest extent of tariff liberalization further to a preceding period of tariff volatility takes place in HICs, followed by UMICs, and LMICs. For LICs, it appears that tariff volatility influences significantly (although negatively) tariff rates only for primary products, as for the groups 'all products' and 'manufactured products', there is no significant effect (at the conventional levels) of tariff volatility on tariff rates. Overall, the analysis suggests that tariff volatility is associated with tariffs liberalization, except for LICs for which this finding applies only to primary products.

The analysis has gone deeper to examine whether AfT related to trade policy and regulation matters for the effect of tariff volatility on tariff rates. Results suggest that at the 10% level, and on average over the sub-sample of AfT recipient-countries, the effect of tariff volatility on tariff rates appears to be conditional on the amounts of AfT flows only for primary products. For the two other groups (i.e., 'all products' and 'manufactured products'), the effect of tariff volatility on tariffs does not depend on the amounts of AfT related to trade policy and regulation received by recipient-countries. Specially, concerning 'primary products', we find the existence of a substitutability concerning the effect of tariff volatility and the effect of these AfT flows on tariff rates: for lower amounts of AfT flows related to trade policy and regulation, tariff volatility induces a greater extent of tariff liberalization, while for higher amounts of these AfT flows, tariff volatility results in higher tariff rates. In light of these quite surprising outcomes, we have furthered the analysis by investigating the extent to which the effect of AfT flows related to trade policy and regulation on tariff rates applied to primary products depends on the degree of tariff volatility. Results have shown that the higher the amounts of these AfT flows, the greater is the magnitude of the negative effect of tariff volatility on tariffs applied to primary products (i.e., the greater is the positive effect of tariff volatility on the extent of the liberalization of tariff on primary products).

From a policy perspective, this analysis shows that in light of the adverse economic (including trade) effects of the uncertainty that could arise from trade policy volatility, governments of countries that experience such volatility will end up liberalizing their trade policies, including their tariffs so as to revitalize economic growth and economic activities. At the same time, AfT flows related to trade policy and regulation will be effective in reducing tariffs on primary products only in recipient-countries that endeavour to avoid significant variations of these tariffs over time. The stability (or less volatility) of tariffs, including on primary products, enhances the stability and predictability of the business environment, and encourages the development of international trade activities, notably (in the case of primary products) for investors in trading partners that use primary commodities as inputs in their production processes.

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TABLES

Table 1: Effect of tariff volatility on tariffs over the full sample / and Robustness check over the full sample using trade policy ("TP")

Estimators: FE and FGLS with common AR(1) coefficient for all panels

	Full sample				Full sample		
	FEDK	FGLS			FGLS		
Variables	TARIFFALL	TARIFFALL	TARIFFMAN	TARIFFPRIM	TP	TP	TP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TARIFFALLVOL _{t-1}	-0.237*** (0.0638)	-0.298*** (0.0375)			0.0226*** (0.00850)		
TARIFFMANVOL _{t-1}			-0.488*** (0.0479)			0.0142** (0.00587)	
TARIFFPRIMVOL _{t-1}				-0.305*** (0.0343)			0.0346*** (0.0107)
Log(GDPC) _{t-5}	-0.650*** (0.103)	-0.143*** (0.0119)	-0.157*** (0.0117)	-0.141*** (0.0157)	0.0363*** (0.00337)	0.0367*** (0.00325)	0.0356*** (0.00339)
GROWTH _{t-5}	0.00230* (0.00129)	0.000544 (0.000809)	0.000268 (0.000705)	-0.000155 (0.000834)	0.000221 (0.000249)	0.000229 (0.000243)	0.000250 (0.000252)
INST _{t-5}	-0.00282 (0.0170)	-0.0898*** (0.00694)	-0.0895*** (0.00814)	-0.0788*** (0.00983)	0.0228*** (0.00229)	0.0225*** (0.00219)	0.0232*** (0.00229)
Log(POP)	-0.455*** (0.117)	-0.0777*** (0.00373)	-0.0496*** (0.00454)	-0.0886*** (0.00713)	0.00151 (0.00146)	0.00149 (0.00144)	0.00201 (0.00144)
Log(TERMS)	-0.256*** (0.0397)	-0.104*** (0.0232)	-0.115*** (0.0232)	-0.0108 (0.0289)	0.0469*** (0.00735)	0.0450*** (0.00728)	0.0456*** (0.00733)
Constant	14.65*** (2.346)	4.604*** (0.121)	4.185*** (0.119)	5.034*** (0.183)	3.858*** (0.0354)	3.856*** (0.0349)	3.853*** (0.0354)
Observations - Countries	1,726 - 163	1,726 - 163	1,712 - 162	1,726 - 163	1,834 - 157	1,834 - 157	1,820 - 156
Within R-squared	0.2360						
Pseudo R-squared		0.6449	0.6685	0.5356	0.5945	0.5909	0.5988

Note: * p -value<0.1; ** p -value<0.05; *** p -value<0.01. Robust Standard Errors are in parenthesis. The Pseudo R^2 has been calculated for FGLS-based regressions, as the correlation coefficient between the dependent variable and its predicted values. Time dummies have been included in the FGLS-based regressions

Table 2: Effect of tariff volatility on tariffs over the sub-samples of LICs and LMICs*Estimator:* FGLS with common AR(1) coefficient for all panels

	LICs			LMICs		
Variables	TARIFFALL	TARIFFALL	TARIFFALL	TARIFFALL	TARIFFMAN	TARIFFPRIM
	(1)	(2)	(3)	(4)	(5)	(6)
TARIFFALLVOL _{t-1}	0.0263			-0.176***		
	(0.0900)			(0.0388)		
TARIFFMANVOL _{t-1}		-0.105			-0.792***	
		(0.0893)			(0.102)	
TARIFFPRIMVOL _{t-1}			-0.357**			-0.220***
			(0.141)			(0.0549)
Log(GDPC) _{t-5}	0.156**	-0.0151	-0.238***	-0.117**	-0.127**	-0.0245
	(0.0791)	(0.0873)	(0.0914)	(0.0523)	(0.0554)	(0.0646)
GROWTH _{t-5}	0.00117	-0.000285	0.00320	-6.05e-05	0.00148	0.000578
	(0.00136)	(0.00183)	(0.00313)	(0.00255)	(0.00247)	(0.00312)
INST _{t-5}	-0.146***	-0.0961***	-0.135***	0.00658	-0.0241	-0.0387
	(0.0175)	(0.0254)	(0.0181)	(0.0211)	(0.0184)	(0.0308)
Log(POP)	-0.0407*	-0.114***	-0.160***	0.0836***	0.0695***	0.0776***
	(0.0232)	(0.0336)	(0.0166)	(0.0184)	(0.0153)	(0.0193)
Log(TERMS)	0.0183	-0.00649	0.0781	-0.0714	-0.140**	0.0983
	(0.0416)	(0.0443)	(0.0627)	(0.0641)	(0.0625)	(0.0697)
Constant	1.824**	4.175***	6.270***	2.055***	2.299***	1.471**
	(0.738)	(0.868)	(0.692)	(0.492)	(0.486)	(0.621)
Observations - Countries	169 - 20	169 - 20	169 - 20	393 - 41	393 - 41	393 - 41
Pseudo R-squared	0.5568	0.5965	0.6285	0.3492	0.4560	0.3655

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parenthesis. The Pseudo R² has been calculated for FGLS-based regressions, as the correlation coefficient between the dependent variable and its predicted values. Time dummies have been included in the FGLS-based regressions.

Table 3: Effect of tariff volatility on tariffs over the sub-sample of UMICs and HICs
Estimator: FGLS with common AR(1) coefficient for all panels

	UMICs			HICs		
Variables	TARIFFALL	TARIFFMAN	TARIFFPRIM	TARIFFALL	TARIFFMAN	TARIFFPRIM
	(1)	(2)	(3)	(4)	(5)	(6)
TARIFFALLVOL _{t-1}	-0.395***			-0.524***		
	(0.0784)			(0.0943)		
TARIFFMANVOL _{t-1}		-0.420***			-0.655***	
		(0.0978)			(0.0962)	
TARIFFPRIMVOL _{t-1}			-0.125**			-0.273***
			(0.0516)			(0.0756)
Log(GDPC) _{t-5}	0.431***	0.376***	0.301***	0.0904***	0.0598**	0.184***
	(0.0414)	(0.0500)	(0.0726)	(0.0283)	(0.0266)	(0.0293)
GROWTH _{t-5}	-0.00403**	-0.00517***	-0.000472	0.00113	0.00297**	-0.000703
	(0.00158)	(0.00153)	(0.00224)	(0.00115)	(0.00118)	(0.00160)
INST _{t-5}	-0.0568***	-0.0307	-0.0819***	-0.128***	-0.112***	-0.117***
	(0.0206)	(0.0211)	(0.0244)	(0.00794)	(0.0101)	(0.0136)
Log(POP)	-0.0795***	-0.0934***	-0.127***	-0.0816***	-0.0670***	-0.0802***
	(0.00971)	(0.0121)	(0.0160)	(0.00668)	(0.00843)	(0.00950)
Log(TERMS)	0.119**	0.0506	0.0574	-0.189***	-0.201***	-0.375***
	(0.0524)	(0.0561)	(0.0749)	(0.0510)	(0.0451)	(0.0736)
Constant	-0.0510	0.675	1.723**	2.387***	2.232***	1.662***
	(0.390)	(0.472)	(0.699)	(0.289)	(0.285)	(0.283)
Observations - Countries	462 - 45	462 - 45	462 - 45	702 - 57	688 - 57	702 - 57
Pseudo R-squared	0.5516	0.5530	0.5532	0.6375	0.6388	0.5638

Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parenthesis. The Pseudo R² has been calculated for FGLS-based regressions, as the correlation coefficient between the dependent variable and its predicted values. Time dummies have been included in the FGLS-based regressions.

Table 4: Effect of tariff volatility on tariff for varying amounts of AfT_over the full sample
Estimator: FGLS with common AR(1) coefficient for all panels

Variables	TARIFFALL	TARIFFMAN	TARIFFPRIM
	(1)	(2)	(3)
[TARIFFALLVOL _{t-1}]*[AfTPOL _{t-5}]	-0.0151		
	(0.0225)		
[TARIFFMANVOL _{t-1}]*[AfTPOL _{t-5}]		-0.00180	
		(0.0206)	
[TARIFFPRIMVOL _{t-1}]*[AfTPOL _{t-5}]			0.0577***
			(0.0215)
TARIFFALLVOL _{t-1}	-0.362		
	(0.305)		
TARIFFMANVOL _{t-1}		-0.551*	
		(0.282)	
TARIFFPRIMVOL _{t-1}			-1.192***
			(0.298)
AfTPOL _{t-5}	-0.000251	-0.00496	-0.0147***
	(0.00341)	(0.00332)	(0.00469)
Log(GDPC) _{t-5}	-0.188***	-0.162***	-0.261***
	(0.0104)	(0.0110)	(0.0136)
GROWTH _{t-5}	0.000928	-0.00110	0.00124
	(0.000971)	(0.000921)	(0.00124)
INST _{t-5}	-0.0247***	-0.0369***	-0.0388***
	(0.00930)	(0.00879)	(0.0129)
Log(POP)	-0.0427***	-0.0507***	-0.0701***
	(0.00696)	(0.00813)	(0.0117)
Log(TERMS)	0.0428	0.00462	0.0978***
	(0.0278)	(0.0281)	(0.0366)
Constant	4.195***	4.213***	5.303***
	(0.143)	(0.163)	(0.231)
Observations - Countries	840 - 112	840 - 112	840 - 112
Pseudo R-squared	0.4743	0.4986	0.4851

*Note: *p-value<0.1; **p-value<0.05; ***p-value<0.01. Robust Standard Errors are in parenthesis. The Pseudo R² has been calculated for FGLS-based regressions, as the correlation coefficient between the dependent variable and its predicted values. Time dummies have been included in the FGLS-based regressions.*

Figures

Figure 1: Correlation pattern between Tariffs volatility and Tariffs_Over the full sample

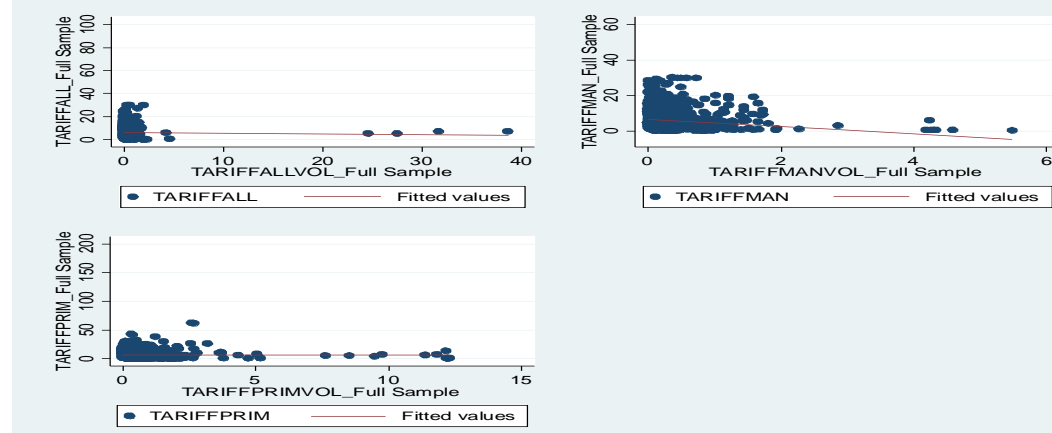


Figure 2: Correlation pattern between Tariffs volatility and Tariffs_Over the full sample

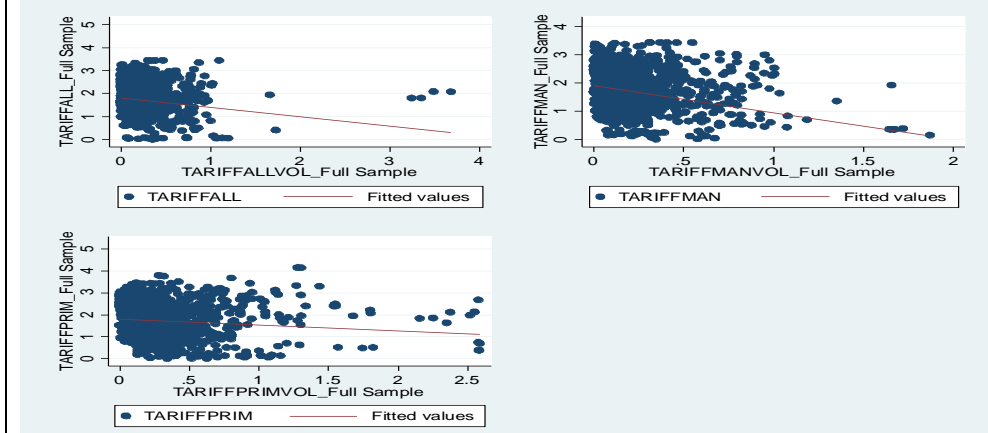


Figure 3: Correlation pattern between Tariffs volatility and Tariffs_Over the sub-sample of LICs

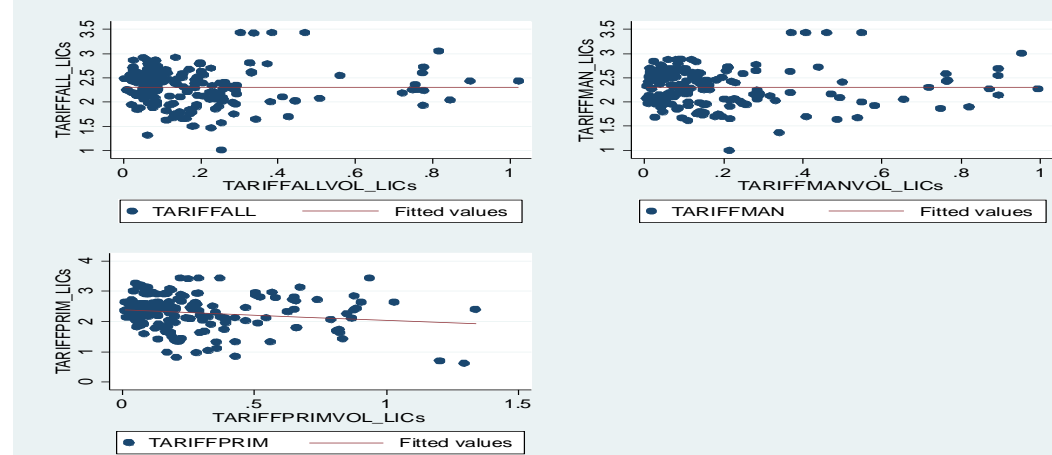
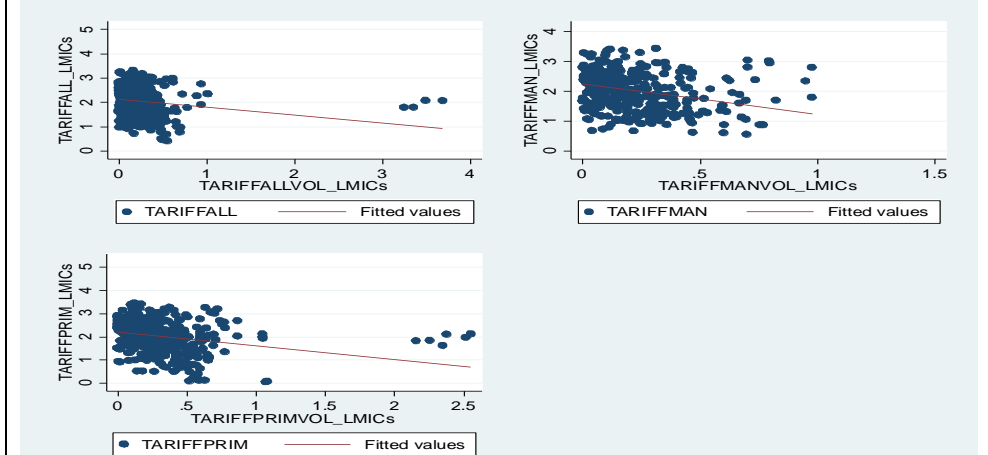


Figure 4: Correlation pattern between Tariffs volatility and Tariffs_Over the sub-sample of LMICs



Source: Author - Note: The variables in Figure 1 have not been transformed using the method of Yeyati et al. (2007), while the variables in Figures 2 to 6 have been transformed using the method of Yeyati et al. (2007).

Figures (Continued)

Figure 5: Correlation pattern between Tariffs volatility and Tariffs_Over the sub-sample of UMCs

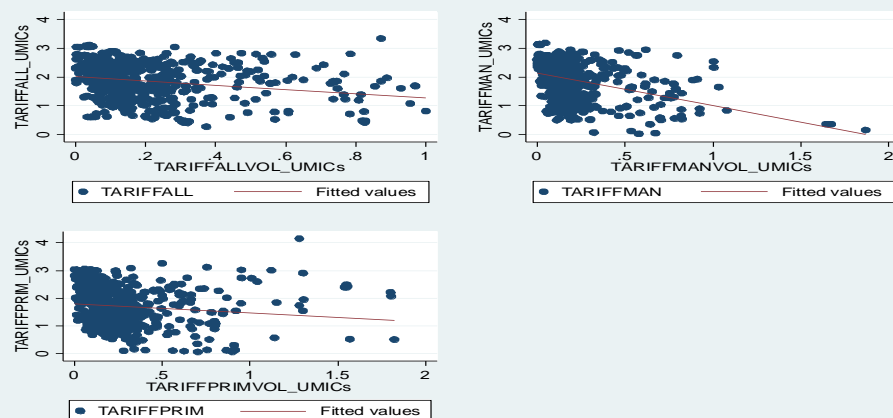


Figure 6: Correlation pattern between Tariffs volatility and Tariffs_Over the sub-sample of HICs

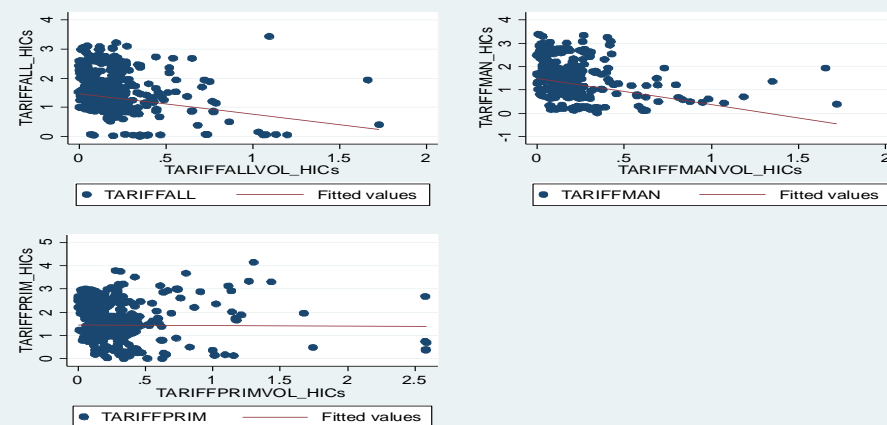


Figure 7: Marginal Impact of "TARIFFPRIMVOL" on "TARIFFPRIM", for varying amounts of Aft allocated for trade policy and regulation

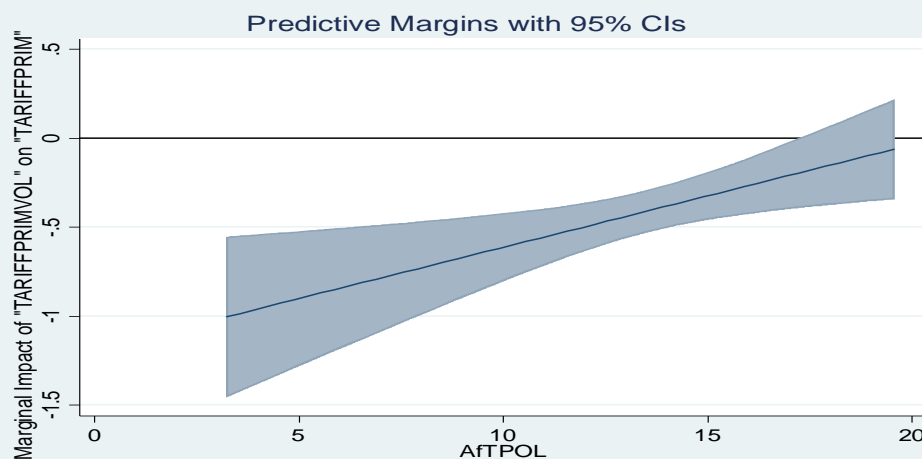
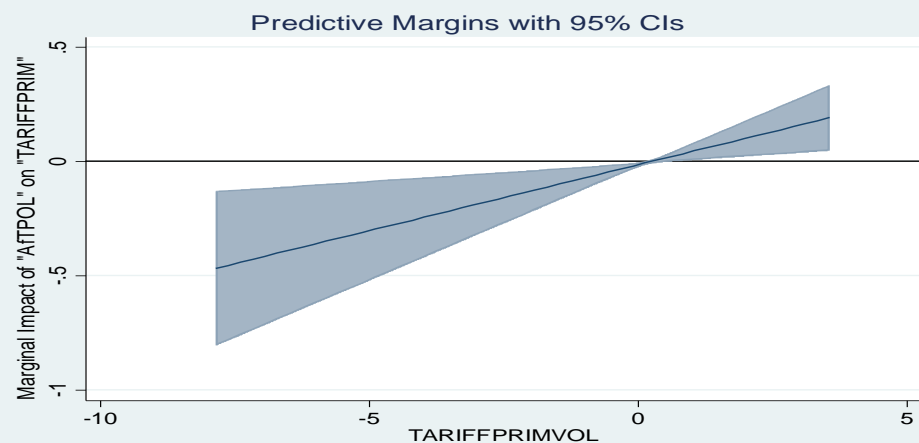


Figure 8: Marginal Impact of "AftPOL" on "TARIFFPRIM", for varying degrees of the volatility of tariffs on primary products



Source: Author - Note: The variables have been transformed using the method of Yeyati et al. (2007). For Figures 7 and 8, the variables "TARIFFALLVOL" has been lagged at $t-1$, while the variable "AftPOL" has been lagged at year $t-5$.

APPENDICES

Appendix 1: Definition and Source of variables

Variables	Definition	Sources
TARIFFALL	<p>The variable "TARIFFALL" is the transformation of the variable measuring the tariff rate, applied, weighted mean for all products (%), the latter being denoted "TARIFFALL1". In fact, as the variable "TARIFFALL1" contains many zeros, we cannot apply the natural logarithm to it so as to reduce its high skewness, as observed in Figure 1. The transformed variable "TARIFFALL" has been obtained using the following formula (see Yeyati et al. 2007):</p> $\text{TARIFFALL} = \text{sign}(\text{TARIFFALL1}) * \log(1 + \text{TARIFFALL1}),$ <p>where TARIFFALL1 refers to the absolute value of the variable "TARIFFALL1".</p>	Author's calculation based on data on the variable "TARIFFALL1" extracted from the World Development Indicators (WDI) of the World Bank.
TARIFFMAN	<p>The variable "TARIFFMAN" is the transformation of the variable measuring the tariff rate, applied, weighted mean for manufactured products (%), the latter being denoted "TARIFFMAN1". In fact, as the variable "TARIFFMAN1" contains many zeros, we cannot apply the natural logarithm to it so as to reduce its high skewness, as observed in Figure 1. The transformed variable "TARIFFMAN" has been obtained using the following formula (see Yeyati et al. 2007):</p> $\text{TARIFFMAN} = \text{sign}(\text{TARIFFMAN1}) * \log(1 + \text{TARIFFMAN1}),$ <p>where TARIFFMAN1 refers to the absolute value of the variable "TARIFFMAN1".</p>	Author's calculation based on data on the variable "TARIFFMAN1" extracted from the WDI.
TARIFFPRIM	<p>The variable "TARIFFPRIM" is the transformation of the variable measuring the tariff rate, applied, weighted mean for primary products (%), the latter being denoted "TARIFFPRIM1". In fact, as the variable "TARIFFPRIM1" contains many zeros, we cannot apply the natural logarithm to it so as to reduce its high skewness, as observed in Figure 1. The transformed variable "TARIFFPRIM" has been obtained using the following formula (see Yeyati et al. 2007):</p> $\text{TARIFFPRIM} = \text{sign}(\text{TARIFFPRIM1}) * \log(1 + \text{TARIFFPRIM1}),$ <p>where TARIFFPRIM1 refers to the absolute value of the variable "TARIFFPRIM1".</p>	Author's calculation based on data on the variable "TARIFFPRIM1" extracted from the WDI.
TARIFFALLVOL	<p>The variable "TARIFFALLVOL" is the transformation of the variable capturing the volatility of the tariff rate, applied, weighted mean for all products (%), the latter being denoted "TARIFFALLVOL1". The variable "TARIFFALLVOL1" has been computed as the standard deviation over 5-year rolling windows (that is, from $t-4$, ..., $t-1$, t) of the growth rate of "TARIFFALL1" (defined above) (see Bekaert et al. 2006; Ebeke and Ehrhart, 2012 who have also used such approach of computing the volatility of their relevant variables). As the variable "TARIFFALLVOL1" contains many zeros, and displays a high skewness, it has been</p>	Author's calculation based on data on the variable "TARIFFALL1" extracted from the WDI.

	transformed using the following formula (see Yeyati et al. 2007): $TARIFFALLVOL = \text{sign}("TARIFFALLVOL1") * \log(1 + TARIFFALLVOL1)$, where $ TARIFFALLVOL1 $ refers to the absolute value of the variable " <i>TARIFFALLVOL1</i> ".	
TARIFFMANVOL	The variable "TARIFFMANVOL" is the transformation of the variable capturing the volatility of the tariff rate, applied, weighted mean for all products (%), the latter being denoted "TARIFFMANVOL1". The variable "TARIFFMANVOL1" has been computed as the standard deviation over 5-year rolling windows (that is, from t-4, ..., t-1, t) of the growth rate of "TARIFFMAN1" (defined above) (see Bekaert et al. 2006; Ebeke and Ehrhart, 2012 who have also used such approach of computing the volatility of their relevant variables). As the variable "TARIFFMANVOL1" contains many zeros, and displays a high skewness, it has been transformed using the following formula (see Yeyati et al. 2007): $TARIFFMANVOL = \text{sign}("TARIFFMANVOL1") * \log(1 + TARIFFMANVOL1)$, where $ TARIFFMANVOL1 $ refers to the absolute value of the variable " <i>TARIFFMANVOL1</i> ".	Author's calculation based on data on the variable "TARIFFMAN1" extracted from the WDI.
TARIFFPRIMVOL	The variable "TARIFFPRIMVOL" is the transformation of the variable capturing the volatility of the tariff rate, applied, weighted mean for all products (%), the latter being denoted "TARIFFPRIMVOL1". The variable "TARIFFPRIMVOL1" has been computed as the standard deviation over 5-year rolling windows (that is, from t-4, ..., t-1, t) of the growth rate of "TARIFFPRIM1" (defined above) (see Bekaert et al. 2006; Ebeke and Ehrhart, 2012 who have also used such approach of computing the volatility of their relevant variables). As the variable "TARIFFPRIMVOL1" contains many zeros, and displays a high skewness, it has been transformed using the following formula (see Yeyati et al. 2007): $TARIFFPRIMVOL = \text{sign}("TARIFFPRIMVOL1") * \log(1 + TARIFFPRIMVOL1)$, where $ TARIFFPRIMVOL1 $ refers to the absolute value of the variable " <i>TARIFFPRIMVOL1</i> ".	Author's calculation based on data on the variable "TARIFFPRIM1" extracted from the WDI.
AfTPOL	This is transformation of the variable measuring the real gross disbursements of Aid for Trade allocated for trade policies and regulation (expressed in constant prices 2017, US Dollar), the latter being denoted "AfTPOL1". As this variable contains many negative values, it has been transformed using the following formula (see Yeyati et al. 2007): $AfTPOL = \text{sign}(AfTPOL1) * \log(1 + AfTPOL1)$, where $ AfTPOL1 $ refers to the absolute value of the variable " <i>AfTPOL1</i> ".	Author's calculation based on data on Aid for Trade allocated for trade policies and regulation, extracted from the database of the OECD/DAC-CRS (Organization for Economic Cooperation and Development/Donor Assistance Committee)-Credit Reporting System (CRS). Aid for Trade policy and regulations includes trade policy and regulations and

		trade-related adjustment (category "331" of the CRS code).
TP	<p>This is the transformed indicator of the overall trade policy of a given country. The overall trade policy (denoted "TP1") is measured by the trade freedom score, which is a major component of the Economic Freedom Index. It is composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. This score is graded on a scale of 0 to 100, with a rise in its value indicating lower trade barriers, i.e., higher trade liberalization, while lower values reflect rising trade protectionism. In our sample, "TP1" contains zero values, and, therefore, cannot be transformed using the natural logarithm (to reduce its skewness). The transformation into "TP" of the variable denoted "TP1" goes as follows (see Yeyati et al. 2007): $TP = \text{sign}(TP1) * \log(1 + TP1)$, where $TP1$ refers to the absolute value of the variable "TP1".</p>	Heritage Foundation (see Miller et al., 2019)
GROWTH	GDP growth (annual %)	WDI
GDPC	Per capita Gross Domestic Product (constant 2010 US\$)	WDI
POP	This is the measure of the total Population	WDI
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 from the WDI.
INST	<p>This is the variable representing the institutional and governance quality in a given country. It has been computed by extracting the first principal component (based on factor analysis) of the following six indicators of governance. These indicators include a measure of political stability and absence of violence/terrorism; the regulatory quality; an index of rule of law index; the government effectiveness index; the index of Voice and Accountability; and the index of corruption.</p> <p>Higher values of this index are associated with better governance and institutional quality, while lower values reflect worse governance and institutional quality.</p>	Data on the components of the variable "INST" has been collected from World Bank Governance Indicators (WGI) developed by Kaufmann, Kraay and Mastruzzi (2010) and recently updated.

Appendix 2a: Descriptive statistics on variables

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
TARIFFALL1	2,480	6.298	5.034	0.000	40.690
TARIFFMAN1	2,480	6.350	5.320	0.000	44.380
TARIFFPRIM1	2,480	6.542	5.929	0.000	62.010
TP1	2,840	71.171	13.876	0.000	90.000
TARIFFALLVOL1	2,384	0.264	1.025	0.000	31.644
TARIFFMANVOL1	2,366	0.233	0.342	0.000	5.485
TARIFFPRIMVOL1	2,384	0.370	0.806	0.000	12.288
AfTPOL1	789	4689969	11900000	-28781	235000000
GDPC	3,062	13593.040	18982.130	187.517	111968.300
GROWTH	3,061	3.883	4.443	-36.037	88.958
INST	3,067	0.097	2.159	-5.060	4.857
POP	3,067	3.97e+07	1.43e+08	17606	1.39e+09
TERMS	2,900	1.203	0.397	0.214	5.361

Appendix 2b: Descriptive statistics on within and between variations on variables

Variable		Mean	Standard deviation	Minimum	Maximum	Observations
TARIFFALL1	Overall	5.572	4.454	0.010	29.880	N = 1723
	Between		4.228	0.059	18.610	n = 163
	Within		1.987	-4.734	21.912	T bar = 10.5706
TARIFFMAN1	Overall	5.640	4.632	0.000	30.000	N = 1723
	Between		4.506	0.000	26.690	n = 163
	Within		1.907	-3.466	23.694	T bar = 10.5706
TARIFFPRIM1	Overall	5.732	5.368	0.000	61.640	N = 1723
	Between		5.081	0.191	28.853	n = 163
	Within		2.831	-10.931	38.519	T bar = 10.5706
TP1	Overall	75.793	11.222	0.000	90.000	N = 1649
	Between		9.667	42.300	88.786	n = 157
	Within		5.992	5.214	97.093	T bar = 10.5032
TARIFFALLVOL1	Overall	0.247	0.718	0.000	27.484	N = 1710
	Between		0.318	0.019	3.533	n = 163
	Within		0.656	-3.279	24.197	T bar = 10.4908
TARIFFMANVOL1	Overall	0.236	0.347	0.000	5.485	N = 1696
	Between		0.239	0.007	2.214	n = 162
	Within		0.257	-1.862	3.839	T bar = 10.4691
TARIFFPRIMVOL1	Overall	0.374	0.808	0.000	12.288	N = 1710
	Between		0.508	0.013	5.031	n = 163
	Within		0.607	-4.344	7.771	T bar = 10.4908
GDPC	Overall	16157.430	20370.120	219.962	111968.300	N = 1716
	Between		19301.400	233.081	104249.200	n = 163
	Within		1731.965	1954.980	34184.790	T bar = 10.5276
GROWTH	Overall	3.364	3.863	-36.037	25.163	N = 1716
	Between		2.536	-12.081	10.073	n = 163
	Within		3.228	-33.403	24.310	T bar = 10.5276
INST	Overall	0.361	2.158	-4.522	4.857	N = 1644
	Between		2.145	-4.264	4.545	n = 163

	Within		0.258	-1.149	1.703	T bar = 10.0859
POP	Overall	45400000	157000000	17665	1390000000	N = 1723
	Between		146000000	17732.670	1340000000	n = 163
	Within		8071402	-106000000	158000000	T bar = 10.5706
TERMS	Overall	1.256	0.442	0.214	5.361	N = 1723
	Between		0.372	0.633	3.283	n = 163
	Within		0.242	-1.210	3.334	T bar = 10.5706

Appendix 3a: List of countries contained in the full Sample

Entire sample					
Albania	Chad	Guatemala	Malta	Saudi Arabia	Yemen, Rep.
Algeria	Chile	Guinea	Mauritania	Senegal	Zambia
Angola	China	Guinea-Bissau	Mauritius	Singapore	Zimbabwe
Antigua and Barbuda	Colombia	Guyana	Mexico	Slovak Republic	
Argentina	Comoros	Haiti	Moldova	Slovenia	
Armenia	Congo, Dem. Rep.	Honduras	Mongolia	South Africa	
Aruba	Congo, Rep.	Hungary	Morocco	Spain	
Australia	Costa Rica	Iceland	Mozambique	Sri Lanka	
Austria	Cote d'Ivoire	India	Myanmar	St. Kitts and Nevis	
Azerbaijan	Croatia	Indonesia	Namibia	St. Lucia	
Bahamas, The	Cuba	Ireland	Netherlands	St. Vincent and the Grenadines	
Bahrain	Cyprus	Israel	New Zealand	Suriname	
Bangladesh	Czech Republic	Italy	Nicaragua	Sweden	
Barbados	Denmark	Jamaica	Niger	Switzerland	
Belarus	Dominica	Japan	Nigeria	Tajikistan	
Belgium	Dominican Republic	Jordan	North Macedonia	Tanzania	
Belize	Ecuador	Kazakhstan	Norway	Thailand	
Benin	Egypt, Arab Rep.	Kenya	Oman	Togo	
Bermuda	El Salvador	Korea, Rep.	Pakistan	Tonga	
Bolivia	Estonia	Kuwait	Palau	Trinidad and Tobago	
Bosnia and Herzegovina	Eswatini	Kyrgyz Republic	Panama	Tunisia	
Botswana	Ethiopia	Lao PDR	Papua New Guinea	Turkey	
Brazil	Fiji	Latvia	Paraguay	Uganda	
Brunei Darussalam	Finland	Lebanon	Peru	Ukraine	
Bulgaria	France	Lesotho	Philippines	United Arab Emirates	
Burkina Faso	Gabon	Lithuania	Poland	United Kingdom	
Burundi	Gambia, The	Luxembourg	Portugal	United States	
Cabo Verde	Georgia	Madagascar	Qatar	Uruguay	
Cambodia	Germany	Malawi	Romania	Uzbekistan	
Cameroon	Ghana	Malaysia	Russian Federation	Vanuatu	
Canada	Greece	Maldives	Rwanda	Venezuela, RB	
Central African Republic	Grenada	Mali	Samoa	Vietnam	

Appendix 3b: List of countries contained in the sub-Samples

LICs	LMIC	UMIC	HIC	
Burkina Faso	Algeria	Albania	Antigua and Barbuda	Singapore
Burundi	Angola	Argentina	Aruba	Slovak Republic
Central African Republic	Bangladesh	Armenia	Australia	Slovenia
Chad	Benin	Azerbaijan	Austria	Spain
Congo, Dem. Rep.	Bolivia	Belarus	Bahamas, The	St. Kitts and Nevis
Ethiopia	Cabo Verde	Belize	Bahrain	Sweden
Gambia, The	Cambodia	Bosnia and Herzegovina	Barbados	Switzerland
Guinea	Cameroon	Botswana	Belgium	Trinidad and Tobago
Guinea-Bissau	Comoros	Brazil	Bermuda	United Arab Emirates
Haiti	Congo, Rep.	Bulgaria	Brunei Darussalam	United Kingdom
Madagascar	Cote d'Ivoire	China	Canada	United States
Malawi	Egypt, Arab Rep.	Colombia	Chile	Uruguay
Mali	El Salvador	Costa Rica	Croatia	Singapore
Mozambique	Eswatini	Cuba	Cyprus	Slovak Republic
Niger	Ghana	Dominica	Czech Republic	Slovenia
Rwanda	Honduras	Dominican Republic	Denmark	Spain
Tajikistan	India	Ecuador	Estonia	St. Kitts and Nevis
Togo	Kenya	Fiji	Finland	Sweden
Uganda	Kyrgyz Republic	Gabon	France	Switzerland
Yemen, Rep.	Lao PDR	Georgia	Germany	Trinidad and Tobago
	Lesotho	Grenada	Greece	United Arab Emirates
	Mauritania	Guatemala	Hungary	United Kingdom
	Moldova	Guyana	Iceland	United States
	Mongolia	Indonesia	Ireland	Uruguay
	Morocco	Jamaica	Israel	
	Myanmar	Jordan	Italy	
	Nicaragua	Kazakhstan	Japan	
	Nigeria	Lebanon	Korea, Rep.	
	Pakistan	Malaysia	Kuwait	
	Papua New Guinea	Maldives	Latvia	
	Philippines	Mexico	Lithuania	
	Senegal	Namibia	Luxembourg	
	Sri Lanka	North Macedonia	Malta	
	Tanzania	Paraguay	Mauritius	
	Tunisia	Peru	Netherlands	
	Ukraine	Russian Federation	New Zealand	
	Uzbekistan	Samoa	Norway	
	Vanuatu	South Africa	Oman	
	Vietnam	St. Lucia	Palau	
	Zambia	St. Vincent and the Grenadines	Panama	
	Zimbabwe	Suriname	Poland	
		Thailand	Portugal	
		Tonga	Qatar	
		Turkey	Romania	
		Venezuela, RB	Saudi Arabia	

Appendix 3c: List of AfT recipient-countries retained in the analysis

AfT recipient-countries			
Albania	Cote d'Ivoire	Kyrgyz Republic	Peru
Algeria	Croatia	Lao PDR	Philippines
Angola	Cuba	Lebanon	Rwanda
Argentina	Dominica	Lesotho	Samoa
Armenia	Dominican Republic	Madagascar	Saudi Arabia
Azerbaijan	Ecuador	Malawi	Senegal
Bangladesh	Egypt, Arab Rep.	Malaysia	South Africa
Belarus	El Salvador	Maldives	Sri Lanka
Belize	Eswatini	Mali	St. Lucia
Benin	Ethiopia	Mauritania	St. Vincent and the Grenadines
Bolivia	Fiji	Mauritius	Suriname
Bosnia and Herzegovina	Gabon	Mexico	Tanzania
Botswana	Gambia, The	Moldova	Thailand
Brazil	Georgia	Mongolia	Togo
Burkina Faso	Ghana	Morocco	Tonga
Burundi	Grenada	Mozambique	Trinidad and Tobago
Cabo Verde	Guatemala	Myanmar	Tunisia
Cambodia	Guinea	Namibia	Turkey
Cameroon	Guinea-Bissau	Nicaragua	Uganda
Central African Republic	Guyana	Niger	Ukraine
Chad	Haiti	Nigeria	Uruguay
Chile	Honduras	North Macedonia	Uzbekistan
China	India	Oman	Vanuatu
Colombia	Indonesia	Pakistan	Venezuela, RB
Comoros	Jamaica	Palau	Vietnam
Congo, Dem. Rep.	Jordan	Panama	Yemen, Rep.
Congo, Rep.	Kazakhstan	Papua New Guinea	Zambia
Costa Rica	Kenya	Paraguay	Zimbabwe