Do Trade Agreeements Reduce the Volatility of Agricultural Distortions?

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Abstract

The objective of this paper is to evaluate the extend to which trade agreements affect agricultural trade policy volatility. Using a new panel database compiled as part of the World Bank's Agricultural Distortions research project, we estimate the effect of regionalism (proxied in various ways) on the volatility of price distortions measured by the absolute value of their first differences, averaged, for each country and year, over all agricultural goods. Using an instrumental-variable approach to correct for the endogeneity of regional trade agreements, (RTAs), we find that participation in RTAs has a significantly negative effect on agricultural trade-policy volatility. We find that the WTO's agricultural agreement also contributed to reducing agricultural trade-policy volatility, in spite of the weak disciplines involved, but the effect is only weakly identified. Our results are robust to a variety of robustness checks and hold, in particular, for the Latin American sub-sample.

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The economic analysis of Regional Trade Agreements (RTAs) has largely focused so far on how they affect the *level* of trade distortions. On that count, the verdict is still out: whereas early political economists held a dim view of their benefits (e.g. Grossman and Helpman 1995 showed that politically feasible RTAs were the most trade-diverting), recent papers (e.g. Ornelas 2005) have taken a more nuanced view, showing that RTAs can release trade-liberalizing forces. However, as noted by Braumoeller (2006), institutional arrangements like RTAs can equally importantly affect the volatility of trade policy, and that aspect has been largely overlooked (with a few notable exceptions discussed below). We explore empirically here whether RTAs have reduced the volatility of barriers to agricultural trade, using the World Bank's new database on agricultural distortions (Anderson and Valenzuela 2008).

The issue of whether regionalism has dampened agricultural trade-policy volatility is an important one. Volatility in food prices is more likely to trigger riots than volatility in the price of, say, shirts or home appliances. Indeed, Anderson (2009, Ch. 1) shows that border measures have been used systematically by Asian countries to dampen the volatility of the world price of rice, a particularly sensitive commodity in that region. If changes in the level of border measures were used only to insulate domestic markets against terms-of-trade volatility, they could be justified on insurance grounds (Rodrik 1998). But they are also likely to have an " autonomous" , discretionary component driven by the vagaries of local political processes. This discretionary policy volatility is likely to be welfare-reducing, because the welfare costs of distortions rise with the square of the wedge between domestic and world prices. It may also harm investment and growth if it creates an atmosphere of policy uncertainty (Sudsawasad and Moore 2006). If RTAs have the effect of reducing it through a commitment effect (whether based on rules-vs-discretion or strategic delegation), this is an important " non-traditional" argument in their favor,

using the terminology of Fernandez and Portes (1998).

Whether policy volatility is reduced by international institutions has been explored empirically in two recent papers: Rose (2004) on the WTO and Mansfield and Reinhardt (2008) on RTAs. Both papers use the volatility of trade flows (rather than policy) as the variable of interest, and are based on variants of the gravity equation.

Rose (2004) starts from the observation that one of the stated goals of the multilateral trading system is to enhance the stability and predictability of the environment in which traders operate. The WTO's web site, for instance, states that "just as important as freer trade -- perhaps more important -- are other principles of the WTO system. For example: non-discrimination, and making sure the conditions for trade are stable, predictable and transparent."[1] There are many mechanisms through which WTO rules could make the policy environment of WTO members more stable. For instance, binding tariffs reduces the scope for manipulating them. However, tariffs have been bound by developing countries at levels substantially above those applied: China bound its tariffs on imported agricultural goods at an average level of 16.5 percent even though the Nominal Rate of Assistance (NRA) that it applied at the time of its accession was only 7.3 percent; likewise, India, Pakistan and Bangladesh bound their tariffs on agricultural imports at 114, 96 and 189 percent, respectively, against NRAs of 34, 4 and 6 percent (Anderson 2009). Similar arguments can be made about other aspects of WTO rules and about the effectiveness of its dispute-resolution system. Thus, whether the disciplines imposed by the multilateral trading system are sufficient to dampen trade-policy volatility -- in agriculture or in other sectors -- is an empirical question.

Rose's empirical strategy consists of regressing a measure of the long-term volatility of one-way bilateral trade flows (their coefficient of variation over two successive 25-year periods) on period averages of standard gravity regressors as well as two binary variables marking WTO membership of the importer and exporter. The exercise can be thought of as a treatment-effect estimation with a treatment of variable intensity (zero, one or two countries in the pair being "treated" by WTO membership). Using a variety of specifications (importer and exporter fixed effects, country-pair fixed effects, and so on), Rose consistently finds that WTO membership fails to reduce the volatility of trade flows, concluding that the multilateral trading system's disciplines are simply not strong enough to have a statistically traceable effect. The variety of

[1] www.wto.org/english/thewto_e/whatis_e/10mis_e/10m02_e.htm, quoted in Rose (2004, p. 1).

specifications yielding the same negative answer makes it unlikely that Rose's result is merely a type-II error; however, the exercise highlights two difficulties: First, using the second moment of a time series as the dependent variable requires long series with lots of variation, especially if one looks at long-term volatility. Second, as often in treatment-effect estimation, the treatment is here likely to be endogenous (since one of the stated purposes of the WTO is precisely to reduce trade-policy volatility); at the same time, it is not immediately obvious what would be the right instrumentation strategy for something like WTO membership.

Mansfield and Reinhardt (2008) ask a similar question about regionalism, noting that the stated objective of a number of preferential agreements is to enhance security in market access, in accordance with Fernandez and Portes's "insurance" argument. As Abbott (2000) notes, RTAs are part of a general "trend toward higher levels of precision, obligation, and delegation in international trade that has been ongoing since the adoption of the General Agreement on Tariffs and Trade (GATT) in 1947" (Abbott 2000, p. 519). Precision, obligation and delegation should all contribute to reducing discretionary policy volatility. Indeed, Abbott notes that "in regard to NAFTA, Canada insisted on adding precision to rules of origin and transformation with respect to automobiles and parts, because imprecise rules of CUSFTA had been interpreted by the United States to the detriment of Japanese investors in Canada. This U.S. interpretation created substantial uncertainty among prospective Japanese investors" (Abbott 2000, p. 528).

It is even more difficult to assess empirically the ability of RTAs to reduce discretionary policy volatility than in the case of WTO membership, because RTAs are diverse in nature and their effects can be asymmetric across their own member states. As to heterogeneity, Abbott shows in his detailed comparison of NAFTA and the European Union that the EU relied heavily on delegation to supra-national institutions (the European Commission and the European Court of Justice) to give substance to an initial text (the Treaty of Rome) that was imprecise. By contrast, NAFTA relies very little on delegation to supra-national institutions, except in the areas of investment (where private agents can challenge the governments of partner countries at the World Bank's arbitration court, the ICSID) and anti-dumping. The reason for the EU's heavy reliance on delegation is that it was, at the outset, a political project meant to lead to political integration, whereas NAFTA never had that goal and the U.S. Congress would have resisted any infringement on its sovereignty in legislative matters. However, the NAFTA treaty is very precise in its wording by the standards of preferential trade agreements. Thus the commitment

mechanisms of NAFTA and the EU are different: rules vs. discretion for the former, delegation for the latter.

As to asymmetry in the effects of RTAs, taking again the example of NAFTA, even though Article VI of the U.S. Constitution states that treaties are the supreme law of the land, the U.S. Congress "expressly denied the possibility of domestic direct effect for NAFTA in the legislation approving and implementing the agreement, and it may not be relied on as a source of rights in U.S. law" (Abbott 2000, p. 538). Thus NAFTA cannot be invoked directly by an importer to challenge a Customs decision; the legal basis of the challenge must be U.S. domestic law (presumably put in accordance with the NAFTA treaty though). By contrast, under the Mexican Constitution, the NAFTA Treaty has force of law and can be invoked directly in courts. This stronger commitment no doubt reflects the Mexican government's desire to use NAFTA to improve the country's image in terms of legal stability in order to encourage foreign direct investment. According to Whalley (1998), Mexican negotiators were mainly concerned with locking in domestic policy reforms rather than a bilateral exchange of concessions during NAFTA negotiations.

These two examples highlight both the potential for RTAs to act as commitment mechanisms (suggesting there should be an effect to look for) and the potential heterogeneity of their effect on domestic policy volatility (suggesting that the effect may be difficult to identify). Mansfield and Reinhardt (2008) explore empirically whether any effect is statistically traceable by estimating a system of two equations. In the first, the dependent variable is the level of bilateral trade in a standard gravity equation augmented, on the right-hand side, by the variance of the flows (that is, the equation is a particular kind of heteroskedastic regression where the variance of the dependent variable is among the regressors) and by "treatment variables" marking whether a bilateral trade flow is ruled by a preferential agreement or not and whether the trading countries are WTO members or not. In the second equation, the variance of trade flows is regressed on a number of control variables and the same treatment variables. Positive coefficients on the treatment variables in the first equation indicate that the treatments (RTAs and WTO membership) raise the level of trade conditional on its volatility; a negative coefficient on the variance indicates that volatility is, in itself, associated, *ceteris paribus*, with less trade (what the authors call a "volatility tax"). Negative coefficients on the treatment variables in the second equation indicate that they reduce the volatility of trade flows.

In contrast to Rose, Mansfield and Reinhardt find that both RTAs and WTO membership are associated with less volatility and with higher levels of trade flows, and that reduced volatility is itself associated with higher trade flows, giving a double bang on levels (directly and indirectly via reduced volatility). Because the thought experiences of Rose and Mansfield and Reinhardt are different, there is no immediate explanation for their conflicting results. One obvious difference is that the latter use short-term measures of volatility (year-on-year absolute values of log-differences or variances) whereas Rose used a very long-run approach (measured over a 25-year span). There are other differences as well. By contrast, one common feature of these two studies is that neither treats the potential endogeneity of WTO and RTA membership, while both recognize -- indeed, emphasize -- that stability and predictability are among the stated objectives of the WTO and many RTAs, raising the suspicion that countries that adopt WTO or RTA membership may be those that suffer most from volatility (the argument is probably more important for RTAs than for the WTO). This creates a potential bias in the estimates.

We revisit the issue using World Bank's new panel database on agricultural distortions (Anderson and Valenzuela 2008), which gives, at the product level, the ad-valorem equivalent of the wedge between domestic and world prices (what they call the Nominal Rate of Assistance or NRA) for 70 countries over half a century. For each product, we define volatility as the absolute value of the first difference in the NRA and take the simple average across all goods. This yields a gross measure of policy volatility for each country-year pair (our unit of observation), which we subsequently purge of the influence of world-price volatility calculated the same way to retain only the discretionary component that is orthogonal to world-price volatility. That is, we ask a question that is similar to Rose's and Mansfield and Reinhardt's but taking trade policy rather than trade flows as our dependent variable and focusing on agricultural products. This means that our "WTO variable" (equal to one for WTO members after 1994) should be interpreted as picking up only the effect of the Uruguay Round's agricultural agreement, and nothing else. This also means that our measure of volatility is "multilateral" rather than bilateral: for each country, we measure the effect of membership in RTAs and the WTO on the volatility of an indicator of trade policy that lumps together all MFN and preferential border measures. This is important, because our measure picks up not only the effect of an RTA on the stability of the bilateral trade regime, but also on an aggregate of each member country's trade regimes vis-à-vis all its partners. Put differently, we measure whether membership in NAFTA reduces the

volatility of Mexican trade policy not just vis-à-vis the U.S. and Canada but also vis-à-vis Japan, by encouraging the susbtitution of rules for discretion in all areas of trade policy.

We also instrument our basic treatment variable (membership in RTAs), using the theoretical literature on determinants of trade agreements as a guide in the selection of potential instruments. Motives that we consider as potential instruments for signing trade agreements include the internalization of terms of trade externalities (Bagwell and Staiger 1999), market access insurance (Fernandez and Portes 1998), solving time-inconsistency problems in trade policy decisions (Maggi and Rodriguez-Clare 1998 and 2007), and the provision of public goods (Limao 2007).

Like Mansfield and Reinhardt, we find that RTAs are robustly associated with a decrease in agricultural trade-policy volatility across a variety of specifications. But we find that the effect of WTO membership is less precisely estimated, sometimes being insignificant, which seems to go some way toward reconciling their results with Rose's. Thus, as far as we can tell from our empirical experiment, in this particular instance the multilateral trading system and regional agreements work in the same direction, but the disciplines of the latter seem more readily identifiable than those of the former.

Estimation

Let c denote a country, t denote time, σ_{ct} be the volatility of c's trade policy in year t, and TA_{ct} be a summary measure of the incidence of RTAs for country c in year t. The construction of σ_{ct} and TA_{ct} is discussed in the data section below. Let also WTO_{ct} be a dummy variable marking WTO membership, $\mathbf{X}_{ct}$ a vector of controls (whose composition is also discussed in the data section), α_t and α_c time and country fixed effects, and ε_{ct} an error term. The equation of interest is

$$\sigma_{ct} = \alpha_0 + \alpha_1 TA_{ct} + \alpha_2 WTO_{ct} + \mathbf{X}\boldsymbol{\beta} + \alpha_t + \alpha_c + \varepsilon_{ct}. \quad (1)$$

where all continuous variables (including σ) are log linearized.

Because RTAs may be formed precisely in response to excessive trade-policy volatility,

OLS estimates of (1) will be biased downwards. We accordingly instrument TA_{ct} with a vector of instruments $\mathbf{Z}$ and estimate (1) by 2SLS and efficient two-stage GMM.

The existing theoretical literature on the determinants of trade agreements offers some guidance in finding valid instruments. First, large countries may want to sign trade agreements in order to overcome prisoner's dilemma situations where they unilaterally set tariffs too high because of terms-of-trade externalities. Moreover, the larger is a country, the larger is the interest other countries have in securing access to that particular market.[2] In contrast, smaller countries may not be large enough to influence world prices or attract the interest of other countries. Therefore, we expect a positive relationship between the economic size of a country, measured by the level of its GDP, and its involvement in regionalism (the endogenous right-hand-side variable).

Second, Maggi and Rodrguez-Clare (1998) argue that governments with weak bargaining positions vis-à-vis interest groups are more likely to want to precommit because weak bargaining positions reduce the rents that they derive from the political game. This suggests using domestic political institutions, a standard approach to instrumenting policy variables (see Besley and Case 2000 for a discussion). Maggi and Rodrguez-Clare also suggest that governments that are neither too sensitive, nor too impervious, to interest-group pressures are more likely to sign trade agreements. The argument is that a government that is too sensitive would not want to pre-commit for fear of losing the lobbies' contributions, while one that puts a large weight on social welfare would not need to precommit. To capture these non-linearities, we include in the list of instruments the square of a measure of governments' weight on social welfare, taken from

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[2]This is nothing but Fernandez' `insurance" motive for the large country's partners. The argument gave rise to a lively debate on Dani Rodrik's blog. Commenting on Senator Clinton's proposal to submit trade agreements like NAFTA to five-year reviews, political scientist Dan Drezner wrote:

``Her campaign website proudly declares that as president, Clinton would restore America's standing in the world. Last week, however, she proposed that we reassess our trade agreements every five years and demand adjustments to them if necessary, starting with NAFTA.

``This proposal makes me wonder if Senator Clinton understands the value-added of these free-trade agreements, or FTAs. The dirty secret is that most FTAs do not have large effects on the American economy, but they do yield foreign policy dividends. These agreements cement ties with key allies. They offer a guarantee to these countries that their relationship with the United States -- and their access to American consumers -- will not be disrupted. Compare the unease and mistrust that characterized Mexican-American relations prior to NAFTA with the past 15 years. The effect can be dramatic.

``In short, trade agreements improve America's standing in the world. But Senator Clinton's proposal would strip these agreements of the very certainty that makes them attractive to our allies. How does Senator Clinton think our trading partners in the Middle East, Central America, and Pacific Rim will react to her proposal? How is this proposal any different from the unilateralism that Democrats have condemned for the past six years?" (comment posted on October 18, 2007).

Grossman and Helpman's common-agency model.

Finally, as argued by Limao (2007), countries sign trade agreements to facilitate the provision of public goods. For instance, under the Andean Trade Promotion Act (ATPA) the US offered duty-free access to Andean exports in return for cooperation in the war on drugs. Similarly, the European Union offers special preferential treatment to countries cooperating on "Singapore" and environmental issues under its GSP-plus.[3] Regional agreements can also reflect security concerns. This was certainly the case of Europe's Common Market, which was set up to reduce Franco-German tensions. Security concerns in the face of threats of Communist subversion have also been historical drivers of ASEAN. To proxy such security concerns, we use the number of military alliances to which each country belongs in a given year.

We use under-, over- and weak-identification tests to assess the suitability of our instruments. All specifications control for heteroskedasticity and first-order autocorrelation in the error term, and in a robustness section we also control for the lagged level of trade distortions, conjecturing that the volatility of trade barriers may somehow be proportional to their level.

Dependent variable data

Data on agricultural trade policy is from the World Bank's Agricultural Distortions project (Anderson and Valenzuela 2008, the methodology for which is outlined in Anderson et al. 2008). Distortions are measured by the wedge between domestic and external price, that is, by the Nominal Rate of Assistance (NRA). Formally, let i be an agricultural product and, as before, c and t be country and year.

$$NRA_{ict} = \frac{p_{ict} - p^*_{ict}}{p^*_{ict}}$$

where p^*_{ict} is good i's CIF external price (that is, its world price plus transportation cost to country c) and p_{ict} its domestic price in country c. Therefore, the NRA is the ad-valorem equivalent of the effect of all agricultural protection measures. Border taxes and subsidies largely contribute to the nominal rate of assistance. Border policy instruments have the lowest

[3]Note that both the ATPA and the GSP-plus run afoul of GATT Article XXIV and the Enabling Clause. The ATPA is accordingly being transformed into a reciprocal FTA with willing Andean partners, while the legal future of the GSP-plus is uncertain.

contribution to the NRA (62 percent) in Latin America and the highest (94 percent) in high-income countries. In order to isolate the effect of border measures, we subtract from the NRA the part corresponding to domestic price-support measures. The database provides NRA estimates, disaggreated at the product level, for 68 countries over an average period of 39 years. The countries and goods covered account for about two-thirds of global agricultural production.

The distribution of NRAs shows large variation across and within goods and countries. By and large, NRAs have been rising in high-income countries since the mid-1950s (the beginning of the database) with the exception of Australia and New Zealand. In developing countries, NRAs have also been rising, with export taxes rising between the 1950s and the 1980s and receding thereafter, and import taxes rising monotonically. Whether for export or import-competing goods, variations around the trend remain large over time. Clearly, trade policy volatility is a common characteristic of both high-income and developing countries.

We measure the volatility of NRAs in two steps: First, we take the absolute value of first differences in Anderson and Valenzuela's measure of the price wedge, product by product; next, we take the simple average of those absolute values across all goods in a given country and year. That is,

$$\sigma_{ct} = \frac{1}{M}\sum_{i=1}^{M}\left|NRA_{ict} - NRA_{ic,t-1}\right|.$$

Defining variability this way allows us to minimize the loss of observations in the time dimension.[4] In order to reduce the influence of outliers, we put σ_{ct} and all volatility variables in logs.

Independent variable data

The first regressor of interest is TA_{ct}. Many measures of the extent of a country's involvement in regionalism are possible. The proxy we use is the number of trade agreements (regional as well as bilateral) signed by country c and in force in year t. Computed this way, TA_{ct} weights all agreements equally regardless of their depth, number of partners, or economic size. (We explore

[4]Alternative measures include the square of the first differences (instead of the absolute value) or the variance calculated over blocs of n years. This last approach however entails a substantial loss of observations, which would reduce our ability to estimate the autocorrelation parameter in the error term.

various alternative measures in the robustness section below.) The second regressor of interest is WTO_{ct}, which marks membership in the WTO and therefore ratification of the Uruguay Round's Agricultural Agreement. WTO_{ct} is a dummy variable equal to one after 1994 for WTO members. It is therefore akin to a standard treatment-effect variable.

Our vector of controls is

$$\mathbf{X}_{ct} = \left[\sigma^{*}_{ct}, \sigma^{GDP}_{ct}, PRES_{c}, PARL_{c}, a_{ct}\right]$$

where σ^{*}_{ct} is the volatility of country c's external price (aggregated across goods), σ^{GDP}_{ct} that of its GDP (both in logs), $PRES_{c}$ and $PARL_{c}$ are dummy variables marking, respectively, presidential and parliamentary systems, and a_{ct} is the `revealed' weight on social welfare in a Grossman-Helpman (1994) governmental objective function (more on this below).

The rationale for including the volatility of the external price is two-fold. First, as discussed in the introduction, variations in border measures can be used to insulate domestic markets from terms-of-trade shocks, in which case variations in world prices would be negatively correlated with variations in trade barriers. Second, external-price variations translate mechanically into variations in the ad-valorem equivalent of specific tariffs and quotas, two types of border measures widely used in agriculture. Putting the volatility of world prices on the righrt-hand side controls for both. The rationale for the volatility of GDP is to control for the use of trade policy to correct macroeconomic shocks (like Mexico's Tequila crisis of 1994, which triggered a round of tariff increases). We consider such tariff changes as different from purely discretionary interventions. Finally, following Besley and Case (2000), it has become customary to use political-institution variables to instrument for policy variables. We use the World Bank's Political Institutions Database (Beck et al. 2001, 2008) to identify systems other than pure parliamentary systems (the omitted dummy), reasoning that (following the argument of Maggi and Rodrguez-Clare 1998) parliamentary systems are the weakest in terms of executive decision-making. Because coalitions are typically less stable in parliamentary regimes, governments are likely to have less bargaining power and to be more sensitive to political pressure. Therefore, one might expect less trade-policy volatility under $PRES$ than under $PARL$.[5]

[5]The PID's classification of political regimes can be considered too coarse. For instance, Olper and Raimondi (2010) show that autocracies and democracies behave differently in shaping agricultural policy. As a sensitivity check, we set autocracies apart and differentiated between presidential, assembly-elected and parliamentary systems only for

We turn now to the construction of the weight on social welfare, a_{ct}. We adapt the tariff equation of Grossman and Helpman's common-agency model to an agricultural context following the empirical methodology of Gawande, Krishna and Olarreaga (2009).[6] In contrast to the existing literature, we assume that a sizable proportion of the population is politically organized. Relaxing the assumption of high concentration of the ownership of specific factors used in production makes it possible to generate import subsidies and export taxes in equilibrium, which is important in an agricultural context.[7] We calculate an aggregate weight on social welfare, overlooking possible differences between the case of export and import-competing goods. To recall, omitting the country subscript c, Grossman and Helpman's tariff equation is

$$\frac{\tau_{it}}{1+\tau_{it}} = \frac{I_{it}-\alpha_t}{a_t+\alpha_t}\cdot\left[\frac{y_{it}}{m_{it}}\right]\cdot\frac{1}{|e_{it}|} \tag{2}$$

where τ_{it} is the tariff on good i in year t; I_{it} is an indicator function equal to one if sector i is politically organized in year t; y_{it} is domestic production of good i in year t; m_{it} are imports of good i in year t; e_{it} is the import demand elasticity of good i in year t; α_t is the fraction of the total population of voters who are represented by a lobby in year t; and a_t is the parameter we are interested in estimating (the weight given to social welfare in year t relative to political contributions in the government's objective function). Taking observables in (2) to the left-hand side, we can express it as

$$\frac{\tau_{it}}{1+\tau_{it}}\cdot\left[\frac{m_{it}}{y_{it}}\right]\cdot|e_{it}| = -\frac{\alpha_t}{a_t+\alpha_t}+\frac{1}{a_t+\alpha_t}\cdot I_{it} \tag{3}$$

where m_{it} are imports (exports) of good i in year t and e_{it} is the import demand elasticity

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democracies. We also decoupled presidential, assembly-elected and parliamentary democracies into majoritarian and proportional systems and distinguished them, again, from autocracies. Whichever definition of institutions we use, the incidence of trade agreements and of the multilateral trading system on agricultural trade policy volatility remains robust.

[6] In doing so we abuse the model somewhat, as Grossman and Helpman's (GH) model did not include any bindings or commitment mechanism. What follows should of course not be constructed as a test of GH, but rather as a shortcut to proxy the vulnerability of governments to capture by special interests, a crucial element of any political-economy analysis of trade protection.

[7] The database includes a large proportion of negative $NRAs$, in particular in its early years (roughly up to the 1980s). As the data in Anderson (2009) show, developing-country governments have switched from taxing agriculture to protecting it only recently. For Latin America as a whole, for instance, average NRAs turned positive only in the 1990s.

(export demand elasticity) of good i in year t if product i is classified as importable (exportable). If the sector is organized, that is if $I_{it}=1$, producers are able to buy protection and $\tau_{it}>0$. If good i is imported (exported), τ_{it} is an ad-valorem tariff (subsidy). If $I_{it}=0$, $\tau_{it}<0$; that is, if sector i is unorganized, its producers are penalized by an import subsidy if it is import-competing good and by an export tax if it is an export good. Letting $\beta_{1t}=-\alpha_t/(a_t+\alpha_t)$ and $\beta_{2t}=1/(a_t+\alpha_t)$ and adding a normally-distributed iid error term u_{it}, we have

$$\frac{\tau_{it}}{1+\tau_{it}}\cdot\left[\frac{m_{it}}{y_{it}}\right]\cdot|e_{it}|=-\frac{\alpha_t}{a_t+\alpha_t}+\frac{1}{a_t+\alpha_t}\cdot I_{it}+u_{it}$$

$$=\beta_{1t}+\beta_{2t}I_i+u_{it}. \qquad (4)$$

Formulating the problem this way allows us to remove any endogeneity issue between output, imports and tariffs as well as measurement-error issues for elasticities. As for I_{it}, it is not observable in general. Following Gawande and Hoekman (2010), we set $I_{it}=0$ for all industries/countries such that $\tau_{it}<0$ (import subsidies or export taxes) and $I_{it}=1$ otherwise. This way we have really two equations:

$$\phi_{it}=\begin{cases}\beta_{1t}+\beta_{2t}+u_{it} & \text{if } \tau_{it}\geq 0\\ \beta_{1t}+u_{it} & \text{otherwise}\end{cases}$$

where ϕ_{it} is the expression on the left-hand side of (4). In both cases, the right-hand side is a constant (up to the error term), so the OLS estimates of $\beta_{1t}+\beta_{2t}$ for the organized-industries subsample ($\tau_{it}\geq 0$) and of β_{1t} for the unorganized subsample ($\tau_{it}<0$) are simply the respective averages of ϕ_{it}. Subtracting the second from the first gives $\hat{\beta}_{2t}$, and the parameter of interest $\hat{a}_t$ can then be retrieved as

$$\hat{a}_t=\left(1+\hat{\beta}_{1t}\right)/\hat{\beta}_{2t}$$

while the estimate of the proportion of the population organized in interests'groups is given by

$$\hat{\alpha}_t=-\hat{\beta}_{1t}/\hat{\beta}_{2t}.$$

Import-demand elasticities at the HS 6-digit level are borrowed from Kee, Nicita and Olarreaga (2008, 2009). Table 1 gives descriptive statistics for all variables. For dummy variables, the mean is simply the proportion of countries/years for which the variable is equal to one, i.e. the incidence of the variable in question.

Results

We begin by discussing the baseline results, and then examine their robustness before turning to asses whether Latin America is different from other parts of the world.

Baseline results

Estimation results of the basic specification are shown in Table 2. The first column shows OLS results, while the second and third column gives 2SLS and GMM results. In each case, standard errors are robust to heteroskedasticity and autocorrelation.

As expected, OLS estimates are biased downward and the bias is sizable, suggesting that, as conjectured, countries enter RTAs at least partly to overcome excess trade-policy volatility. Whatever the estimation method, TA_{ct} significantly reduces agricultural trade policy volatility. The point estimates of the coefficient on the count of trade agreements are very close under 2SLS and GMM (-0.140 and -0.122, respectively). That is, consistent estimation of the basic specification indicates that an additional trade agreement reduces agricultural trade-policy volatility by 12-14 percent (recall that our specification is a semi-log one).

Ratification of the WTO's agricultural agreement also reduces agricultural trade-policy volatility (with a large effect of -19.6 percent and -17.5 percent under 2SLS and GMM, respectively) but the effect is significant at the 5 percent level in the former case and at the 10 percent only level in the latter case. The low level of significance of this effect is more in line with Rose's (2004) result than Mansfield and Reinhardt's (2008) who found a large and precisely estimated effect for WTO membership. It is not overly surprising, given the weak disciplines involved in the agricultural agreement. Note that we have not attempted to instrument for the WTO's agricultural agreement in the baseline specification. Instrumentation gives qualitatively similar results.

Except for macro shocks, controls behave as expected. World price volatility is significant, justifying the adjustment to purge the volatility of agricultural trade policy of its non-

discretionary component. The weight government puts on social welfare seems to be an important factor in explaining the dependent variable, as it statistically decreases volatility. While the effect of assembly-elected systems does not differ statistically from the one of parliamentary regimes, presidential systems, as conjectured, reduce volatility compared with parliamentary regimes.

Table 3 shows estimation results for the first-stage equation (determination of the number of trade agreements). Except for the weight on social welfare, the results are consistent with the conjectures. Large countries are more likely to sign agreements, and so are countries that are members of many military alliances.

Robustness

This section presents the results of two types of robustness checks, each including robust standard errors. The first type consists in using again the basic specification, but controlling for the lagged level of assistance. In a model where changing trade policy implies political and economic adjustment costs (say a partial-adjustment model), the initial level of assistance will be a determinant of changes in trade policy. Also, one may assert that the relevant measure of trade policy volatility is not the percentage-point change in the rate of assistance, but rather the proportional change in the rate of assistance. Controlling for the lagged level of assistance addresses these concerns. Results of OLS, 2SLS and GMM estimates are provided in Table 4.

Results of the first stage estimation are available upon request. With the exception of the world price volatility in the second stage, the results are qualitatively the same to those reported in Tables 2 and 3. Adding the initial level of assistance causes the world price volatility coefficient to become insignificant. Also, the lagged level of assistance is statistically significant in the second stage, while negative and statistically insignificant in the first stage.

The second set of robustness checks consists of using different measures of trade agreements. First, in order to proxy for the depth of agreements, we mark apart those with provisions on trade in services. This gives us a new variable TA_{ct}^{GATS}, with

$$TA_{ct}^{GATS} = \begin{cases} TA_{ct} & \text{if } c\text{'s agreements all have service provisions} \\ TA_{ct} - s & \text{if } s \text{ of } c\text{'s agreements do not have service provisions.} \end{cases}$$

Second, we recode TA_{ct}^{GATS} to take into account the number of signatories in agreements with

service provisions. Let k index agreements, S_{ct} be the subset of c's agreements at t with service provisions, and n_k the number of c's partners in k. Then

$$TA_{ct}^{GATS\,/\,PARTNERS} = \sum_{k \in S_{ct}} n_k .$$

Third, in order to account for the "borrowed-credibility" effect discussed in the introduction, we differentiate agreements by their number of OECD partners. Letting N_{ct} be the set of all of c's agreements at t (so $S_{ct} \subseteq N_{ct}$) and n_k^{OECD} the number of OECD partners in agreement k,

$$TA_{ct}^{OECD} = \sum_{k \in N_{ct}} n_k^{OECD} .$$

Finally, we interact the number of OECD partners and the presence of GATS provisions, which gives us

$$TA_{ct}^{GATS\,/\,OECD} = \sum_{k \in S_{ct}} n_k^{OECD} .$$

GMM results for the incidence of alternative measures of trade agreements are shown in Table 5. Deeper forms of trade agreements have stronger volatility-reducing effects. One additional RTA with a service-liberalization provision reduces volatility by 24 percent on average, against 12-14 percent in the baseline specification. The number of RTA partners, be it the number of OECD partners or the number of partners in service-including RTAs, also reduces agricultural trade-policy volatility significantly: -5 percent for an additional OECD partner (TA_{ct}^{OECD}), -6.5 percent for an additional partner in an RTA with a service provision ($TA_{ct}^{GATS\,/\,PARTNERS}$), and -7.4 percent for an additional OECD partner in an RTA with a service provision ($TA_{ct}^{GATS\,/\,OECD}$). Note that these coefficients are not directly comparable with those of the baseline specification, since the regressor of interest now counts partners, rather than agreements (so the marginal effect is that of a partner country rather than that of an agreement, which means that the effect should be expected to be smaller). The number of partners alone does not seem to have any effect. This largely accords with intuition: rules-vs-discretion effects are more likely to be present when a developing country with relatively weak institutions teams up with an industrial one having stronger institutions. The developing country can then "borrow the credibility" of the industrial one, pretty much like countries with weak inflation-fighting records in Europe borrowed the Bundesbank's credibility under the European Monetary System.

This effect can be expected to be magnified with deeper agreements, which is what we find. The coefficients on political-economy controls are largely unaffected by the choice of measure for RTAs.

Is Latin America different?

Latin America is a region which has high levels of trade policy volatility, and one where regional integration has been quite active since the late 1970s with the creation of the Latin American Integration Association (LAIA). Of the 200 trade agreements that were active in 2006 and that had been notified to the WTO, 50 were signed by at least one Latin American country (25 percent, whereas Latin America represented around 10 percent of WTO's membership). It has been estimated that the share of trade in Latin America that occurs under regional trade agreements is above 50 percent (Grether and Olarreaga 1999). Trade policy volatility is also higher than in other developing regions. In our sample of agricultural products, Latin America is the region with the highest volatility in trade policy among developing countries, followed by Sub-Saharan Africa which has a degree of agricultural trade policy volatility which is 30 percent smaller.

In order to disentangle any differences in the relationship between trade policy volatility and regional trade agreements in Latin America, we introduced in (1) an interaction term between TA and a dummy that takes the value 1 when the observation corresponds to a Latin American country. A positive coefficient on the interaction term would indicate that the negative impact of trade agreements on volatility is smaller in Latin America (or Latin American countries), whereas a negative coefficient would be evidence of a larger effect. Results are shown in table 6 for the OLS, 2SLS and GMM estimators. Standard errors are robust to heteroskedasticity and autocorrelation.

Under OLS, the interaction term coefficient is insignificant. However, once we instrument, the interaction term is negative and statistically significant. And this additional effect for Latin American countries is economically as important as the one found on average for the full sample involving all regions. This implies that the average effect in Latin America is on average double the one estimated for the rest of the sample. Note that the impact of being a member of the WTO on trade policy volatility becomes statistically insignificant, which can be

partly explained by the fact that all Latin American countries are WTO members and therefore part of the Latin American-specific effect was being captured by the WTO variable. This is now consistent with the results found by Rose (2004).

Given that on average trade agreements impose more discipline in Latin America than in the rest of the world, one may wonder which countries in Latin America are driving these results: is it Chile or Brazil, and what can explain these differences? Table 7 provides the results of the estimation where we added several additional variables that interact TA with country dummies for Latin American countries.[8]

The coefficients of the interaction terms for Argentina and Chile are negative and significant. They are also economically very large, with coefficients that are 2 to 4 times the average impact in the rest of the sample, suggesting that trade agreements have been particularly successful in reducing agricultural trade policy volatility in these countries. In the case of Argentina, one needs to note that it is a country that has historically experienced a lot of volatility in terms of not only trade policy but economic policy in general. The signing of the Mercosur agreement and the creation of a customs union with a much larger neighbor (Brazil) imposed an important constraint in terms of what can be done in the area of trade policy. In the case of Chile, the signing of bilateral trade agreements with large developed countries (Canada, European Union, United States) and large developing countries (Argentina, Brazil, Mexico, etc.) may partly explain the large reduction in trade policy volatility. It can also be explained partly by the fact that Chile's tariffs became uniform at the time at which Chile engaged in an important number of trade agreements. Note, however, that non-tariff barriers were not made uniform, and this is clearly an important determinant of agricultural trade policy.[9]

In the case of Colombia, the additional effect goes in the opposite direction, suggesting that in Colombia trade agreements reduce trade policy volatility by less than in the rest of the sample. Moreover, the magnitude of this additional effect is large enough to offset the impact predicted on average in our sample, which implies that Colombia's trade agreements had little impact on Colombia's agricultural trade policy volatility. This may not be unexpected if one considers that, until 2002, Colombia was only part of LAIA and the Comunidad Andina de

[8]Note that the analysis is restricted by the database. Therefore only six Latin American countries are part of the discussion.

[9]Indeed according to estimates by Kee, Nicita and Olarreaga (2008, 2009), non-tariff barriers explain 90 percent of the trade restrictiveness of Chile.

Naciones (CAN). These are agreements among developing countries that have been weakly enforced, and have taken many different forms over the years.

Results for Brazil, Nicaragua and Mexico suggest that the discipline imposed by trade agreements in those countries do not differ statistically from the rest of the world. For Nicaragua and Brazil, this may not be surprising as they are engaged either in weak agreements or, in Brazil's case, with much smaller members. The outcome is more surprising for Mexico, which had at least three agreements in force for most of the time for which data are available. In 2002, 12 agreements were in force. Moreover, since 1994, Mexico is part of the NAFTA. One potential explanation as to why we do not observe additional effects for Mexico is that most of the bilaterals post-NAFTA were signed with other Latin American countries. Presumably, the exit costs of those bilaterals are not high enough to provide a credible threat in the case of deviations.

Concluding remarks

This chapter looks at the volatility-reducing effect of RTAs on trade policy for agricultural products, taking as our dependent variable a direct measure of policy distortions rather than trade flows. In that sense we differ from Mansfield and Reinhardt (2008) and Rose (2004), who looked at the effect of regionalism and WTO membership, respectively, on trade-flow volatility. This means that the effect we are looking for is at the same time more direct (since we consider directly the policy variable rather than an outcome variable whose volatility can pick up many other parasite influences) but also more diffuse, because our measure of policy distortions is a mixture of a country's bilateral and MFN trade policies. That is, we test whether a trade agreement between, say, Mexico and the U.S. stabilizes Mexican trade policy not just vis-à-vis the U.S. but also vis-à-vis all of its partners, preferential or MFN. In spite of these differences, our results are remarkably in line with those of Mansfield and Reinhardt: regionalism significantly reduces the volatility of trade policy for agricultural goods, and the effect is quantitatively substantial (about 13 pecent less volatility for each additional RTA) and robust across a wide variety of specifications.

Our result concerning WTO membership (which means, in an agricultural context,

ratification of the Uruguay Round's agricultural agreement) is less pessimistic than Rose's. Rose found no effect whatsoever, whereas we find a weakly significant but nevertheless identifiable volatility-reducing effect. One obvious difference between our exercise and Rose's is that we look at short-run volatility whereas he looks at the long run. Perhaps more importantly, in our equation that includes both WTO membership and various proxies for RTA membership, we instrument for the latter. Since most RTAs state, as one of their primary goals, the creation of a stable and predictable trading environment, countries that are most eager to form RTAs can be expected to be those that suffer from intractable policy volatility and therefore need to find outside commitment mechanisms. This means that OLS estimates are likely to be biased downward (indeed this is what we find). Using fixed effects, as Rose does, certainly alleviates the problem by controlling for time-invariant country characteristics that may affect trade-policy volatility, but it may not be altogether neutralized. More research is clearly called for to explain completely this difference in results.

We also find that deeper agreements and those involving "Northern" (industrial) partners seem to have more volatility-reducing effects. This accords with intuition. If the reduction in volatility is obtained by strategic delegation to supra-national institutions, those are likely to be stronger if they are formed, like the EU, by countries with strong domestic institutions. Put crudely, Bulgaria is likely to get a stronger anchor for its trade policy by joining the EU than by forming an RTA with Romania, for example. If the reduction in volatility is obtained instead by substituting rules for discretion in an RTA with precise rules (like NAFTA), those rules will be stronger if they are backed by a country with strong and stable institutions. This is like countries with weak institutions (e.g. weak separation of powers) "borrowing" the credibility of countries with stronger institutions.

Results for Latin America, where regionalism and trade policy volatility have been predominant, confirm the overall picture. They suggest that the trade policy volatility-reducing effect of regional integration agreements has on average been stronger in this region, although there is some interesting heterogeneity within the region.

Thus, by and large our results suggest that the reduction in policy volatility should be counted as one of the "non-traditional" gains from regionalism. Inasmuch as policy volatility has harmful effects for investment and growth, this may be an important argument in support of regionalism.

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Table 1: Summary statistics

Variable	**Mean**	**(Std. Dev.)**	**Min.**	**Max.**	**N**
Trade agreements (TAs)	3.136	(4.392)	0	26	1095
TAs (GATS' type)	0.832	(1.66)	0	9	1095
TAs (Partners and GATS' type)	3.561	(6.167)	0	27	1095
TAs (Partners and OCDE countries)	4.282	(6.622)	0	20	1095
TAs(Partners, OCDE countries and GATS' type)	3.389	(5.835)	0	20	1095
WTO	0.282	(0.45)	0	1	1095
Nominal rate of assistance	0.343	(0.626)	-3.4	4.476	1095
Nominal rate of assistance volatility	0.243	(0.346)	0	6.766	1095
Nominal rate of assistance volatility (in log)	-1.813	(0.972)	-12.822	1.912	1095
Price volatility	221.154	(447.641)	2.589	4824.143	1095
Price volatility (in log)	4.713	(1.039)	0.951	8.481	1095
Price inverse volatility	0.001	(0.002)	0	0.043	1095
Price inverse volatility (in log)	-7.429	(0.85)	-9.665	-3.148	1095
GDP (current bio USD)	292.394	(640.722)	1.664	5303.791	1095
GDP (current bio USD, in log)	4.257	(1.789)	0.509	8.576	1095
GDP volatility (current bio USD)	27.239	(69.446)	0.007	658.607	1095
GDP volatility (current bio USD, in log)	1.576	(2.042)	-4.974	6.49	1095
Government's social welfare weighting	9.061	(31.229)	0.007	246.405	1095
Government's social welfare weighting (in log)	0.54	(1.674)	-4.902	5.507	1095
Square of the government's social welfare weighting (in log)	3.092	(5.114)	0	30.327	1095
Presidential system	0.348	(0.477)	0	1	1095
Assembly-elected president system	0.064	(0.245)	0	1	1095
Parliamentary system	0.588	(0.492)	0	1	1095
Military alliances	3.688	(5.267)	0	31	1095

Table 2: Explaining trade policy changes

Dependent Variable: *Trade policy volatility (in log)*	**OLS**	**2SLS**	**GMM**
Regressors:			
Trade agreements	-0.045***	-0.140***	-0.122***
	(0.014)	(0.043)	(0.042)
WTO	-0.101	-0.196**	-0.175*
	(0.083)	(0.094)	(0.093)
World price volatility (in log)	0.071**	0.080**	0.072**
	(0.031)	(0.032)	(0.031)
GDP volatility (in log)	0.030*	0.031*	0.031*
	(0.018)	(0.018)	(0.018)
Government's social welfare weighting (in log)	-0.086***	-0.095***	-0.094***
	(0.024)	(0.024)	(0.024)
Presidential system	-0.216*	-0.247**	-0.211*
	(0.116)	(0.120)	(0.118)
Parliamentary system	-0.122	-0.231*	-0.203
	(0.119)	(0.136)	(0.135)
Country and time fixed effects	yes	yes	yes
Observations	1095	1095	1095
R^2	0.216	0.159	0.178

Source : Authors' calculations

Table 3: Why do countries sign trade agreements?

Dependent Variable: *Trade agreements*	**1st stage of 2SLS**
Regressors:	
WTO	-1.223***
	(0.443)
World price volatility (in log)	0.063
	(0.057)
GDP (in log)	1.475***
	(0.239)
GDP volatility (in log)	-0.054
	(0.054)
Presidential system	-0.046
	(0.257)
Parliamentary system	-1.012***
	(0.355)
Government's social welfare weighting (in log)	-0.008
	(0.058)
Square of the government's social welfare weighting (in log)	-0.024
	(0.019)
Military alliances	0.097***
	(0.036)
Country and time fixed effects	yes
Observations	1095
R^2	0.584

Source : Authors' calculations

Table 4: Explaining trade policy changes (lagged NRA)

Dependent Variable: *Trade policy volatility (in log)*	**OLS**	**2SLS**	**GMM**
Regressors:			
Trade agreements	-0.039**	-0.129***	-0.104***
	(0.015)	(0.042)	(0.039)
WTO	-0.205**	-0.284***	-0.261***
	(0.088)	(0.096)	(0.095)
Lagged nominal rate of assistance (in log)	0.098***	0.090***	0.090***
	(0.031)	(0.032)	(0.032)
World price volatility (in log)	0.044	0.051	0.040
	(0.031)	(0.032)	(0.031)
GDP volatility (in log)	0.032*	0.035*	0.034*
	(0.018)	(0.018)	(0.018)
Government's social welfare weighting (in log)	-0.058**	-0.071***	-0.075***
	(0.026)	(0.026)	(0.026)
Presidential system	-0.199*	-0.199*	-0.202*
	(0.107)	(0.111)	(0.111)
Parliamentary system	-0.090	-0.204	-0.175
	(0.121)	(0.139)	(0.138)
Country and time fixed effects	yes	yes	yes
Observations	998	998	998
R^2	0.255	0.199	0.225

Source : Authors' calculations

Table 5: Explaining trade policy changes: alternative counts of trade agreements (GMM)

Dependent Variable: *Trade policy volatility (in log)*	(1)	(2)	(3)	(4)
Regressors:				
TAs (GATS' type) (1)	-0.238***			
	(0.077)			
TAs (Partners and GATS' type) (2)		-0.065***		
		(0.023)		
TAs (Partners and OCDE countries) (3)			-0.050*	
			(0.026)	
TAs (Partners, OCDE countries and GATS' type) (4)				-0.074***
				(0.027)
WTO	-0.190**	-0.123	-0.066	-0.121
	(0.089)	(0.090)	(0.094)	(0.091)
World price volatility (in log)	0.085***	0.083***	0.072**	0.082**
	(0.031)	(0.032)	(0.032)	(0.032)
GDP volatility (in log)	0.029	0.028	0.027	0.029
	(0.018)	(0.018)	(0.018)	(0.018)
Government's social welfare weighting (in log)	-0.089***	-0.102***	-0.106***	-0.103***
	(0.024)	(0.024)	(0.025)	(0.024)
Presidential system	-0.217*	-0.303**	-0.248**	-0.320**
	(0.118)	(0.129)	(0.126)	(0.134)
Parliamentary system	-0.093	-0.131	-0.060	-0.140
	(0.123)	(0.127)	(0.142)	(0.128)
Country and time fixed effects	yes	yes	yes	yes
Observations	1095	1095	1095	1095
R^2	0.219	0.203	0.187	0.199

Source : Authors' calculations

Table 6: Is the Latin American region different?

Dependent Variable: *Trade policy volatility*	**OLS**	**2SLS**	**GMM**
Regressors:			
Trade agreements	-0.045***	-0.138***	-0.120***
	(0.013)	(0.041)	(0.040)
Trade agreements in LAC	-0.032	-0.108**	-0.111**
	(0.028)	(0.050)	(0.050)
WTO	-0.092	-0.167*	-0.147
	(0.084)	(0.094)	(0.093)
World price volatility (in log)	0.071**	0.083***	0.079**
	(0.031)	(0.032)	(0.031)
GDP volatility (in log)	0.030*	0.029	0.032*
	(0.018)	(0.018)	(0.018)
Government's social welfare weighting (in log)	-0.087***	-0.099***	-0.101***
	(0.024)	(0.024)	(0.023)
Presidential system	-0.204*	-0.204*	-0.169
	(0.117)	(0.122)	(0.120)
Parliamentary system	-0.147	-0.314**	-0.278**
	(0.121)	(0.141)	(0.140)
Country and time fixed effects	yes	yes	yes
Observations	1095	1095	1095
R^2	0.216	0.157	0.176

Source : Authors' calculations

Table 7: Are Latin American countries different?

Dependent Variable: *Trade policy volatility*	**OLS**	**2SLS**	**GMM**
Regressors:			
Trade agreements	-0.047***	-0.122***	-0.089***
	(0.014)	(0.039)	(0.033)
Trade agreements in ARG	-0.145	-0.357***	-0.384***
	(0.132)	(0.115)	(0.112)
Trade agreements in BRA	-0.154	-0.235	-0.192
	(0.102)	(0.151)	(0.142)
Trade agreements in CHL	-0.106**	-0.142**	-0.142**
	(0.050)	(0.064)	(0.059)
Trade agreements in COL	0.115*	0.134*	0.153**
	(0.060)	(0.079)	(0.077)
Trade agreements in MEX	-0.008	0.002	-0.009
	(0.028)	(0.041)	(0.040)
Trade agreements in NIC	-0.231	-0.396*	-0.229
	(0.158)	(0.235)	(0.225)
WTO	-0.089	-0.156*	-0.126
	(0.084)	(0.091)	(0.090)
World price volatility (in log)	0.076**	0.089***	0.087***
	(0.031)	(0.032)	(0.031)
GDP volatility (in log)	0.030*	0.031*	0.026
	(0.018)	(0.018)	(0.018)
Government's social welfare weighting (in log)	-0.085***	-0.091***	-0.078***
	(0.024)	(0.024)	(0.023)
Presidential system	-0.169	-0.167	-0.123
	(0.127)	(0.132)	(0.129)
Parliamentary system	-0.250*	-0.402**	-0.323**
	(0.135)	(0.168)	(0.157)
Country and time fixed effects	yes	yes	yes
Observations	1095	1095	1095
R^2	0.220	0.182	0.204

Source : Authors' calculations