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Does Trade Foster Institutions? An Empirical Assessment

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Abstract: The relationship between trade and institutions has been extensively debated by trade economists and political scientists. The aim of the present paper is to provide some empirical evidence on the causal relationship between institutions and trade flows in a panel framework. We present a Granger causality test (1969) as well as a Hurlin and Venet (2001) test for panel data using a bilateral trade flows panel that covers 29 years. The issue of zero flows of trade is handled by using a panel Poisson Pseudo-Maximum Likelihood estimator.

JEL classification: F10, C10
Keywords: institutional quality, Granger causality test; panel data; zero trade flows.

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1 Introduction

The field of institutional economics stresses the role of institutions as a possible determinant of many economic phenomena (see among many others North, 1990). On the other hand, recent contributions suggest that economic features may determine the development of a country's institutional setting (Acemoglu and Robinson, 2006). Therefore, the issue of the endogeneity of institutions is well known and widely debated whenever a causal relationship between economic variables and institutions is suggested.

When focussing on international trade among countries, the literature has generally investigated the effect that good institutional quality has on trade. A number of papers show theoretically, and demonstrate empirically, that better institutions foster trade flows. However, recent developments suggest that the causality may actually also run in the other direction: larger trade flows may foster better institutions. Any empirical exercise that considers both variables cannot ignore the possible endogeneity of institutions. Therefore, some empirical evidence seems necessary to shed light on this controversial issue.

To investigate the causal relationship between trade and institutions, we adopt the Granger causality test. This methodology is widely acknowledged as the most popular instrument for investigating the causality between two variables. We implement the econometric exercise using data on bilateral trade flows for the period 1976-2004. Given the panel dimension of our data, which vary across country pairs and over time, we adopt a fixed effects estimator.

The standard Granger causality test (1969) seems to suggest that causality runs in both directions. However, when we implement the homogeneous non causality test suggested by Hurlin and Venet (2001), which takes the cross-sectional heterogeneity of the observations into account, we find no causality.

Given the peculiar nature of trade data, namely a large presence of zeros, we implement some robustness checks. First, we present the results using a Poisson pseudo-maximum likelihood estimator (Santos Silva and Tenreyro, 2006), which is better suited to this type of data. Additionally, we investigate whether our results are valid on a subsample comprising positive trade flows only. Both robustness checks yield the same conclusions as the main results presented.

The remainder of this paper is organized as follows: Section 2 discusses the theoretical literature, Section 3 presents the empirical model, and discusses the econometric specification. Section 4 describes the data and presents the results, while Section 5 concludes.

2 Review of the Literature

The literature that investigates the link between trade and institutions is vast. As this relationship is multifaceted, the issue has been investigated from different points of view. A large stream of literature has inspected the effects of both institutions and trade on economic growth. Starting from the seminal work by Frankel and Romer (1999), several authors have investigated this relationship, generally finding a positive effect of trade on economic growth (Tavares and Wacziarg, 2001; Rigobon and Rodrik, 2005; Bhattacharyya et al., 2009).

Other authors have investigated how democratic regimes influence trade policy (Mayer, 1984; Yang, 1995): the literature on endogenous tariff formation predicts that trade policy under democracy follows the preferences of the median voter. Grossman and Helpman (1994) suggest that the role of special interest groups may be relevant in this respect.

Neither stream of literature, however, deals with the direct relationship between institutions and the effective amount of trade. This has been investigated by a number of authors in the political science literature. Using different samples of countries, over different time periods, they generally find that democracy increases trade (Dixon and Moon, 1993; Morrow et al., 1998; Bliss and Russett, 1998; Mansfield et al., 2000; Decker and Lim, 2009).

In their seminal article, Anderson and Marcouiller (2002) show that in the presence of low quality institutions trade is reduced, as insecurity raises the price of traded goods. This implies that trade expands when supported by a good level of institutional quality, which ensures the enforcement of contracts. In their words, incomplete contract enforcement acts as a ”hidden tax” on trade. Kaufmann and Wei (1999) test the ”efficient grease” hypothesis, which suggests that a firm may find bribes helpful to reduce the effective red tape it faces. However, they find that corruption does not improve exchanges, instead, if corruption is widespread, time spent with bureaucrats and the regulatory burden are high. Anderson and Young (2006) develop a model that predicts that a low level of contract enforcement reduces trade volume. The search for a trading partner in the spot market, instead of the contract market, is inefficient, and this reduces trade volume. Under risk neutrality, imperfect contract enforcement is equivalent to a tariff.

A parallel stream of literature has recently demonstrated, both theoretically and empirically, that institutional quality may be a source of comparative advantage in the production of goods which are more complex (Levchenko, 2007; Nunn, 2007; Acemoglu et al., 2007; Costinot, 2009).

Very recently, Aidt and Gassebner (2010) have presented a theoretical model that shows that autocracies trade less than democracies, and provide empirical evidence in support of this, while Yu (2010) presents a gravity equation augmented with democracy, and finds that it has a positive effect on trade flows.

Overall, these different contributions suggest that good institutions, either in the form of a democratic regime or effective contract enforcement, favour trade. On the other hand, corruption and poor contract enforcement hamper trade. However, none of these articles considers the possibility that the causality may run in the opposite direction, namely that trade may foster institutions.

With regard to this, a number of other contributions try to provide an answer, but the findings from these studies diverge: Lopez-Cordova and Meissner (2005) and Rudra (2005) find a positive effect of trade on democracy; conversely, Li and Reuveny (2003) and Rigobon and Rodrik (2005) find a negative impact. Additionally, Bussmann (2001) finds no impact of trade globalization on democracy at all. Baier and Bergstrand (2001) affirm that trade liberalization, transport improvements and other developments over the last fifty years leave a large positive residual growth in world trade unexplained. This implies positive knock-on effects travelling from trade to institutions. More recently, Anderson (2009) has provided a formal model in which either positive or negative knock-on from trade to institutions is possible.

Institutions are suspected to be endogenously determined by the economic environment of a country, and the opposite may also hold: institutions shape the economic performance of a country. Therefore, the issue of the endogeneity of institutions in trade flows cannot be simply ignored.

Yu (2007) investigates the two-way causality between trade globalization and political liberalization in a gravity framework. He finds that trade globalization dampens political liberalization, while political liberalization has a positive effect on trade. Eichengreen and Leblang (2008) find a positive relationship running in both directions between democracy and globalization. However, a clear assessment of the causality relationship is missing in both papers. We aim at filling this gap in the literature, by formally investigating the causal relationship between institutions and trade.

3 The Empirical Model

So far, there are no works in the literature in which the causal relationship between contract enforcement and trade has been explicitly tested. To investigate this point, we adopt an instrument widely adopted in the time-series econometrics literature: the Granger causality test (1969). This methodology is widely acknowledged as the most popular instrument for evaluating the nature of the causal relationship between two variables (Hood et al., 2008). The purpose of this test is to check whether a certain variable, called x_t, causes another variable, called y_t, considering a linear autoregressive data generating process. This procedure is useful to highlight how much of the current value of y_t can be explained by its past values, and also to show whether lagged values of x can improve the fit of the model.

In this way, y_t is said to be Granger-caused by x_t if x_t helps in the prediction of y_t, or equivalently if the coefficients on the lagged x_t's are statistically significant. In our framework, we implement this test in order to investigate whether the causality runs from institutions to trade, or in the other direction, or, finally, in both directions.

However, our analysis is different from standard applications of this test in two respects. First, our data show a panel dimension: we have data on bilateral trade for 197 countries, trading with 243 partner countries over a time interval that runs from 1976 to 2004. Secondly, bilateral trade flows are characterized by a strong presence of zeros (as will be shown in Section 4), which requires appropriate estimators. Consequently, the empirical evidence is affected by all these characteristics and we need to use an appropriate econometric tool to fit these data.

A preliminary step to implement the Granger causality test is the choice of the number of lags to include in the system. Several possibilities are adopted in the literature: the lag length is often selected by checking the cross-correlogram and correlograms for each series (following the Box and Jenkins, 1976 method). Given that we have a panel of 34,131 trading pairs, the option of investigating the correlogram for each series is not feasible. Alternatively, the choice is based on classical information criteria, such as Akaike Information Criterion (AIC) and the Schwarz Bayesian Information Criterion (BIC). Notice that the literature also acknowledges other criteria such as rules of thumb or arbitrary lag selection (Thornton and Batten, 1985), however we prefer to follow the indications of the information criteria.

Then, the test is implemented by testing the joint null hypothesis that $H_0 : \beta_1 = ... = \beta_N = 0$ for both equations. If we accept the null, y is not Granger-caused by x and viceversa. The alternative hypothesis is that at least one β_i is different from zero.

This test is meant for time-series data, however Granger (2003) stresses the importance of extending the causality test to panel data. As an example, the relationship between the real economy and money (Sims, 1972) could be investigated considering both the time and country dimensions. Hurlin and Venet (2001) discuss the use of the causality test in the case of heterogenous panel data, defining some properties to take into consideration the causality in the presence of heterogeneity, considering linear estimators. They present an application to the relationship between financial deepening and economic growth for sub-Saharian countries over the period 1967-1998. Following the same theoretical assumptions, Lu et al., (2006) implement a causality test to investigate the relationship between R&D and productivity growth. Hurlin (2005, 2007) presents a complete theoretical analysis about the assumptions of the Granger Causality test with heterogenous fixed effects panel data. Indeed, as Granger (2003) highlights, in the case of panel data the null hypothesis should be reconsidered: *"if some variable, say x_t causes another variable, say y_t, everywhere in the panel [...]. This is rather a strong* *null hypothesis."*

The extension of the standard causality test to panel data implies testing cross-sectional linear restrictions on the coefficients of the model. Considering the cross-sectional information is useful to extend the information set. Following Hurlin (2007), we consider two generic variables, x and y, observed on T periods and on N individuals. For each individual $i = 1, ..., N$ at time $t = 1, ..., T$, the following linear model is taken into consideration:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \tag{1}$$

where K is a positive integer, $\beta_i = \left(\beta_i^{(1)}, ..., \beta_i^{(K)}\right)'$ and α_i represent the individual fixed effects. The initial conditions $(y_{i,-K}, ..., y_{i,0})$ and $(x_{i,-K}, ..., x_{i,0})$ of both individual processes $y_{i,t}$ and $x_{i,t}$ are given and observable. The lag orders K are identical for all cross-section units of the balanced panel. The autoregressive parameters $\gamma_i^{(k)}$ and regression coefficient slopes $\beta_i^{(k)}$ are constant and could differ across groups.

Hurlin and Venet (2001) define four kinds of causality relationships which could occur in a panel data model with heterogeneity. The first one is the Homogenous Non-Causality (HNC) hypothesis, which implies that there does not exist any individual causality relationship between x and y. The second case is the opposite one, the Homogenous Causality (HC) hypothesis. In this situation there exist N causality relationships and the individual predictors of y, obtained conditionally on the past values of y and x, are identical. The third hypothesis is the Heterogenous Causality (HEC) hypothesis. As in the previous case, there exist N causality relationships, but the dynamics of y are heterogenous. However, the heterogeneity does not affect the causality result. The fourth case is the Heterogenous Non Causality (HENC) hypothesis, in which there exists a subgroup of individuals for which there is a causal relationship from x to y. The test procedure for these hypotheses is shown in Figure 1.

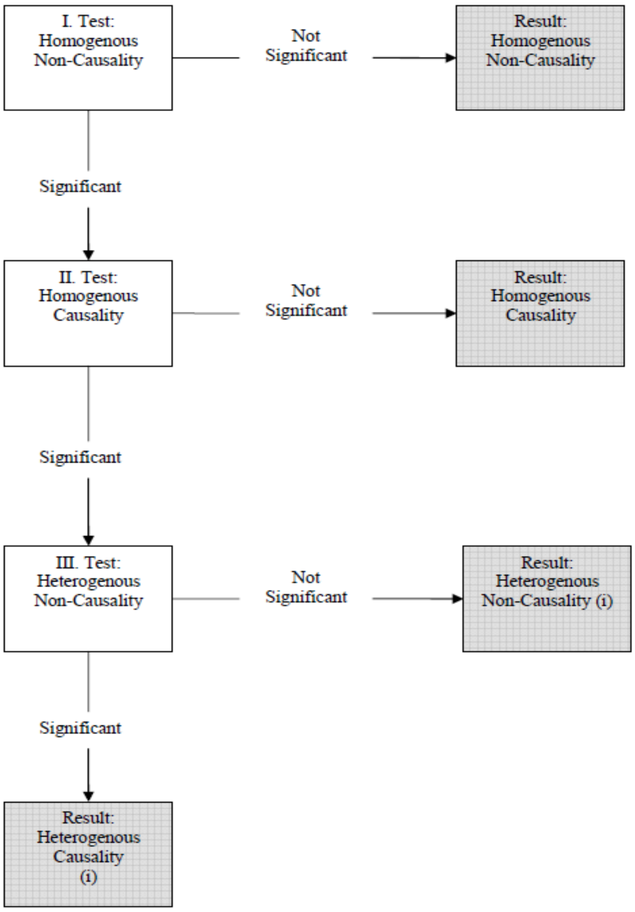
Consider the HNC hypothesis: under the alternative, there exists a subgroup of individuals with no causality relations and a subgroup of individuals for which the variable x Granger causes y.

The null hypothesis of HNC is that $\beta_i = 0$ for all individuals. Under the alternative hypothesis, β_i is allowed to differ across groups. This hypothesis allows for some, but not all, of the individual vectors to be equal to 0 (non causality assumption). Under H_1, there are $N_1 < N$ individual process with no causality from x to y.

The alternative hypothesis is:

$$\begin{aligned} H_1 &: \beta_i = 0 \forall i = 1, ..., N_1 \\ H_1 &: \beta_i \neq 0 \forall i = N_1 + 1, ..., N \end{aligned}$$

Figure 1 - Test Procedure for a Panel Granger Causality Test (as reported in Hood et al., 2008)



where N_1 is unknown but satisfies the condition $0 \leq N_1/N \leq 1$. Notice that if $N_1 = N$ the hypothesis becomes of no causality for each individual in the panel, which is the null hypothesis in the case of HNC. If $N_1 = 0$ instead, there is causality for all the individuals in the sample. The structure of this test is similar to the unit root test in the case of heterogenous panel data proposed by Im et al. (2003). If the null hypothesis is not rejected, the variable x does not Granger cause the variable y for all the individuals of the panel and we get an homogenous result. If $N_1 > 0$, the causality relations are different according to the individuals in the sample.

Given the characteristics of the data we use, namely a large presence of zeros in the trade variables (see Section 4), we have to consider a different estimator. We follow the recent literature and adopt a Poisson Pseudo-Maximum Likelihood estimator (Santos Silva and Tenreyro, 2006). Indeed, an OLS estimator requires the normality of the error term. If the dependent variable, trade flow, is not normally distributed, it is common practice to take its logarithm. However, in presence of zero flows of trade this is not feasible. Secondly, even if all observations of y_{it} are positive, the expected value of the log-linearized error depends on the covariance term and the OLS estimator is not consistent.

To solve this problem, a non-linear model should be taken into account. Santos Silva and Tenreyro (2006) show that, following McCullagh and Nelder (1989), it is possible to find a pseudo-maximum likelihood estimator which is more efficient than the standard non-linear least squares (NLS) and does not need nonparametric regression. The estimator suggested is numerically equivalent to the Poisson pseudo-maximum likelihood (PPML) estimator used for count data.

Thus, we apply the Granger Causality test in the case of Poisson Pseudo-Maximum Likelihood estimator. We present the traditional Granger test on panel data, and as a robustness check, the test adopting a non-linear estimator, the PPML, when trade flow is the dependent variable.

4 The Empirical Evidence

4.1 *The Data*

In order to investigate the causal relationship between trade and institutions, we use data taken from the Trade, Production and Protection Database, maintained by the World Bank (Nicita and Olarreaga, 2006). It contains information on bilateral trade flows classified by ISIC (International Standard Industrial Classification), Revision 2. As we are not interested in the sectoral dimension, we consider overall bilateral trade flows (exports and imports for each country pair). This leads to an unbalanced panel with 403,135 observations on trade between 197 countries and 243 partner countries, that covers the period 1976-2004 (29 years). However, zero trade flows are a relevant share of our observations: 13.8% of reported imports are equal to zero, and the share rises to 20.5% in the case of exports. The measures of institutional quality, $inst_{ct}$, are taken from the Freedom

Table 1 - Summary Statistics

Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
export	403135	203149	2210484	0.000	1.99E+08
export (no zeros)	320666	255394.9	2475791	0.027	1.99E+08
import	403135	203887	2241021	0.000	1.99E+08
import (no zeros)	347484	236540.3	2412214	0.052	1.99E+08
inst	374241	0.6622	0.2937	0.000	1

Notes: trade values are expressed in thousands of US Dollars.

House Database, which provides information on political rights and civil liberties for 204 countries since 1976. The index on political rights is based on measures of electoral process, political pluralism and participation and the functioning of government. The measure of civil liberties takes into account four different aspects: freedom of expression and belief; associational and organizational rights; the rule of law and personal autonomy and individual rights. This is our preferred measure. These indicators are measured on a one-to-seven scale, with one representing the highest degree of freedom and seven the lowest. They have been rescaled in the interval [0,1] with increasing values associated with highest economic freedom. Table 1 shows some descriptive statistics.

Before implementing any econometric exercise, it is necessary to investigate the stationarity of the variables considered. Thus, we present the Im et al. (2003) unit root test, which does not assume a common autoregressive parameter across all panels. Therefore, the null hypothesis is that all panels contain a unit root, while the alternative is that some panels are stationary. Results are reported in Table 2.

Table 2 - Results of the Im et al. (2003) Test

Variable	*Min*	*Max*
lexport	-188.099	(0.000)***
lexport (no zeros)	-198.773	(0.000)***
limport	-211.283	(0.000)***
limport (no zeros)	-195.297	(0.000)***
inst	-101.425	(0.000)***

Notes: trade flows are expressed in logs.

For each variable, the null hypothesis is rejected at any level of significance. Therefore, we can affirm that all series are stationary. This preliminary condition is satisfied, and we can thus implement the Granger test.

4.2 *The Econometric Results*

Our purpose is to understand if there is a causality relationship between institutions and trade flows (either exports or imports). Thus, we regress exports and imports in turn on their lags and on the lagged values of the "civil liberties" variable for the reporting country, which is the variable we use to proxy institutional quality. Therefore, in the export equation we investigate whether institutional quality of the exporting country Granger-causes exports, while in the import equation we look for a causality relationship between institutional quality and the amount of imports. This allows us to test if export or import flows are Granger caused by institutions. We thus estimate

$$trade_{it} = \alpha_0 + \alpha_1 trade_{it-1} + ... + \alpha_N trade_{it-N} + \beta_1 inst_{it-1} + ... + \beta_N inst_{it-N} + \epsilon_t \quad (2)$$

where trade may be either $export_{it}$ or $import_{it}$. Vice versa, we regress institutions on their lags and on the lagged values of trade flows:

$$inst_{it} = \alpha_0 + \alpha_1 inst_{it-1} + ... + \alpha_N inst_{it-N} + \beta_1 trade_{it-1} + ... + \beta_N trade_{it-N} + u_t \quad (3)$$

As discussed before, the choice of lag length is generally based on the information criteria. We estimate the equations (2) and (3) using different lag length, from 1 to 4. The AIC and BIC statistics suggest that, whenever trade, either import or export, is the dependent variable the specification with a higher order of lags is to be preferred. However, when the dependent variable is institutions, the information criteria give the opposite result: the preferred specification is the one which includes only one lag. Reassuringly, the signs and significance levels of the explanatory variables, as well as the test on the joint significance, are robust across different specifications. In other words, our results do not depend on the number of lags included in the specification. To save space, we choose to report the results for the specifications including both one or four lags for both the dependent and the independent variables.[1] Tables 3 and 4 show the results obtained considering respectively exports and imports. The results are obtained adopting a fixed effect estimator, to take into account the panel structure of the data.

The first two columns in Table 3 show that export flows are explained by their lagged values, as well as the lagged values of the institutional quality variable. Column 1 in Table 3 shows that past values of export flows and institutional quality are both significant in explaining export behaviour. Indeed, all explanatory variables are positive and significant. The third and fourth column suggest that institutional quality is explained by its lagged values, as well as the lagged value of export flows. Results in Table 4 present the same picture, with imports. However, these results do not imply any causality. To check for the presence of causality, in either direction, we first implement the standard Granger Causality test, which boils down to testing the joint significance of the lagged values of the independent variable. Thus, the null hypothesis is $H_0 : \beta_1 = ... = \beta_N = 0$.

The results for the F test reported in the first two columns of Table 3 and 4 show that we reject the null hypothesis that the coefficients for the lagged values of institutional quality are equal to zero, either with four or one lag.[2] Therefore, we find evidence that exports are Granger caused by institutional quality. We expect a similar effect of institutional quality on imports, indeed better institutions are expected to facilitate trade, in both directions. As expected, we observe an analogous result for import flows. Again, the F test suggests that past values of institutional quality explain import flows: imports are Granger caused by contract enforcement. These results are reported in the first two columns of Table 4. Turning to the causal effect of institutions on trade, we repeat the same F test on the specification

[1] Results with two and three lags are available upon request.

[2] Notice that we obtain the same result with two and three lags.

Table 3 - Granger Causality Test Between Exports and Institutions (Fixed Effects Estimator)

	lexport	lexport	inst	inst
$lexport_{t-1}$	0.3855 (0.0022)***	0.5023 (0.0016)***	0.0005 (0.0001)***	0.0018 (0.0001)***
$lexport_{t-2}$	0.1310 (0.0023)***	-----	0.0006 (0.0001)***	----
$lexport_{t-3}$	0.0843 (0.0023)***	-----	0.0011 (0.0001)***	----
$lexport_{t-4}$	0.0519 (0.0021)***	----	0.0016 (0.0001)***	----
$inst_{t-1}$	0.3325 (0.0464)***	0.9680 (0.0262)***	0.7572 (0.0022)***	0.7588 (0.0012)***
$inst_{t-2}$	0.2182 (0.0561)***	----	0.0199 (0.0026)***	----
$inst_{t-3}$	0.1146 (0.0553)**	----	-0.1025 (0.0026)***	----
$inst_{t-4}$	0.1945 (0.0439)***	----	0.0805 (0.0020)***	----
constant	2.1787 (0.0288)***	2.8121 (0.0198)***	0.1530 (0.0013)***	0.1567 (0.0009)***
Number of observations	223487	316076	223487	316076
Number of individuals	19458	26209	19458	26209
R2 within	0.3017	0.2706	0.5929	0.6034
R2 between	0.9598	0.9543	0.9861	0.9884
R2 overall	0.8823	0.8493	0.9487	0.9482
Granger (1969) causality test	F(4,204021)=152.34*** (0.000)	F(1,289865)=1360.13*** (0.000)	F(4,204021)=313.91*** (0.000)	F(1,289865)=689.64*** (0.000)
Hurlin and Venet (2001) homogeneous non causality test	F(77832,126193)=0.10	F(26209,263657)=0.09	F(77832,126193)=0.01	F(26209,263657)=0.09
AIC	714478.6	1091072	-657303	-882986.1
BIC	714571.4	1091104	-657210.1	-882954.1

Notes: Fixed effect estimates. * significant at 10%, ** significant at 5%, *** significant at 1%. Hurlin and Venet (2001) follows a non-centered Fisher distribution. Critical value for 95th percentile is 1.30 (Greene, 2008).

with institutional quality as dependent variable. The coefficient estimates of the lagged values of both exports and imports are significant, and the F test shows that the null hypothesis that these coefficients are jointly equal to zero has to be rejected. Thus, we observe that trade Granger causes institutional quality.

However, the preliminary evidence provided by the F test is flawed. Indeed, the test as such is designed for time series variables, but is not correct in the context of panel data. While we are testing that the coefficients of the lagged independent variables are jointly statistically different from zero, we are neglecting the heterogeneity across different individuals in the panel, namely countries.

Therefore, we present the test for HNC as suggested by Hurlin and Venet (2001). This is the first step of the Granger causality testing procedure with panel data, as reported in Figure 1.

In this case, we assume the Homogenous Non-Causality hypothesis with

Table 4 - Granger Causality Test Between Imports and Institutions (Fixed Effects Estimator)

	limport	limport	inst	inst
$limport_{t-1}$	0.3632 (0.0022)***	0.4899 (0.0016)***	0.0005 (0.0001)***	0.0015 (0.0001)***
$limport_{t-2}$	0.1329 (0.0023)***	----	0.0008 (0.0001)***	----
$limport_{t-3}$	0.0773 (0.0023)***	----	0.0005 (0.0001)***	----
$limport_{t-4}$	0.0572 (0.0021)***	----	0.0012 (0.0001)***	----
$inst_{t-1}$	0.5874 (0.0513)***	0.7765 (0.0275)***	0.7590 (0.0022)***	0.7599 (0.0012)***
$inst_{t-2}$	-0.0658 (0.0620)	----	0.0197 (0.0026)***	----
$inst_{t-3}$	-0.4490 (0.0612)***	----	-0.1022 (0.0026)***	----
$inst_{t-4}$	0.5212 (0.0485)***	----	0.0824 (0.0020)***	----
constant	2.3460 (0.0313)***	2.8826 (0.0207)***	0.1580 (0.0013)***	0.1585 (0.0009)***
Number of observations	223487	316076	223487	316076
Number of individuals	19458	26209	19458	26209
R2 within	0.2691	0.2497	0.592	0.6031
R2 between	0.9651	0.9489	0.9874	0.9886
R2 overall	0.8764	0.835	0.9489	0.9479
Granger (1969) causality test	F(4,204021) =87.12*** (0.000)	F(1,289865)=795.97*** (0.000)	F(4,204021)=208.22*** (0.000)	F(1,289865)=499.08*** (0.000)
Hurlin and Venet (2001) homogeneous non causality test	F(77832,126193)=0.08	F(26209,263657)=0.60	F(77832,126193)=0.01	F(26209,263657)=0.54
AIC	759351.5	1122595	-656842.2	-882778.7
BIC	759444.4	1122627	-656749.4	-882746.7

Notes: Fixed effect estimates. Trade flows are expressed in logs. * significant at 10%, ** significant at 5%, *** significant at 1%. Hurlin and Venet (2001) follows a non-centered Fisher distribution. Critical value for 95th percentile is 1.30 (Greene, 2008).

the following null and alternative hypotheses:

$$H_0 \quad : \quad \beta_i^{(k)} = 0 \forall i = 1, ..., N, \forall k = 1, ..., p$$

$$H_1 \quad : \quad \beta_i = 0 \forall i = 1, ..., N_1$$
$$H_1 \quad : \quad \beta_i \neq 0 \forall i = N_1 + 1, ..., N$$

in which N_1 is equal to zero, thus preliminarily testing for a homogenous causal relationship. To test these Np linear restrictions, we compute the following statistic:

$$F_{hnc} = \frac{(RSS_2 - RSS_1)/Np}{RSS_1/[NT - N(1+p) - p]}$$

Table 5 - Granger Causality Test Between Trade and Institutions (Poisson Estimator)

	export	export		import	import
$export_{t-1}$	0.0007 (0.0000)***	0.0005 (0.0000)***	$import_{t-1}$	0.0007 (0.0000)***	0.0005 (0.0000)***
$export_{t-2}$	-0.0003 (0.0000)***	----	$import_{t-2}$	-0.0003 (0.0000)***	----
$export_{t-3}$	0.0002 (0.0000)***	----	$import_{t-3}$	0.0002 (0.0000)***	----
$export_{t-4}$	-0.0003 (0.0000)***	----	$import_{t-4}$	-0.0003 (0.0000)***	----
$inst_{t-1}$	1.6789 (0.0001)***	1.8744 (0.0000)***	$inst_{t-1}$	1.4035 (0.0001)***	1.7653 (0.0000)***
$inst_{t-2}$	0.1404 (0.0001)***	----	$inst_{t-2}$	0.1343 (0.0001)***	----
$inst_{t-3}$	-1.1918 (-0.0001)***	----	$inst_{t-3}$	-1.1076 (-0.0001)***	----
$inst_{t-4}$	0.8042 (0.0001)***	----	$inst_{t-4}$	0.9690 (0.0001)***	----
constant	11.4036 (0.0000)***	10.8416 (0.0000)***	constant	11.4603 (0.0000)***	10.9502 (0.0000)***
Number of observations	223487	316076		223487	316076
log likelihood	-1.522e+11	-1.762e+11		-1.670e+11	-1.907e+11
Chi2-test	chi2(4)=7.0e+09*** (0.000)	chi2(1)=1.3e+10 (0.000)		chi2(4)=6.9e+09*** (0.000)	chi2(1)=1.2e+10*** (0.000)
AIC	3.04e+11	3.52e+11		3.34e+11	3.81e+11
BIC	3.04e+11	3.52e+11		3.34e+11	3.81e+11

Notes: Poisson pseudo-maximum likelihood estimates. Trade flows are expressed in levels. * significant at 10%, ** significant at 5%, *** significant at 1%.

where RSS_2 denotes the restricted sum of squared residuals obtained under H_0 and RSS_1 represents the residual sum of squares of the model (1). The F_{hnc} statistic has a Fischer distribution with Np and $NT-N(1+p)-p$ degrees of freedom. If the realization of the statistic is not significant, it implies that the exogenous explanatory variable is not Granger-causing the dependent variable in all the country pairs in the sample. Results are reported in Tables 3 and 4. We observe that when the proper F test is implemented, we get to the opposite conclusion. We are not able to reject the null hypothesis of homogeneous non causality, in both directions. Thus, we conclude that there is no causality running from trade to institutions, and vice versa, when it is tested with proper econometric instruments that take into account the cross-sectional heterogeneity.

4.3 Robustness

The previous results are obtained using the logarithm of trade flows. Although this is common practice in the trade literature, it has recently been proven by Santos Silva and Tenreyro (2006) that the Poisson pseudo-maximum likelihood estimator is to be preferred to the log-linearization of the dependent variable. Therefore, a first robustness check is to implement the same exercise, adopting the PPML estimator. Table 5 reports the results.

When looking at the impact of lagged values of institutional quality of import and export flows, we observe that the coefficient estimates are al-

Table 6 - Granger Causality Test Between Trade and Institutions (Panel Poisson)

	export	export		import	import
export$_{t-1}$	0.0029 (0.0000)***	0.0020 (0.0000)***	import$_{t-1}$	0.0026 (0.0000)***	0.0018 (0.0000)***
export$_{t-2}$	-0.0009 (0.0000)***	----	import$_{t-2}$	-0.0010 (0.0000)***	----
export$_{t-3}$	0.0001 (0.0000)***	----	import$_{t-3}$	0.0002 (0.0000)***	----
export$_{t-4}$	-0.0003 (0.0000)***	----	import$_{t-4}$	-0.0002 (0.0000)***	----
inst$_{t-1}$	0.9869 (0.0001)***	1.0065 (0.0001)***	inst$_{t-1}$	0.8583 (0.0001)***	0.8706 (0.0001)***
inst$_{t-2}$	0.2252 (0.0001)***	----	inst$_{t-2}$	0.1799 (0.0001)***	----
inst$_{t-3}$	-0.5551 (-0.0001)***	----	inst$_{t-3}$	-0.6638 (-0.0001)***	----
inst$_{t-4}$	0.1774 (0.0001)***	----	inst$_{t-4}$	0.2873 (0.0001)***	----
Number of observations	217777	303713		220307	310291
Number of individuals	16979	21782		17637	23193
log likelihood	-8.353e+09	-1.109e+10		-9.239e+09	-1.220e+10
Chi2-test	chi2(4) 3.9e+08*** (0.000)	chi2(1)=5.2e+08*** (0.000)		chi2(4)=2.8e+08*** (0.000)	chi2(1)=3.8e+08*** (0.000)
AIC	1.67e+10	2.22e+10		1.85e+10	2.44e+10
BIC	1.67e+10	2.22e+10		1.85e+10	2.44e+10

Notes: Panel Poisson estimates. Trade flows are expressed in levels. * significant at 10%, ** significant at 5%, *** significant at 1%.

ways statistically significant. Notice however that when levels of trade flows are used, instead of logs, the magnitude of the coefficients for trade values drops considerably. The χ^2 test suggests that trade flows are Granger caused by institutional quality. However, these tests neglect the cross-sectional heterogeneity. If we repeat this exercise adopting a panel Poisson estimator the results do not change. Table 6 shows indeed that the coefficients for the lagged values of institutions are statistically significant, and jointly different from zero. However, we are not able to implement the F test suggested by Hurlin and Levin (2001) for homogeneous non causality within this econometric framework, as the Poisson estimator is non linear.

We avoid the problem of zero flows, by re-estimating our model on a subsample of positive observations for trade flows. This is feasible, as it has been shown in Table 2 that the stationarity condition also holds on the subsample of positive trade flows. The results for fixed effects estimates on the subsample of observations with positive export flows are reported in Table 7, while results with positive import flows only are reported in Table 8, respectively.

These results are in line with those reported in Tables 3 and 4. Indeed, the F test suggests the presence of Granger-causality, in both directions. However, the Hurlin and Venet (2001) HNC test does not reject the null hypothesis. Thus, taking into account cross-sectional heterogeneity in the causal relationship, we can not reject the null hypothesis that there is no causality across all countries in the sample.

Table 7 - Granger Causality Test Between Exports and Institutions (Positive Trade Flows Only)

	lexport	lexport	inst	inst
$lexport_{t-1}$	0.3399 (0.0020)***	0.4381 (0.0015)***	0.0003 (0.0001)***	0.0016 (0.0001)***
$lexport_{t-2}$	0.1172 (0.0021)***	----	0.0006 (0.0001)***	----
$lexport_{t-3}$	0.0636 (0.0021)***	----	0.0011 (0.0001)***	----
$lexport_{t-4}$	0.0634 (0.0018)***	----	0.0017 (0.0001)***	----
$inst_{t-1}$	0.2649 (0.0403)***	0.7093 (0.0236)***	0.7644 (0.0023)***	0.7579 (0.0012)***
$inst_{t-2}$	0.2510 (0.0486)***	----	0.0251 (0.0027)***	----
$inst_{t-3}$	-0.0388 (0.0477)	----	-0.1053 (0.0027)***	----
$inst_{t-4}$	0.0985 (0.0377)***	----	0.0663 (0.0021)***	----
constant	3.2672 (0.0269)***	4.1008 (0.0194)***	0.1588 (0.0015)***	0.1636 (0.0010)***
Number of observations	204411	271922	204411	271922
Number of individuals	17871	22727	17871	22727
R2 within	0.3061	0.2676	0.5889	0.6001
R2 between	0.9177	0.8951	0.9846	0.9866
R2 overall	0.8728	0.8236	0.9476	0.9477
Granger (1969) causality test	F(4,186532)=100.09*** (0.000)	F(1,249193)=902.21*** (0.000)	F(4,186532)=269.87*** (0.000)	F(1,249193)=417.16*** (0.000)
Hurlin and Venet (2001) homogeneous non causality test	F(71484,115052)=0.0822	F(22727,226467)=0.52	F(71484,115052)=0.009	F(22727,226467)=0.017
AIC	565049	823034.6	-609506.4	-775688.1
BIC	565141.1	823066.1	-609414.4	-775656.6

Notes: Fixed effect estimates. Results obtained on the subsample of positive export flows. Trade flows are expressed in logs. * significant at 10%, ** significant at 5%, *** significant at 1%. Hurlin and Venet (2001) follows a non-centered Fisher distribution. Critical value for 95th percentile is 1.30 (Greene, 2008).

Table 8 - Granger Causality Test Between Imports and Institutions (Positive Trade Flows Only)

	limport	limport	inst	inst
$limport_{t-1}$	0.3205 (0.0020)***	0.4361 (0.0015)***	0.0004 (0.0001)***	0.0015 (0.0001)***
$limport_{t-2}$	0.1165 (0.0021)***	----	0.0008 (0.0001)***	----
$limport_{t-3}$	0.0692 (0.0021)***	----	0.0004 (0.0001)***	----
$limport_{t-4}$	0.0582 (0.0019)***	----	0.0013 (0.0001)***	----
$inst_{t-1}$	0.3738 (0.0446)***	0.6740 (0.0250)***	0.7540 (0.0023)***	0.7570 (0.0013)***
$inst_{t-2}$	-0.0107 (0.0541)	----	0.0169 (0.0028)***	----
$inst_{t-3}$	-0.1247 (0.0535)**	----	-0.1065 (0.0027)***	----
$inst_{t-4}$	0.3696 (0.0426)***	----	0.0894 (0.0022)***	----
constant	3.2455 (0.0287)***	3.8998 (0.0195)***	0.1596 (0.0015)***	0.1588 (0.0010)***
Number of observations	201100	276994	201100	276994
Number of individuals	18769	24867	18769	24867
R2 within	0.2837	0.2571	0.5829	0.5956
R2 between	0.9384	0.9147	0.9867	0.9878
R2 overall	0.8704	0.8263	0.9499	0.9496
Granger (1969) causality test	F(4,182323) =83.58*** (0.000)	F(1,252125)=725.45*** (0.000)	F(4,182323)=187.84*** (0.000)	F(1,252125)=423.40*** (0.000)
Hurlin and Venet (2001) homogeneous non causality test	F(75076,107251)=0.0745	F(24867,227259)=0.56	F(75076,107251)=0.006	F(24867,227259)=0.015
AIC	602304.8	878564.1	-594688	-781178.3
BIC	602396.7	878595.7	-594596.1	-781146.7

Notes: Fixed effect estimates. Trade flows are expressed in logs. Results obtained on the subsample of positive import flows. * significant at 10%, ** significant at 5%, *** significant at 1%. Hurlin and Venet (2001) follows a non-centered Fisher distribution. Critical value for 95th percentile is 1.30 (Greene, 2008).

5 Conclusions

The causal relationship between institutional quality and trade has been debated at length. As theory suggests that the causality could work in both directions, we implement a Granger causality test in order to inspect this relationship. We use data on export and import flows between 197 countries with 243 partners over the period 1976 to 2004, and present the results using a fixed effects estimator. The F-test proposed by Granger (1969) suggests that causality runs in both directions. However, this test neglects the cross-sectional variability. To properly take this into account, we present the homogeneous non causality test suggested by Hurlin and Venet (2001): we find that adopting a proper test to account for cross-sectional heterogeneity produces different results, and there is no causality from trade to institutions, nor vice versa.

The trade literature has recently debated the proper way to handle trade flow variables, which have a non-normal distribution given the large number of zeros. While the standard solution is to consider the log of the trade flow plus one, we implement an alternative recently suggested by Santos Silva and Tenreyro (2006). Namely, we consider trade flows in levels, and adopt a Poisson pseudo maximum likelihood estimator. Results do not change. As a further robustness check, we repeat the exercise on the subsample of positive trade flows. Again, our results are robust.

Overall, our results point to the need for a correct specification of the Granger test, to be coherent with the kind of data at hand. Indeed, the panel structure of our data requires an alternative specification of the Granger test to allow for possibly different causality relationships across the individuals in the panel. Our results show that when a panel-specific test is implemented, the causality relationship identified through the standard Granger test disappears.

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