Structural Reforms and Agricultural Export Performance: An Empirical Analysis

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Abstract

This study empirically investigates the effects of structural reforms on bilateral trade flows of agricultural products. Specifically, the study jointly analyzes the impacts of three different reforms including financial reform, trade reform, and agricultural reform on agricultural trade. The results suggest that less restrictive credit constraints, reduced tariff rates, and less government interventions are likely to generate increase in total agricultural exports. The evidence further indicates that the impacts of the reforms vary considerably across less aggregated products as well as across reform forms. The results provide a solid policy foundation for pursuing structural reforms in order to stimulate trade and economic growth, given the fact that the index level of reforms has not reached the level of full liberalization yet.

Key Words*:* agricultural reform, agricultural sector, financial reform, gravity model, trade reform

Introduction

Structural reforms have taken place in most regions and countries in the last decades. Loosely defined as policy measures that reduce or remove impediments to the efficient allocation of resources, the reform includes a number of dimensions such as the domestic financial system, trade policy, and agricultural policy. Domestic financial reform began in the 1980s and accelerated in 1990. Although there has been a backlash in the reform, the current regime of financial systems has deepened and become less regulated. While developed countries such as in the European Union (EU) region have adopted some restricted liberalization, trade liberalization policies have been widely adopted in most developing countries. As a result, trade regimes have become more open. Similarly, the agriculture sector has been the subject of reforms with less

government intervention. Countries like India, Indonesia, Brazil, Argentina, among others have reduced their interventions. Structural reforms have exerted meaningful effects on international trade, including trade of agricultural products.

A number of studies have investigated the effects of reforms on export growth. The results are inconclusive. In the trade reforms, for example, some studies have identified positive effects of trade liberalization on export performance (Krueger, 1997; Bleaney, 1999; Ahmed, 2002), while others confirmed an insignificant or even a negative relationship (Greenaway, *et al*., 1994; Jenkins, 1996; Greenaway, *et al.*(2002). There are a number of reasons for conflicting conclusions including different researchers having used different indicators for liberalization and different methods to analyze the effects. Analyzing scenarios rather than evaluating the effects have also contributed to the different conclusions.

Beck (2002, 2003), Hur et al. (2006), Greenaway et al. (2007), Muûls (2008), Manova (2008), and Berman and Héricourt (2008) have investigated the effects of financial reforms on trade flows and found the positive impacts of financial reforms on trade flows. Based on the results, they basically agree that financial reforms should promote production and trade in financially dependent industries by reducing the cost of external capital.

The reforms that took place in the agricultural sector such as the removal of state-imposed price controls and marketing boards have promoted domestic production and agricultural trade as well. A report by ERS, for example, shows that full elimination of agricultural support policies in developed countries would increase agricultural exports in developing countries by 24 percent and full elimination of agricultural distortions in developing countries would increase the values of their own agricultural exports by 5.5 percent.

The purpose of this paper is to empirically examine the impacts of structural reforms on agricultural trade performance. Unlike other empirical papers that mostly focused on a single type of reform, this paper jointly analyzes the impacts of three different reforms, namely financial reform, trade reform, and agricultural policy reforms, on agricultural trade performance. This analysis enables us to estimate the joint impacts as well as to disentangle each impact from the other. This study also analyzes agricultural exports in both the aggregate level and the disaggregate level on the basis of SITC classification.

Empirical Specification and Estimation Procedure

To assess the impacts of structural reforms on agricultural exports, we use a gravity model of panel data. The gravity model has been widely used to describe bilateral trade patterns and has given satisfactory performance in representing trade flows (Deardorff, 2004; Disdier and Head, 2008). It also has strong theoretical foundations as provided in papers such as Anderson (1979) and Anderson and van Wincoop (2003). In addition, the panel version of the gravity model provides an attractive way of dealing with unobserved heterogeneity as well as functional specifications (Baldwin, 1994; Matyas, 1997).

The empirical gravity model is written as

$$(1) \qquad \ln T_{ijt} = \alpha_i + \gamma_j + \nu_t + x_{ijt}'\beta + \delta_1 FinReform + \delta_2 TradeReform + \delta_3 AgricReform + u_{ijt},$$

where $\ln T_{ijt}$ is the logarithmic value of bilateral exports and $\mathbf{x}_{ijt}'$ is a $k x 1$ row vector of explanatory variables normally included in the gravity model. All variables in $\mathbf{x}_{ijt}'$ are stated in logarithm form except for the dummy variables. α_i, γ_j and ν_t are, respectively, exporter, importer, and time effects. *FinReform, TradeReform, and AgriReform* are variables representing financial reform, trade reform, and agricultural reform, respectively.

The inclusion of *FinReform* is based on the recent development in finance-trade link proposed by Kletzer and Bardhan (1987) and Baldwin (1989), Beck (2002, 2003), Muuls (2008) and Berman and Hericourt (2008), Hur et al. (2006), Manova (2008), among others. According the proposed theory, the channels through which financial reform can translate into trade patterns can vary, with the most prominent arguments is based on the liquidity constraints that most firms face. From this perspective, when a domestic financial institution is weak and inefficient, firms in export-oriented sectors are burdened by liquidity constraints that prevent a subset of productive firms from entering the foreign market (Chaney 2005). On the other hand, firms in financially developed countries face less restrictive credit constraints and therefore can increase investment in response to a lowering of variable export costs and all firms with productivity above a certain cut-off level become exporters (Melitz 2003). A model with credit-constrained generally predicts that financially developed countries are more likely to export bilaterally and ship greater volumes (Manova 2008). Therefore, we include financial reform index in exporting countries in the model as a predictor of agricultural trade patterns.

TradeReform indicator in this study is constructed by using average effective tariffs as a measure. It is calculated as the ratio of customs and import duties to the value of imports (IMF, 2004). The index shows tariff reduction in importing countries and thus it also represents trade openness. We include *TradeReform* in importing country to represent trade openness. The *AgricReform* captures intervention in the markets for the main agricultural export commodity in each country. Our model includes *AgricReform* index in exporting countries to predict the behavior of trade flows.

All indicators are normalized to fall into an interval ranging from 0 to 1, with an increase signaling a reduction in the degree of restrictiveness or greater liberalization. Differences in the

values of each index across countries and over time provide information on the variation in the absolute degree of economic reform within each sector. However, indices are not strictly comparable across sectors, so a higher value of the trade reform index than the banking reform index does not imply that an economy is less restricted with respect to international trade than domestic finance. It is expected that each reform has positive impacts on agricultural trade flows.

In empirical work, a number of explanatory variables are included in the row vector $\mathbf{x}_{ijt}^{'}$ including gross domestic product (GDP), population, geographic distance, and time invariant variables such as language commonality, border measures, and trade blocs. Following Helpman (1987) and Baltagi *et al*. (2003), our empirical model includes three explanatory variables related to both gross domestic product and population: the sum of bilateral trading partner GDP as a measure of bilateral overall country size ($LGDP_{ijt}$), an index that measures relative country size ($LGDPI_{ijt}$), and the absolute difference in relative factor endowments between the two trading partners ($LGDPP_{ijt}$). As in the standard gravity model, geographical distance between trading partners ($LDIS_{ij}$) is included in the model to represent a proxy of trade costs. We also include language commonality to represent cultural familiarity and regional trade agreements (RTA) variables. To measure distance proximity, we also include a variable to reflect common borders between trading partners.

Including all variables, our empirical gravity equation can be expressed as follows:

$$\begin{aligned}\ln T_{ijt} = {} & \alpha_i + \gamma_j + \nu_t + \beta_1 LGDP_{ijt} + \beta_2 LGDPI_{ijt} + \beta_3 LGDPP_{ijt} + \beta_4 LDIS_{ij} \\ & + \beta_5 Langauge + \beta_6 Border + \beta_6 RTA + \delta_1 FinReform + \delta_2 TradeReform \\ & + \delta_3 AgricReform + u_{ijt}\end{aligned} \tag{2}$$

where

$$LGDP_{ijt} = Ln(GDP_{it} + GDP_{jt}),$$

$$LGDPI_{ijt} = Ln\left[1 - \left(\frac{GDP_{it}}{GDP_{it} + GDP_{jt}}\right)^2 - \left(\frac{GDP_{jt}}{GDP_{it} + GDP_{jt}}\right)^2\right],$$

$$LGDPP_{ijt} = \left|Ln\left(\frac{GDP_{it}}{N_{it}}\right) - Ln\left(\frac{GDP_{jt}}{N_{jt}}\right)\right|.$$

Language is language commonality that takes a value of one if two trading partners share common language and zero otherwise. *Border* takes a value of one if two trading partners share common border and zero otherwise. *RTA* takes a value of one if a pair of countries takes part in at least one of the same RTA. All other variables are as defined previously.

Different estimators have been proposed to estimate the log transformation of the gravity model. A widely used approach is the fixed effects model (FEM). This approach has been successful in dealing with heterogeneity issues such as the correlation between some of the exogenous variables with the model's error term. However, it does not work for time invariant variables such as distance, language commonality, and common borders. A second best alternative is to use a random effects estimator, which has an advantage over the fixed effects estimator in that it allows the recovery of the parameter estimates of any time invariant explanatory variables which would otherwise be removed in the fixed effects transformation. A more recent and viable approach to estimating the model is the Hausman-Taylor (HT) estimator (Hausman and Taylor, 1981). The HT estimator allows for a proper handling of data setting when some of the regressors are correlated with the individual effects. The estimation strategy of the HT estimator is based on an instrumental variable estimator which uses both between and within variation of the strictly exogenous variables as instruments (Hausman and Taylor, 1981; Baltagi et al, 2003). We adopt both REM and HT estimators to estimate the specified models

because they can accommodate the time invariant variables. The results of the two estimators are compared.

Data

To conduct analysis, we use bilateral export data on agricultural products for a set of 78 countries in the period 1980 and 2010. The bilateral trade data on agricultural products are obtained from UN COMTRADE database with SITC rev.1. GDP and population used to construct the variables LGDP, LGDPPI, and LGDPP are from World Development Indicator (WDI) of the World Bank. GDP is in billion US dollars and population is in millions. The geographical distance is in miles and is calculated between the capitol cities of two trading partners using the World Atlas. We use OECD data on major regional trade agreements (RTAs) to determine whether pairs of countries take part in a particular RTA. We use CIA's World Fact Book to assess whether two countries have at least the same official language in order to create the dummy variable Language.

Index of financial reforms is taken from by Abiad et al (2010) and indices for trade reforms and agricultural reforms are from Spilimbergo et al (2009). We obtained the data through personal correspondence with Antonio Spilimbergo. The three indices run through the year 2005 and started as earlier as 1973 for financial reform index and 1960 for trade and agricultural reform indices. For the period of 2006 and 2010, we assume that there was no significant reform, therefore the index values of this period are the same as those in 2005. The three indices are normalized index with values range from zero to one. A value of zero of the financial reform index indicates fully repressed and one is fully liberalized. In the trade reform, zero means the tariff rates are 60 percent or higher, while unity means the tariff rates are zero. The agricultural reform index can take four values: (1) zero (public monopoly or monopsony in

production, transportation, or marketing, e.g., export marketing boards); (2) one-third (administered prices); (3) two-thirds (public ownership of relevant producers or concession requirements); and (4) one (no public intervention).

Table 1 gives summary statistics for the variables used in the estimations. As shown that the average value of financial reform index is 0.66 and its standard deviation of 0.26. As expected, the index for advanced countries is much higher that that of developing countries (0.80 versus 0.56). The average index of trade reform is 0.78 with advanced countries of 0.90 and developing countries of 0.69. In the agricultural sector, the average index shows that agricultural reform nearly falls in the zone 3 with average value of 0.58. The average index value for advanced countries is slightly higher than that of developing country.

[Insert Table 1 Approximately Here]

Results and Discussions

Regression Results

Table 2 shows the estimation results of the empirical gravity model of total agricultural trade using the FE, RE, and HT procedures. To control for unobserved characteristics of a country, the empirical model was estimated by including both exporter and importer dummy variables. Time effects are also included in the estimation process. The results show that the magnitudes of parameter estimates given by the three procedures are very similar with the exception of LGDPI and LGDPP. The FE procedure does not produce estimates of LDIST, BORDER, and LANGUAGE because they are binary variables. Note that FE still gives a parameter estimate of RTA even though it is a dummy variable. This is because RTA changes in time.

Because of the similarities in terms of the magnitudes parameter estimates, we use the FE estimates as our based for further discussions and interpretations. Therefore, all the numbers cited further refereed to FE estimates. As shown in Table 2, both LGDP and LGDPI have positive signs. The positive signs of both LGDP and LGDPI show that bigger country size (overall and relative) has positive impacts on trade volume. The estimated elasticities of LGDP and LGDPI are 0.99 and 0.40, respectively. This indicates that a 1% increase in LGDP (LGDPI) raises agricultural exports on average by approximately 1% (0.40%). The coefficient of LGDPP is negative indicating that trade volumes are smaller the more dissimilar two countries are in terms of relative factor endowments.

[Insert Table 2 Approximately Here]

The geographic distance (LDIST) that typically serves as a proxy for the size of transportation costs, negatively affects the intensity of trade as expected. The parameter estimates of LDIST indicate elasticity of distance with respect to trade. The statistically significant of geographic distance supports the importance of trade costs for explaining the patterns of agricultural exports. As can be seen in Table 2, the distance elasticity is -1.37 suggesting that bilateral distance reduces trade more than proportionately. This estimate is very close to the average estimate of distance decay as reported by Disdier and Head (2008). The variables describing cultural proximity (LANGUAGE) and having a free trade agreement (RTA) positively affects the volume of bilateral trade. Because LANGUAGE and RTA are dummy variables, the parameter estimates cannot be directly interpreted as elasticity. The effects can be measured by taking anti logarithm of the parameter estimates. Doing so, our estimates suggest trade within RTA member is about 17.9% above what could be expected from the gravity model

and having the same language is expected to have higher trade by 70.2%. On the other hand adjacent countries dummy (BORDER) has negative impacts but not significant.

We also estimate the model using disaggregated data of three SITC classifications (SITC0, SITC1, and SITC4). The results as given in Table 3 show substantial differences in the magnitudes of parameter estimates across product classification. The impacts of overall GDP (LGDP) on trade are highest in SITC0 followed by SITC1 and SITC4. On the other hand the relative measure of factor endowment (LGDPI) is highest in SITC1 and it has the same impact in SITC0 and SITC4. LGDPP has similar impacts on trade flows of both SITC0 and SITC1 but it does not have significant impacts in SITC4.

The variables BORDER and LANGUAGE have mixed impacts on bilateral trade flows. Our results suggest that BORDER does not have significant impacts on trade flows in both SITC0 and SITC1. However, trade of SITC4 between adjacent countries is higher that than of non-contiguous countries with its effects of about 46 percent. Trade of SITC0 and SITC1 are higher between countries having the same language and it is not significantly different for SITC4. The effects of RTA on bilateral trade of the disaggregated products are significant with its impacts between 17 to 24 percent higher compared to those countries not engaging in the same RTA. As expected, variable distance has negative and significant impacts on trade flows. The magnitudes of estimates are not significantly different than the total impact as shown in Table 2.

[Insert Table 3 Approximately Here]

Impacts of Structural Reforms on Agricultural Trade

This section discusses the main variables of interest: structural reforms. The regression results show that the impacts of structural reform variables on total agricultural trade flows are positive and highly statistically significant. The three procedures give close parameter estimates. As given in Table 2, the magnitudes of parameter estimates for *FinReform* are 0.511, 0.492, and 0.506 for the FE, RE, and HT procedures, respectively. These figures are slightly higher for *TradeReform*, which are 0.752, 0.740, and 0.741 and much lower for *AgricReform* which are 0.142, 0.144, and 0.142, all are in respective order. These estimated parameters, however, do not directly reflect the effects of changes of the variables on exports because they are not log-linearized with the trade variable. The estimates are considered as semi-elasticity and therefore, the quantitative effects are obtained by taking the anti-logarithm. In this case, we measure the effects on the basis of one standard deviation from the mean of financial reform variables as it gives the average impact of variation in structural reforms on agricultural exports.

Using the data given in Table 1 and based on the RE estimation, our estimates as provided in Table 4 suggests that an increase in financial reform index by one standard deviation from the mean leads to an increase of 13.6 percent in agricultural exports. Financial reforms, particularly in the reduction of credit constraints that took place in most countries since 1980s and accelerated in 1990s seem to have contributed to the increase in agricultural trade flows. In terms of trade reform, we found that for one standard deviation increase from the mean of trade reform index would likely increase agricultural trade by about 15.1 percent. This evidence shows how agricultural exports respond to trade reforms. The impacts of agricultural reforms on exports are not as pronounce of the impacts of other reforms. As shown in Table 4, agricultural exports

increase by about 5.2 percent for one standard deviation increase of agricultural reform index from the mean.

[Insert Table 4 Approximately Here]

Table 4 also shows the impacts of financial reforms on disaggregated analysis. As can be seen, the results vary considerably across product classifications and reforms. For the SITC0, trade reform has the highest impacts with 14.7 percent followed by financial reform with 10.2 percent. The impact of agricultural reform, on the other hand, is the lowest with only 4.4 percent. The impacts of structural reforms on SITC1 exports take a somewhat opposite direction compared with those of SITC0 in the sense that financial reform has the lowest impacts compared with trade reform and agricultural reform. As depicted in Table 4, one standard deviation increase of reform index from the mean, leads to an increase of approximately 15.4 percent in agricultural reform compared to 3.8 percent in financial reform. In the case of SITC4, the results, again, provide substantial variations across reform forms. As shown in Table 4, one standard deviation increase of financial reform index would likely increase SITC4 exports by about 30.9 percent and one standard deviation in crease of trade reform index from the mean will result in an increase of SITC exports by 11.2 percent. Surprisingly, the results for agricultural reform are not what expected. We found negative effects of agricultural reform on SITC exports. The figure is somewhat high with 20.6 percent decrease for a one standard deviation increase of the index from the mean.

Conclusions and Implications

Results indicate a positive impact of structural reforms on total agricultural trade. Financial reforms that occurred in the sample countries seem to have eased the level of credit constraints. The implication of the reduced credit constraints is that firms can increase their

investment in response to a lowering of variable costs associated with exporting. Trade reforms in the form of reduced tariffs evidently generate total agricultural trade. Although, the impacts of agricultural reforms on total trade is much less than the other two reforms, less government intervention in the agricultural sector is likely to facilitate the trend toward export, possibly via increasing agricultural production.

The impacts of structural reforms on less aggregated products vary substantially across products as well as across reforms. In the SITC0 and SITC1, the impacts of trade reforms are more profound than financial and agricultural reforms. In the SITC4, on the other hand, the impact of financial reform on trade is the highest followed by trade reform and agricultural reform, with the later reform has negative impacts on trade.

This study provides empirical evidence on the impacts of structural reforms on agricultural trade performance. Furthermore, the results have policy implications for policy reforms. The linkage established by this study is of particular importance given the strong relationship between production and trade in most developing countries and provides a solid policy foundation for pursuing structural reforms in those economies in order to stimulate trade and economic growth. This is particularly important given the fact that the index level of reforms has not reached the level of full liberalization yet, particularly for agricultural sector.

Table 1. Summary statistics of variables used in estimations

Variable	Mean	SD	Min.	Max	N
Agricultural exports (ln)	14.94	3.09	0.69	23.71	114,035
Geographic distance (ln)	8.61	0.89	4.70	9.89	114,035
LGDP	5.95	1.39	1.37	9.93	112,231
LGDPI	-1.89	1.24	-8.88	-0.69	112,231
LGDPP	1.78	1.26	0.00	5.89	108,928
Financial reform index	0.66	0.26	0.00	1.00	113,445
Trade reform index	0.78	0.19	0.00	1.00	113,163
Agricultural reform index	0.58	0.35	0.00	1.00	97,976

Data are panel average for the year of 1980 to 2010 and 2352 individual of pair-countries. The numbers of observations (N) depend on the availability of the data for each variable.

Table 2. Regression Results: Overall Effects of Structural Reforms

Variable	FE	RE	HT
LGDP	1.027 (0.029)***	1.057 (0.028)***	1.047 (0.028)***
LGDPI	0.252 (0.028)***	0.404 (0.023)***	0.231 (0.027)***
LGDPP	-0.324 (0.017)***	-0.188 (0.013)***	-0.287 (0.015)***
LDIST	-	-1.372 (0.034)***	-1.336 (0.051)***
BORDER	-	-0.069 (0.120)	-0.082 (0.176)
LANGUAGE	-	0.489 (0.073)***	0.546 (0.108)***
RTA	0.162 (0.027)***	0.159 (0.026)***	0.168 (0.026)***
FinReform	0.511 (0.051)***	0.492 (0.051)***	0.506 (0.051)***
TradeReform	0.752 (0.045)***	0.740 (0.045)***	0.741 (0.045)***
AgricReform	0.142 (0.035)***	0.144 (0.035)***	0.142 (0.035)***
Intercept	9.217 (0.222)***	15.146 (0.453)***	15.047 (0.630)***
Observations	89,357	89,357	89,357
R-squared	0.301	0.671	N.A

Notes: *** indicates statistically significant at the 1% level.

Dependent variable: Log of total agricultural exports.

Table 3. Regression Results: Disaggregated Analysis

Variable	SITC-0	SITC-1	SITC-4
LGDP	1.124 (0.029)***	1.016 (0.043)***	0.767 (0.056)***
LGDPI	0.459 (0.023)***	0.634 (0.033)***	0.459 (0.043)***
LGDPP	-0.182 (0.014)***	-0.177 (0.019)***	-0.044 (0.024)
LDIST	-1.331 (0.035)***	-1.233 (0.042)***	-1.476 (0.050)***
BORDER	0.043 (0.122)	-0.039 (0.144)	0.377 (0.157)**
LANGUAGE	0.483 (0.075)***	0.439 (0.091)***	0.012 (0.105)
RTA	0.161 (0.027)***	0.219 (0.034)***	0.213 (0.041)***
FinReform	0.375 (0.053)***	0.143 (0.076)*	1.037 (0.099)***
TradeReform	0.721 (0.047)***	0.984 (0.070)***	0.560 (0.085)***
AgricReform	0.122 (0.036)***	0.410 (0.061)***	-0.666 (0.081)***
Intercept	14.779 (0.463)***	14.033 (0.614)***	16.260 (0.751)***
Observations	86,500	59,301	45,559
R-squared	0.653	0.608	0.508

Notes: *** , **, and * indicate statistically significant at the 1%, 5%, and 10% level, respectively.

Table 4. Impacts of Structural Reforms on Agricultural Trade (Percentage)

Variable	Total	SITC0	SITC1	SITC4
Financial Reform	13.6	10.2	3.8	30.9
Trade Reform	15.1	14.7	20.6	11.2
Agricultural Reform	5.2	4.4	15.4	-20.6

Note: Percentage change is based on one standard deviation increase from the mean and is estimated using the results given by FE procedure.

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