

Export-Led Growth: Are the results robust across methodologies and/or data sets?
A Case Study of Latin America

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Abstract

We examine the export-led growth (ELG) hypothesis from a different perspective asking if the choice of data and/or methodology drives the results. We apply the Granger causality test modified by the corresponding error correction model using real export data from two common sources: IMF and UN Commodity Trade Statistics. Additionally, to determine if the level of deflation could be a factor we deflate the data at a disaggregated level and by a single export unit price index. Outcomes are compared to those obtained through the Granger causality procedure developed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996). We use sixteen Latin American countries to test our hypotheses. The analysis reveals inconsistencies in the results both by selection of data and methodology suggesting much of the debate regarding ELG, at least for Latin America, is fuelled by data and/or methodology choice, putting into question previous studies.

Keywords: time series models, robustness, model dimension, export-led growth, Latin America
JEL codes: O11, O40, O54, O47

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Introduction

Does the choice of data source and/or methodology affect results of analyses? Indeed, this paper argues that debates surrounding the topic of export led growth¹ may be a function of different data sources driving the incongruent results. To illustrate the importance of the data sources for the conclusions drawn in the study of export led growth, Granger-Causality tests are performed on the corresponding error correction model for sixteen Latin American countries varying the data source and the deflator.² Additionally, outcomes are compared to those obtained through the Granger causality procedure developed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996). Our work does not attempt to answer the questions are export led growth or growth led export valid hypothesis but rather takes that as given in light of the extensive research on the topic (Giles and Williams, 2000a). We, instead, focus on the robustness of the models and their sensitivity to methodology and data selection.

The study focuses on Latin America in large part because of access to a unique data set compiled by Amin Gutierrez de Pineres and Ferrantino that has two digit trade prior to 1980 (post 1980 disaggregated data is available from Stats Canada) deflated by industry specific indices. Additionally, Latin America is an appropriate region in which to confine this study for a number of reasons. First, for most countries in the region, the United States is the predominant trading partner. The effect of a dominant trading partner minimizes cross currency effects. Second, Latin American countries, while similar on some dimensions, also have diversity in their export portfolios. Diversity exists within countries' portfolios—by sector and factor—and across

¹ For in-depth analysis of export led growth literature see Giles and Williams , 2000a and 2000b; and Ahmad, 2001. For studies that use IFS data see Bahmani-Oskooee, Mohtadi, and Shabsigh, 1991; Jung and Marshall, 1985. For a study that uses COMTRADE data see Amin Gutierrez de Pineres and Ferrantino, 2000. More recent papers on the topic of export-led growth are Abu-Quarn and Abu-Bader (2004), Balanguer and Cantavella-Jorda (2004), and Abual-Foul (2004).

² The sample contains 16 Latin American countries: Argentina, Bolivia, Brasil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Peru, Paraguay, Uruguay, and Venezuela.

countries (Amin Gutierrez de Pineres and Ferrantino, 2000). The diversity in export portfolios creates variance in the sample making the results somewhat generalizable.

The analysis reveals inconsistencies in the results both by choice of data, by level of deflation, and methodology employed. These results suggest much of the debate regarding export led growth is fuelled by data choice and methodology, putting into question previous studies. The implications of this study are far reaching since many developing countries have accepted this policy prescribed by the developed countries. The lack of consistent support for export-led growth could once again bring the question of slow versus fast economic liberalization to the forefront of development policy debates. Researchers should take careful note of the implications of their data for the findings of their studies.

Data: IFS, UN, and COMTRADE

There are two datasets traditionally used as the source for export data in macroeconomic studies, including in the analysis of export-led growth. The International Financial Statistics (IFS) database contains nominal export data collected by the International Monetary Fund and reported in *International Financial Statistics*. Commodity Trade Statistics (COMTRADE) is collected by the United Nations Statistics Division and reported by Statistics Canada. The United Nations (UN) data as defined in this study is the aggregate of the sum of two digit data from merchandise trade flows between member countries as reported by member countries to the United Nations Statistical Office. Data prior to 1990 are from the Bilateral Trade publications. Post 1990 data are from the World Trade Analyzer, which is UN data compiled by Statistics Canada. The nominal data is deflated by the index of unit value of exports which is the fixed-

weight index of price of exports, constructed using the Laspeyres formula.³ All variables in the model are taken in natural logarithms.

Identifying the differences and similarities in the two types of data is more complicated than would appear. In both cases the data are reported by the countries of origin. For UN data, exports are reported in US dollars on a free on board basis at a disaggregated level. IMF leaves it up to the country to report free on board (FOB) or cost, insurance and freight (CIF) and then asks the country to identify which method it uses. IMF data can be reported in US dollars or local currency. IMF only asks for data to be disaggregated into major commodity groups not using the 1996 revision of the Harmonized System as does the UN. The IMF states it makes adjustments and corrections to the data while the UN does not. While it is feasible to adjust aggregate data to improve coverage for factors such as smuggling, shuttle trade, etc. and to align data with balance of payments concepts as the IMF does, this is not a viable option for data reported at a highly disaggregated level. UN data is not only reported by commodity but also by trading partner. IMF data is not differentiated by trading partner. Even in light of these differences, most studies use IMF and COMTRADE data interchangeably and often do not even identify the source.

Two-digit SITC nominal export data from the United Nations trade database for the years 1962-1995 were used to create the database for sixteen Latin American countries. Nominal export values were deflated by appropriate product specific price deflators. Primary commodities were deflated using commodity price indices from the United Nations *Monthly Bulletin of Statistics* and IMF *International Financial Statistics*. Manufactured goods were

³ Series with different base years are linked by ratio splicing at the first annual overlap; linked series are then shifted to a common base period (1970=100). These series differ from export price indices, which are compiled from survey data for prices at the wholesale level or from direct pricing (i.e., directly from the exporter); the latter are generally considered preferable to unit value indices because of biases introduced by the aggregation of commodity classification categories with no meaningful unit of quantity (e.g., categories related to machine tools, capital equipment, and certain consumer goods). Oxford Latin American Economic History Database- Methodology. [Http://oxlad.qeh.ox.ac.uk/sources.php](http://oxlad.qeh.ox.ac.uk/sources.php)

deflated by their appropriate U.S. producer price index, using the general U.S. producer price index when an industry-level one was not available. Therefore, real export values (2DigitUN) for a country are the sum of the real export values of each of the two-digit export values (Amin Gutierrez de Pineres and Ferrantino, 2000). Traditionally, total exports are deflated by a common deflator. The two digit deflated data (2DigitUN) are compared to the same nominal data set deflated by the single export unit price (UN) index to determine if the level at which the data are deflated matters.

Model, Methodology and Results

The model implemented in this paper pursues the essence of the Kaldorian approach as to the demand-oriented theory of growth. In this sense, Kaldor (1964, 1970) argues that the primary constraint of growth is mainly foreign demand. Therefore, it is basically the growth rate of exports that determines the rate of output growth. Our model tries, then, to follow the principle of parsimony by keeping it as simple as possible. It is true that some other variables such as relative prices might have been included. Nevertheless our objective is focused on analysing causality between two variables, economic growth and exports, and determine their possible consistency according to the use of different data sets. Results on the direction of these variables are not significantly affected by the introduction of more variables. It is likely more important the lag length structure when examining causality.

We first use the Granger causality test in the context of an error correction model to examine the ELG hypothesis in Latin America and then compare the outcomes with the methodology proposed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996), hereafter called TYDL. The former method implies the previous knowledge of the non-stationarity characteristics of each variable, before the long-run relationship between exports and

gross domestic product (GDP) can be determined. Non-stationarity trends in time series data can potentially cause a spurious regression problem in which ordinary least squares estimates do not converge to constants and standard t and F statistics do not have the limiting distributions. In view of this concern, we have to analyse whether a series is stationary in levels, $I(0)$, or stationary in differences, $I(1)$, $I(2)$, ..., $I(n)$ in order to apply the appropriate methodology and avoid spurious inferences. The stationarity of the series was investigated by employing the unit root tests developed by Dickey and Fuller (1979, 1981) and Phillips and Perron (1988).⁴ In particular, the augmented Dickey Fuller test with trend was a first approximation not only for knowing the existence of unit roots in the variables but also for recognizing whether the data generation process is either a difference stationary process or a trend stationary process. The structure of the equation is the following:

$$\Delta y_t = \alpha + \beta t + \rho y_{t-1} + \sum_{i=1}^n \theta_i \Delta y_{t-i} + \varepsilon_t \quad (1)$$

where ε_t is a disturbance term independently and identically distributed with zero mean and constant variance. Equation 1 allows for the correction of serial correlation in the residuals by adding sufficient lagged dependent variables.⁵ According to the results, all variables are $I(1)$ except for the following which are $I(0)$ with a trend: Costa Rica (UN, 2DigitUN); Honduras (IFS); Peru (COMTRADE) and Uruguay (GDP, UN, 2DigitUN).⁶ Cointegration provides the appropriate tools in order to work with non-stationary variables and particularly with $I(1)$ variables. Moreover, the technique also allows for a useful and meaningful link between the

⁴ Statistics, diagnostic tests, and equations are available from the authors upon request.

⁵ The Phillips Perron semi-parametric test is based on a generalization of the Dickey-Fuller procedure that allows for fairly mild assumptions concerning the distribution of the errors.

⁶ For trend stationary processes the standard procedure is to make the data stationary not by first differencing, but by taking the residuals from a regression as a constant and trend and then to estimate vector autoregressions on the transformed data.

long- and short-run approaches to econometric modeling. The next step is, then, to test for cointegration between real GDP and real exports using Johansen's methodology (1988). The general vector autoregression to estimate is:

$$y_t = \alpha + \sum_{i=1}^k \pi_i y_{t-i} + \varepsilon_t \quad (2)$$

where either y_t and y_{t-i} include the logarithms of both variables, real GDP and real exports (IFS, COMTRADE, UN, and 2DigitUN); α is the intercept; ε_t should be interpreted as in equation 1, and observations are indexed by time (t). The lag length of the level vector autoregression system was determined by using both the Akaike Information Criterion and the Schwarz Bayesian Criterion. The selection criteria for the lag length (k) involves choosing the VAR(k) model with the highest value of the Akaike (AIC) or the Schwarz Bayesian (SBC). Both criteria do not always agree in the number of chosen lags. The use of SBC is likely to result in choosing a lower order VAR model than when using the AIC. However, in using the two of them it is important that the maximum order selected for the VAR is high enough for high-order VAR specifications to have a reasonable chance to be selected.

Table 2 reports the cointegration results.⁷ The level of deflation does not affect the results. Across countries, the long run relationship existence is consistent between UN and 2DigitUN. It can be observed, however, that the results are not consistent between IFS and COMTRADE data indicating that source of data does influence the results of cointegration tests. We find inconsistencies for Argentina, Brazil, Guatemala, Honduras, and Peru. The next step is to examine whether or not possible causal relationships between real GDP and each of the four export variables exist. Thus, we perform a causality test based on the results given out of the

⁷ Since most of variables are random walks with drift, in other words, have a stochastic trend, they do not appear with constant in the cointegrating vector but a general constant, then, is introduced in the error correction model.

long-run regression. The standard Granger causality appears now as an error correction model.

The structure of this model is the following:

$$DGDP_t = \sum_{i=1}^n \alpha_i DGDP_{t-i} + \sum_{j=1}^n \beta_j DX_{t-j} + \xi ECT_{t-1} + u_{1t} \quad (3)$$

$$DX_t = \sum_{i=1}^m \lambda_i DX_{t-i} + \sum_{j=1}^m \delta_j DGDP_{t-j} + \psi ECT_{t-1} + u_{2t} \quad (4)$$

where u_{1t} and u_{2t} are uncorrelated disturbances, X represents a vector of different real export variables (IFS, COMTRADE, UN, 2DigitUN), ECT is the error correction term. In order to make valid inferences on causality all these variables must be stationary. Thus, the first differences of the variables (denoted by D in equations 3 and 4) and the residuals obtained from the cointegrating vector, which contain long-run information, are included in the Granger causality test structure. Again, since the results derived from these tests may be sensitive to the selection of the lag length, the Akaike Information and Schwartz Bayesian criteria have been used. The export and growth equations are evaluated in a Granger causality structure for each data source allowing a comparison between IFS and COMTRADE data and between data deflated at the two digit levels versus data deflated by a single export unit price deflator. Only the results for the countries with significant and inconsistent coefficients are reported in Tables 3-8.⁸ When examining short run causality, only in Chile are the results consistent for both export-led growth and growth-led export models. Tables 7-10 provide a statistics summary of all causality tests. Tables 7-8 report both short-run and long-run causality results. The latter are

⁸ Results for all countries in the sample are available from the author upon request.

based on the corresponding error correction terms (ECTs) and are the ones to be compared to TYDL outcomes.⁹

Data source affects the results. Examining if exports Granger cause GDP using IMF and COMTRADE data (See Tables 3a-b), the results are inconsistent for Colombia, Ecuador, El Salvador, and Paraguay. Only in Bolivia and Chile are the results consistent across the two data sources. In the following countries the coefficients were insignificant regardless of data source: Argentina, Brazil, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Peru, Uruguay and Venezuela. Switching to examine the impact of level of deflation on the results of export-led growth equations, we find that in Colombia and Mexico are the results inconsistent (See Table 4). The results are consistent for Brazil, Chile, Ecuador, El Salvador, and Guatemala. For Argentina, Bolivia, Costa Rica, Honduras, Nicaragua, Paraguay, Peru, Uruguay, and Venezuela the coefficients are insignificant regardless of level of deflation. It should be noted that Chile is the only country for which the results are significant and consistent across all for four data sources. Furthermore, the results are insignificant across all for data sources for Argentina, Costa Rica, Honduras, Nicaragua, Peru, Uruguay, and Venezuela. These results suggest that data source needs to be a serious consideration when examining the robustness of results in models using export data.

Examining the growth-led export equations using IMF and COMTRADE data (See Tables 5a-b), the results are inconsistent for Brazil, Ecuador, Guatemala, and Honduras. In Chile, Colombia, and El Salvador the results are consistent across the two data sources. In the following countries the coefficients were insignificant regardless of data source: Argentina, Bolivia, Costa Rica, Mexico, Nicaragua, Paraguay, Peru, Uruguay and Venezuela. Switching to

⁹ When analyzing casual relationships, the coefficients of the error correction terms should be significant and negative in order to make valid inferences. Positive coefficients lead ECTs to move away from the long-term equilibrium.

examine the impact of level of deflation on the results of export-led growth equations, we find that in Brazil, El Salvador, Mexico, and Nicaragua are the results inconsistent (See Tables 6a-b). There are no countries for which the results are significant and consistent. For Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Paraguay, Peru, Uruguay, and Venezuela the coefficients are insignificant regardless of level of deflation. It should be noted that there is no country for which the results are significant and consistent across all for four data sources. Furthermore, the results are insignificant across all for data sources for Argentina, Bolivia, Costa Rica, Paraguay, Peru, Uruguay, and Venezuela. These results suggest that level of deflation should be considered when testing the robustness of results.

When examining long-run causality (significant error correction term) in the export-led growth models, once again the choice of either IFS or COMTRADE data does affect the results (See Table 7). Only in Chile are the results significant and consistent across all four data sources. In Costa Rica, Mexico, Nicaragua, and Venezuela are the results are significant and consistent the same for IFS and COMTRADE data. The results are insignificant for Bolivia, Brazil, El Salvador and Guatemala Paraguay, Peru, and Uruguay.¹⁰ For Argentina, Colombia, Ecuador, and Honduras the results are mixed and significant. Level of deflation does not appear to affect the consistency of the results since the results are only inconsistent for Honduras and Paraguay. However, in the case of Chile the coefficients are significant but of opposite sign when level of deflation is considered.

When examining long-run causality (significant error correction term) in the growth-led export models, once again the choice of either IFS or COMTRADE data does affect the results (See Table 8). Only in Chile and Paraguay are the results are significant and consistent the same

¹⁰ For Uruguay there is no application of ECT term at all since its GDP is an $I(0)$ + trend variable and the estimation procedure is different as it was pointed out in footnote 6.

for IFS and COMTRADE data. Nevertheless, the ECT coefficient for Paraguay is positive when using IFS data. For Ecuador the results are mixed and significant. The results are insignificant for all other countries. Level of deflation does not appear to be as much of an issue since the results are only inconsistent for Honduras, Mexico, and Peru. The results for Colombia are consistent and significant. The results are insignificant across level of deflation for all other countries. The causality tests clearly reveal that the results of growth-led export tests are not robust across data sources and level of deflation.

We apply the TYDL methodology to compare not only the results of both techniques but also to determine whether or not inconsistencies across data continue. This is a more flexible tool because it does not require the knowledge of cointegration properties of the system.

Additionally, the test can be applied even if there is no cointegration and/or stability and rank conditions are not fulfilled. Thus for Latin America, the TYDL methodology is more suitable since variables such as real exports and GDP tend to be unstable and may have structural break problems which affect the ADF and PP tests.

Causality between exports and economic growth is, then, examined through the following vector autoregression (k) model:

$$\mathbf{y}_t = \alpha + \beta_1 \mathbf{y}_{t-1} + \dots + \beta_k \mathbf{y}_{t-k} + \mathbf{u}_t \quad t = 1, \dots, T \quad (1)$$

where $\mathbf{y}_t = (GDP_t, X_t, S_t)'$, and \mathbf{u}_t is zero-mean, serially uncorrelated random term. According to the TYDL methodology, we increase the determined number of lags, say k , of the VAR in levels by the maximal order of integration, say d_{max} , that can occur in the model. Then, we estimate a $(k+d_{max})$ -th-order VAR and ignore the coefficients of the last d_{max} lagged vectors. Thereafter, a Wald test about linear and non-linear restrictions on the first k coefficient matrices is performed.

Toda and Yamamoto point out that, for $d=1$, the lag selection procedure is always valid as long as $k \geq d=1$. In order to analyse the causality structure of the system, the number of lags included in the VAR correspond to the ones obtained through the AIC and SBC to which one more lag, regarding the maximum order of integration of these variables, has been added.

Given that TYDL test provides results on long-run causality, we should look at the error correction terms (ECTs) from the ECMs if we want to compare results between the two methodologies. We can observe (Table 7 and 9) that the percentage of cases for which they coincide is only about fifty percent (8 in IFS, 7 in COMTRADE, 10 in UN, 7 in 2DigitUN) for the ELG hypothesis. They both support the same idea that exports promote growth for Chile and Nicaragua when using IFS data and Ecuador and Guatemala when using UN data. In any case, it is important to note that the countries experiencing the ELG hypothesis depend on the choice of the data source.

Using the TYDL model (Table 9) we find the same results across different data sets in only seven out sixteen countries. El Salvador is the only country for which the ELG hypothesis is supported. We do find support for the ELG hypothesis in a number of other Latin American countries when the assumption of consistency across data sets is relaxed. Exports affect economic growth in Chile and Nicaragua when IFS data are employed; Brazil and Guatemala using COMTRADE data; Brazil, Ecuador, and Paraguay using UN data; Nicaragua, and Uruguay using 2DigitUN. These results are particularly troubling since the ELG is a policy prescription and evaluating its success or failure may be more a function of the data chosen than the actual policy outcomes.

Using the same analysis but for the growth-led export (GLE) hypothesis (Tables 8 and 10), the results derived from Granger tests and TYDL tests are in agreement by slightly more

than fifty percent (12 in IFS, 12 in COMTRADE, 8 in UN, 13 in 2DigitUN). When there is concomitance between the two methodologies, only Colombia experiences a causality running from economic growth to exports. In the rest of the cases there is no support for the GLE hypothesis.

Focusing on TYDL results (Table 10), we find same outcome across the different data sets in only seven out of sixteen countries. However, the results are only consistent in cases where we do not find causality from growth to exports. When the assumption of consistent results across data sets is relaxed we find economic growth affects exports in Guatemala (IFS data); Colombia, Mexico, and Nicaragua (COMTRADE data); Costa Rica, Mexico, Nicaragua, Peru, and Venezuela (UN data); Guatemala and Venezuela (2DigitUN). Bi-directional causality exists for Honduras if we use IFS data; Chile, Colombia and Guatemala if we utilize UN data; and for COMTRADE and 2DigitUN data there are no cases.

In short, causality tests produce diverse outcomes depending on whether we use Granger methodology or TYDL methodology. There is consistency in only about fifty percent of the cases and for most of those cases we find no causality between exports and economic growth. The TYDL method also yields mixed results depending on the data choice. However, it can be said that the ELG hypothesis has little support for Latin American countries when one varies data sets and/or methodology.

Conclusion

These results stress the need to test the robustness of models as they pertain to choice of data set and methodology. This study suggests that much of the debate regarding export led growth, at least for Latin America, could be fuelled by both data choice and methodology. Furthermore, the ELG hypothesis receives weak support for Latin American countries according

to our analysis. Given the policy implications of these studies, more care must be taken to ensure the results are robust to not only model specification but also data and methodology. Further research remains to be done to see how these factors affect the results of other macroeconomic models that utilize real export data.

References

- Abu-Quarn, A and Abu-Bader, S., 2004. "The validity of the ELG hypothesis in the MENA region: cointegration and error correction model analysis," *Applied Economics*, vol. **36**, pp. 1685-95.
- Abual-Foul, B., 2004. "Testing the export-led growth hypothesis: evidence from Jordan," *Applied Economics Letters*, vol. **11**, pp. 393-96.
- Ahmad, J., 2001. "Causality between exports and economic growth: what do the econometric studies tell us?" *Pacific Economic Review*, Vol. 6, no. 1, pp.147-167.
- Amin Gutierrez de Pineres, S., Ferrantino, M., 2000. *Export Dynamics and Economic Growth in Latin America: A Comparative Perspective*, Ashgate Publishers, Burlington.
- Bahmani-Oskooee, M., Mohtadi, H., Shabsigh, G., 1991. "Exports, Growth and Causality in LDCs: A Re-examination," *Journal of Development Economics*, vol. 36, pp. 405-415.
- Balanguer, J. and Cantavella-Jorda, M., 2004. "Structural change in exports and economic growth: cointegration and causality analysis for Spain (1961-2000)," *Applied Economics*, vol. **36**, pp. 473-77.
- Dickey, D.A. and Fuller, W.A., 1979, "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association*, vol. 74, pp. 427-431.
- Dickey, D.A. and Fuller, W.A., 1981, "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica*, vol. 49, pp. 1057-1072.
- Dolado, J. J. and Lütkepohl, H., 1996. "Making Wald Tests Work for Cointegrated VAR Systems," *Econometric Reviews*, vol. 15, pp. 369-386.
- Ericsson N.R. and MacKinnon, J.G., 2002, "Distributions of Error correction Tests for Cointegration," *Econometrics Journal*, vol. 5, pp. 285-318.

Giles, J. and Williams, C., 2000a. "Export-led growth: a survey of the empirical literature and some non-causality results. Part 1," *Journal of International Trade and Economic Development*, vol.9, no. 3, pp. 261-337.

Giles, J. and Williams, C., 2000b. "Export-led growth: a survey of the empirical literature and some non-causality results. Part 2," *Journal of International Trade and Economic Development*, vol.9, no. 4, pp. 445-470.

Johansen, S., 1988, "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, vol. 12, pp. 231-254.

Jung, W.S., Marshall, P.J., 1985. "Exports, Growth and Causality in Developing Countries," *Journal of Development Economics*, vol. 18, pp. 1-12.

Kaldor, N., 1964. *Essays on Economic Policy*. London: G. Duckworth.

Kaldor, N., 1970. "The case for regional policies," *Scottish Journal of Political Economy*, pp. 337-48.

Oxford Latin American Economic History Database- Methodology.
[Http://oxlad.qeh.ox.ac.uk/sources.php](http://oxlad.qeh.ox.ac.uk/sources.php)

Phillips, P. and Perron, P. 1988, "Testing for a Unit Root in Time Series Regression," *Biometrika*, vol. 75, pp. 333-346.

Toda, H. and Yamamoto, T., 1995. "Statistical Inference in Vector Autoregressions with Possibly Integrated Process," *Journal of Econometrics* vol. 66, pp. 225-250.

Table 1. Description of the data

Data Source (1962-1995)	Deflator	Variable (Real Exports)
International Monetary Fund (Nominal Exports)	Index of unit value of exports	IFS
United Nations Commodity Trade Statistics (Nominal Exports)	Index of unit value of exports	COMTRADE
United Nations trade database (Two-digit SITC nominal exports)	Index of unit value of exports	UN
United Nations trade database (Two-digit SITC nominal exports)	Primary commodities -commodity price indices from the United Nations <i>Monthly Bulletin of Statistics</i> and IMF <i>International Financial Statistics</i> . Manufactures- by their appropriate U.S. producer price index, using the general U.S. producer price index when an industry-level one was not available.	2DigitUN

Table 2: Long-run relationship existence (Are GDP and exports cointegrated?)

Country	GDP- IFS	GDP- COMTRADE	GDP- UN	GDP- 2DigitUN
Argentina	No	Yes	No	No
Bolivia	No	No	No	No
Brazil	Yes	No	No	No
Chile	Yes	Yes	Yes	Yes
Colombia	Yes	Yes	Yes	Yes
Costa Rica	Yes	Yes	No	No
Ecuador	Yes	Yes	Yes	Yes
El Salvador	No	No	No	No
Guatemala	Yes	No	Yes	Yes
Honduras	No	Yes	Yes	Yes
Mexico	Yes	Yes	Yes	Yes
Nicaragua	Yes	Yes	No	No
Paraguay	Yes	Yes	Yes	Yes
Peru	Yes	No	Yes	Yes
Uruguay	No	No	No	No
Venezuela	Yes	Yes	Yes	Yes

Table 3a. Short Run Causality Tests Export-led Growth Equations using IMF and COMTRADE data

	Colombia DGDP	DGDP	Ecuador DGDP	DGDP
Constant	-	-	-	-
DGDP(-1)	0.43** (2.41)	0.28 (1.58)	-0.02 (-0.22)	0.24 (1.61)
DGP(-2)	-0.03 (-1.11)	0.35* (1.89)	-	0.30** (2.22)
DIFS(-1)	0.29* (1.84)	-	-0.04 (-0.91)	-
DIFS(-2)	0.011 (0.55)	-	-	-
DCOMTRADE(-1)	-	0.03 (1.16)	-	0.016 (0.33)
DCOMTRADE(-2)		0.04 (1.52)	-	0.21** (4.81)
ECT(-1)	-0.04*** (-4.17)	0.001 (1.3)	-0.14*** (-5.11)	-0.009 (-0.78)
R ² (adj.)	0.39	0.16	0.54	0.46
<i>s. c.</i>	0.966	0.129	0.633	0.100
<i>f. f.</i>	0.392	0.909	0.180	0.059
<i>n.</i>	0.512	0.372	0.131	0.930
<i>h.</i>	0.833	0.515	0.526	0.966

Note: *s.c.* stands for serial correlation; *f.f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002).

Table 3b. Short Run Causality Tests Export-led Growth Equation using IMF and COMTRADE data

	El Salvador DGDP	DGDP	Paraguay DGDP	DGDP
Constant	0.08 (1.13)	0.005 (0.95)	-	-
DGDP(-1)	0.71*** (5.49)	0.78*** (6.84)	0.74*** (7.33)	0.89*** (9.18)
DIFS(-1)	0.02 (0.93)	-	0.04** (2.29)	-
DCOMTRADE(-1)	-	0.04** (2.45)	-	-0.04 (-1.07)
ECT(-1)	-	-	0.03 (0.82)	0.001 (0.69)
R ² (adj.)	0.49	0.62	0.23	0.28
<i>s. c.</i>	0.770	0.403	0.552	0.534
<i>f. f.</i>	0.053	0.070	0.642	0.742
<i>n.</i>	0.137	0.367	0.578	0.160
<i>h.</i>	0.832	0.550	0.685	0.808

Note: *s.c.* stands for serial correlation; *f.f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002).

Table 4. Short Run Causality Tests Export-led Growth Equations using UN and 2DigitUN data

	Colombia		Mexico	
	DGDP (eq. 2)	DGDP (eq. 3)	DGDP (eq. 2)	DGDP (eq. 3)
Constant	-	-	-	-
DGDP(-1)	0.37* (1.99)	0.30* (1.78)	0.37 (1.66)	0.18 (1.06)
DGP(-2)	0.32 (1.58)	0.53*** (2.80)	-0.28** (-1.91)	-0.13 (-0.75)
DIFS(-1)	-	-	-	-
DIFS(-2)	-	-	-	-
DUN(-1)	0.02 (1.27)	-	-0.012 (-1.14)	-
DUN(-2)	-0.002 (-0.15)	-	-0.03*** (-3.08)	-
D2DigitUN(-1)		0.05** (2.19)	-	-0.015 (-1.03)
D2DigitUN(-2)		0.05** (2.07)	-	-0.03 (-1.95)
DCOMTRADE(-1)	-	-	-	-
DOMTRADE(-2)	-	-	-	-
ECT(-1)	0.002 (1.28)	0.006 (0.08)	-0.04*** (-4.93)	-0.01*** (-4.67)
R ² (adj.)	0.11	0.29	0.37	0.48
<i>s. c.</i>	0.057	0.290	0.987	0.651
<i>f. f.</i>	0.200	0.546	0.453	0.060
<i>n.</i>	0.617	0.445	0.106	0.859
<i>h.</i>	0.785	0.403	0.190	0.696

Note: *s.c.* stands for serial correlation; *f.f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002).

Table 5a. Short Run Causality Tests Growth-led Export Equations using IMF and COMTRADE data

	Brazil		Ecuador	
	DIFS	DCOMTRADE	DIFS	DCOMTRADE
Constant	0.04 (0.89)	0.07** (2.51)	-	-
DIFS(-1)	-0.043 (-0.26)	-	-0.11 (-0.49)	-
DIFS(-2)	-0.36** (-2.18)	-		
DUN(-1)	-	-	-	-
D2DigitUN(-1)	-	-	-	-
DCOMTRADE(-1)	-	-0.08 (-0.50)	-	-0.42** (-2.42)
DCOMTRADE(-2)			-	(-0.38)** (-2.49)
DGDP(-1)	0.03 (0.062)	0.25 (0.64)	-0.04 (-0.06)	-0.86 (-1.67)
DGDP(-2)	-0.18 (-0.41)	-	-	-0.68 (-1.43)
ECT(-1)	0.26 (1.71)	-	-0.17 (-1.14)	-0.63*** (-5.25)
R ² (adj.)	0.32	-0.04	-0.15	0.38
<i>s. c.</i>	0.951	0.423	0.764	0.81
<i>f. f.</i>	0.137	0.267	0.085	0.162
<i>n.</i>	0.624	0.659	0.460	0.888
<i>h.</i>	0.489	0.123	0.794	0.231

Note: *s.c.* stands for serial correlation; *f.f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002).

Table 5b. Short Run Causality Tests Growth-led Export Equations using UN and 2DigitUN data

	Guatemala		Honduras	
	DIFS	DCOMTRADE	IFS	DCOMTRADE
Constant	-	-0.003 (-0.08)	-0.006 (-0.29)	-
DIFS(-1)	0.14 (0.89)	-	0.38*** (3.17)	-
DIFS(-2)	-0.05 (-0.39)	-		
DUN(-1)	-	-	-	-
D2DigitUN(-1)	-	-	-	-
DCOMTRADE(-1)	-	-0.64*** (-4.41)	-	0.036 (0.18)
DGDP(-1)	2.51*** (4.06)	1.81** (2.07)	0.43 (1.03)	-0.22 (-0.27)
DGDP(-2)	-0.23 (-0.31)	-		
ECT(-1)	0.59 (2.95)	-	-	-0.03 (-1.00)
R ² (adj.)	0.42	0.47	0.27	-0.02
<i>s. c.</i>	0.606	0.360	0.134	0.253
<i>f. f.</i>	0.135	0.585	0.554	0.075
<i>n.</i>	0.670	0.634	0.679	0.802
<i>h.</i>	0.310	0.695	0.521	0.811

Note: *s.c.* stands for serial correlation; *f.f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002). IFS (Honduras) was an I(0) + trend variable and therefore it was detrended.

Table 6a. Short Run Causality Tests Growth-led Export Equations using UN and 2DigitUN data

	Brazil		El Salvador	
	DUN	D2DigitUN	DUN	D2DigitUN
Constant	0.12** (2.58)	0.08 (1.63)	-0.02 (-0.31)	0.03 (0.48)
DIFS(-1)	-	-	-	-
DIFS(-2)		-	-	-
DUN(-1)	-0.45** (-2.53)	-	-0.48*** (-2.97)	-
D2DigitUN(-1)	-	-0.15 (-0.81)	-	-1.65 (-1.39)
D2DigitUN(-2)	-	-	-	0.10 (0.51)
DCOMTRADE(-1)	-	-	-	-
DGDP(-1)	-1.13 (-1.60)	0.32 (0.44)	-1.06 (-0.83)	1.30 (0.72)
DGDP(-2)	-	-	-	-1.65 (-1.00)
ECM(-1)	-	-	-	-
R ² (adj.)	0.20	-0.04	0.19	0.004
<i>s. c.</i>	0.433	0.518	0.612	0.133
<i>f. f.</i>	0.718	0.557	0.200	0.075
<i>n.</i>	0.809	0.103	0.369	0.140
<i>h.</i>	0.218	0.853	0.357	0.848

Note: *s.c.* stands for serial correlation; *f.f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002).

Table 6b. Short Run Causality Tests Growth-led Export Equations using UN and 2DigitUN data

	Mexico		Nicaragua	
	DUN	D2DigitUN	DUN	D2DigitUN
Constant	-	-	-0.04 (-0.98)	-0.014 (-0.38)
DIFS(-1)	-	-	-	-
DIFS(-2)	-	-	-	-
DUN(-1)	-0.21 (-1.06)	-	-0.36** (-2.29)	-
D2DigitUN(-1)	-0.06 (-0.33)	-0.25 (-1.31)	-	-0.17 (-1.16)
D2DigitUN(-2)	-	-0.07* (-1.82)	-	-
DCOMTRADE(-1)	-	-	-	-
DGDP(-1)	-4.33 (-1.63)	-3.36 (-1.57)	1.15** (2.27)	1.69*** (3.62)
DGDP(-2)	1.00 (0.36)	0.67 (0.30)	-	-
ECM(-1)	-0.14 (-1.05)	-0.07* (-1.82)	-	-
R ² (adj.)	-0.02	0.09	0.21	0.29
<i>s. c.</i>	0.436	0.074	0.667	0.655
<i>f. f.</i>	0.107	0.742	0.057	0.112
<i>n.</i>	0.170	0.362	0.790	0.544
<i>h.</i>	0.443	0.331	0.067	0.160

Note: *s. c.* stands for serial correlation; *f. f.* for functional form; *n.* for normality; *h.* for heteroskedasticity. Their values are the percentages at which the null hypothesis is rejected. The critical values for the adjusted *t* of the ECT term are calculated from Ericsson and MacKinnon (2002).

Table 7: Summary of Granger Causality Tests in Export-led Growth Equation

	Data Source				Level of Deflation			
	IFS <i>F</i> -stat.	ECT <i>t</i> -stat.	Comtrade <i>F</i> -stat.	ECT <i>t</i> -stat.	UN <i>F</i> -stat.	ECT <i>t</i> -stat.	2DigitUN <i>F</i> -stat.	ECT <i>t</i> -stat.
Argentina	0.072	-	0.069	-3.19*	0.160	-	0.035	-
Bolivia	4.802**	-	6.905**	-	1.650	-	1.714	-
Brazil	0.920	-0.97	1.366	-	5.323**	-	11.22***	-
Chile	4.625**	-7.03***	7.484**	-4.72***	3.509**	3.13	12.97***	-
								4.53***
Colombia	0.861	-4.17***	1.882	1.3	0.815	1.28	4.498**	0.08
Costa Rica	0.811	-4.27***	0.055	-5.27***	2.193	-	3.193*	-
Ecuador	2.251	-5.11***	4.646**	-0.78	10.93**	-5.70***	14.89***	-
					*			9.38***
El Salvador	0.881	-	5.237**	-	4.825**	-	4.184**	-
Guatemala	0.711	-1.05	0.095	-	6.384**	-4.32***	4.643**	-
								4.49***
Honduras	1.399	-	0.453	-3.38**	0.079	-0.58	0.291	-3.54**
Mexico	2.038	-3.41**	1.904	-3.81**	3.025*	-4.93***	1.974	-
								4.67***
Nicaragua	1.260	-4.53	0.005	-4.18	0.135	-	0.959	-
Paraguay	8.868**	0.82	0.305	0.69	0.904	2.62	2.267	4.50
	*							
Peru	0.065	-2.35	0.638	-	0.796	-0.03	0.007	-
Uruguay	1.195	-	0.168	-	0.366	-	0.197	-
Venezuela	0.023	-3.78**	0.017	-3.80**	0.561	-3.68**	0.384	-3.73**

Note: The critical values for the adjusted *t* of the error correction term (ECT) are calculated from Ericsson and MacKinnon (2002). Causality is interpreted in Granger sense.

Table 8: Summary of Granger Causality Tests in Growth-led Export Equation

	Data Source				Level of Deflation			
	IFS	ECT	Comtrade	ECT	UN	ECT	2DigitU N	ECT
	<i>F</i> -stat.	<i>t</i> -stat	<i>F</i> -stat.	<i>t</i> -stat	<i>F</i> -stat.	<i>t</i> -stat.	<i>F</i> -stat.	<i>t</i> -stat.
Argentina	0.308	-	0.670	1.71	0.039	-	0.130	-
Bolivia	1.131	-	1.433	-	0.577	-	1.033	-
Brazil	1.452	1.71	0.030	-	2.863	-	1.073	-
Chile	1.000	-4.38***	0.230	-3.17*	2.807	2.01	3.077*	-0.34
Colombia	1.924	-2.81	9.096***	3.20*	8.215**	3.93**	5.271**	4.32***
Costa Rica	2.018	-1.29	0.483	-1.74	1.259	-	0.420	-
Ecuador	0.007	-1.14	0.063	-5.25***	0.178	1.05	0.162	0.05
El Salvador	0.034	-	1.646	-	0.679	-	0.131	-
Guatemala a	6.814**	2.95	2.991*	-	4.267**	2.53	4.931**	2.12
Honduras	1.068	-	0.074	-1.00	0.458	-3.50**	0.014	-0.25
Mexico	0.571	-1.74	0.135	-0.47	1.367	-1.05	1.333	-1.82
Nicaragua	0.473	-0.03	0.348	-0.40	5.154**	-	13.10**	-
Paraguay	1.940	3.76**	1.753	-3.36	0.092	-2.41	0.395	-0.53
Peru	0.260	-0.75	0.509	-	1.628	-3.75	4.689**	-
Uruguay	2.546	-	2.537	-	0.009	-	0.047	-
Venezuela	0.796	1.18	2.359	1.42	0.091	1.27	3.573*	1.51

Note: The critical values for the adjusted *t* of the error correction term (ECT) are calculated from Eriesson and MacKinnon (2002). Causality is interpreted in Granger sense.

Table 9: Causality Results in Export-Led Growth Equation Based on Toda-Yamamoto' and Dolado-Lütkepohl's procedure

	Data Source			Level of Deflation				
	IFS	Lag length ($k+d$)	Comtrade	Lag length ($k+d$)	UN	Lag length ($k+d$)	2DigitUN	Lag length ($k+d$)
Argentina	0.887	2	0.047	2	0.097	2	0.871	2
Bolivia	0.040	2	0.618	2	0.699	3	0.826	2
Brazil	2.458	3	6.575**	3	13.57***	3	2.632	3
Chile	4.346*	3	3.180	3	11.56***	3	3.231	3
Colombia	0.714	2	1.643	2	3.121*	2	1.395	2
Costa Rica	1.479	2	0.136	1	0.504	1	2.315	2
Ecuador	1.899	2	0.392	2	8.304***	2	0.314	2
El Salvador	4.361*	3	6.996**	3	10.48**	4	5.781*	3
Guatemala	2.531	2	6.786***	2	7.110***	2	1.685	2
Honduras	8.092***	1	0.261	2	0.901	2	0.035	2
Mexico	1.104	2	0.980	2	0.354	2	0.773	2
Nicaragua	4.890**	2	1.091	2	1.233	2	9.812***	2
Paraguay	1.242	3	1.986	3	8.761**	3	1.116	3
Peru	0.246	2	0.620	3	0.024	2	0.648	1
Uruguay	2.129	2	1.569	3	0.068	2	5.789**	1
Venezuela	0.005	2	0.056	2	0.017	2	0.381	2

Note: Under the null hypothesis of non-causality, the statistic is a Chi-square distributed with k degrees of freedom. ***, **, *, indicate significance at 1, 5 and 10 per cent levels respectively.

Table 10: Causality Results in Growth-Led Export Equation Based on Toda-Yamamoto' and Dolado-Lütkephol's procedure

	Data Source			Level of Deflation				
	IFS	Lag length ($k+d$)	Comtrade	Lag length ($k+d$)	UN	Lag length ($k+d$)	2DigitUN	Lag length ($k+d$)
Argentina	0.001	2	0.061	2	0.040	2	0.004	2
Bolivia	2.019	2	1.807	2	0.014	3	2.553	2
Brazil	0.667	3	1.625	3	2.773	3	0.958	3
Chile	3.024	3	3.823	3	5.226*	3	1.786	3
Colombia	0.649	2	2.905*	2	4.775**	2	1.690	2
Costa Rica	0.697	2	0.217	1	7.502***	1	0.028	2
Ecuador	0.003	2	0.097	2	0.546	2	0.364	2
El Salvador	0.670	3	1.793	3	3.415	4	2.155	3
Guatemala	8.571***	2	2.122	2	2.722*	2	3.984**	2
Honduras	2.797*	1	0.407	2	1.065	2	0.035	2
Mexico	0.276	2	2.800*	2	2.697*	2	0.150	2
Nicaragua	0.002	2	3.671*	2	11.26**	2	0.048	2
Paraguay	3.696	3	0.577	3	0.148	3	0.658	3
Peru	0.328	2	1.030	3	3.328*	2	0.695	1
Uruguay	0.224	2	0.641	3	0.060	2	0.089	1
Venezuela	2.286	2	0.060	2	3.759*	2	2.649*	2

Note: Under the null hypothesis of non-causality, the statistic is a Chi-square distributed with k degrees of freedom. ***, **, *, indicate significance at 1, 5 and 10 per cent levels respectively.