A NOTE ON THE EXPORT-LED GROWTH HYPOTHESIS: A TIME SERIES APPROACH*

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The export-led growth hypothesis is analysed for Argentina, Brazil, and Mexico using cointegration and causality techniques. Cointegration is found for Argentina and Mexico in both a pre-break and post-break period, where the break is related to the introduction of the NAFTA. Furthermore, the causal relationship is either bi-directional or unidirectional from export to GDP revealing support to the hypothesis and an outward oriented policy.

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Keywords: Export-Led Growth; Cointegration; Causality; Argentina; Brazil; Mexico.

1. INTRODUCTION

The role of export to improve the growth potential of a country occupies the centre stage in especially development literature where export promotion and increased openness gradually have replaced import substitution to enhance growth. This shift from import substitution to export promotion and increased openness implies as well a shift in the trade and industry policy from being highly import substituting and government controlled to become more liberalised and deregulated. This shift in policies has also been central in policy recommendations to developing countries concerning improvements of their growth potential. An increased openness to trade will enhance competition for firms producing for the international market. Such an environment generates incentives for an increased productivity and incentives for innovations as well as the possibility to pay higher wages in line with the increased productivity. Furthermore, an increased openness to trade is also central in international negotiations about trade and tariff barriers where trade theory suggests that all parties on aggregate will enhance their welfare position in relation to their autarky situation.

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A number of empirical studies have documented a strong and positive relationship between export and economic growth including Michaely (1977), Balassa (1978), Tyler (1981), Balassa (1985), Chow (1987), Darrat (1987), Khan and Saqib (1993), Singupta and Espana (1994), McCarville and Nnadozie (1995), Thornton (1996), Panas and Vamvoukas (2002), Abual-Foul (2004) and Awokuse (2004) among others. The results reveal evidence in support of the export-led growth hypothesis for various countries. Furthermore, various studies have established a unidirectional causality from export to output while other studies as well have established evidence in support of a unidirectional causation from output growth to export.

During the 1980’s and 1990’s, many Latin American countries liberalised their trade policy towards a more outward oriented policy. Some of the arguments for the more liberalised trade policy was related to an increased international competition generating a more efficient use of scarce resources and increased export opportunities. As a consequence of such an improved situation, economic growth and welfare was expected to improve. Using Granger causality tests in a cointegrating framework, this paper analyse the link between export and economic growth in Argentina, Brazil and Mexico covering as well the period after the introduction of the NAFTA. This allow the possibility to compare the effect of the introduction of a Free Trade Area into the relationship given that Mexico is a member of the NAFTA which is not the case for Argentina and Brazil. Furthermore, the relative economic importance in the region for Argentina, Brazil and Mexico motivates the choice of the countries. In relation to total GDP in current US-dollars for Latin America and the Caribbean, Argentina did account for 10.6 percent, Brazil for 32.2 percent and Mexico for 26.6 percent of total GDP in the region in 1980. The corresponding relationship in 2006 was 7.2 percent for Argentina, 36.0 percent for Brazil and 28.3 percent for Mexico. Concerning export of goods and services in relation to GDP, Argentina improved its relation from 5 percent in 1980 to 25 percent in 2006, Brazil improved its relation from 9 percent in 1980 to 15 percent in 2006 and Mexico improved its relation from 11 percent in 1980 to 32 percent in 2006. During the same period, the average relation for Latin America and the Caribbean as a region improved from 13 percent in 1980 to 26 percent in 2006. Economic welfare measured by yearly GNI per capita in current US-dollars did also improve during this period. In Argentina GNI per capita in current US-dollars did improve from 4,790 US-dollars in 1980 to 11,670 US-dollars in 2006. GNI per capita in current US-dollars in Brazil did improve from 3,350 US-dollars in 1980 to 8,700 US-dollars in 2006 and Mexico did improve its GNI per capita in current US-dollars from 4,380 US-dollars in 1980 to 11,990 US-dollars in 2006. During the same period, GNI per capita in current US-dollars for Latin America and the Caribbean as a region did improve from 3,318 US-dollars in 1980 to 8,682 US-dollars in 2006. The rest of the paper is organised as follows. Section two

1 Data from World Development Indicators (WDI) at www.worldbank.org and author’s own calculations.
describes the methodology and data while section three presents the empirical results and section four concludes.

2. **Empirical methodology and data**

To test for the existence of unit roots and identify the order of integration for each variable, the Augmented Dickey-Fuller (hereafter ADF) test introduced by Dickey and Fuller (1979, 1981) and the Phillips-Perron (1988, hereafter PP) test is used. In order to take into account a possible structural break in the data, the Zivot and Andrews (1992; hereafter ZA) unit root test will be employed. The ZA-test allows for an endogenous structural break where the test is allowed for a unit root against the alternative of a trend stationary process with a structural break. The breakpoint in the ZA-test is selected where the test statistic of the null of a unit root is the most negative for the $t$-statistic of the coefficient of the autoregressive variable. This test is included as the classical unit root tests may be suspect not taking into account that a structural break can lead to a wrong decision when the null hypothesis is not rejected.

As Gonzalo (1994) presents Monte Carlo evidence that the full information likelihood procedure of Johansen (1988) and Johansen and Juselius (1990) performs better than others according to several criteria, the MLE method of Johansen and Juselius (1990) to test for cointegration is used. It can be expressed in an error correction framework and provides a likelihood ratio statistic for the null hypothesis of at most $r$ cointegrating vectors where $r$ ranges from zero to the number of variables in the model. Given that the series are non-stationary and cointegrated, a Granger-type causality test for long-run behavioural relationship is valid with a presumption for causality to run in at least one direction (Granger, 1988, and Engle and Granger, 1987). Development of the cointegration concept indicates that a VAR model specified in differences is valid only if the variables under study are not cointegrated computing a Granger causality test (1969). If the variables are cointegrated, a VECM should be estimated rather than a VAR which is the case when the variables are not cointegrated in the standard Granger causality test. Furthermore, Hendry and Juselius (2000) emphasize the importance of correct specification. Following Granger (1988) and utilising the Guilkey and Salemi (1982) framework, the causal link between the variables is tested.

Quarterly GDP (GDP) at constant prices and export of goods and services (X) at constant prices for Argentina, Brazil and Mexico are collected from the EcoWin database. The data at 1993 constant prices for Argentina covers the period from the first quarter 1993 to the first quarter 2006 including 53 observations. For Brazil, the data at 1990 constant prices covers the period from the first quarter...

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2 Geweke et al. (1983) have shown that the Guilkey-Salemi approach performs well in finite sample problems.
1991 to the first quarter 2006 including 61 observations. The data at 1993 constant prices for Mexico covers the period from the first quarter 1980 to the first quarter 2006 including 105 observations\(^3\). The growth series is constructed as the logarithm (L) and first difference (D) of each series where the correlation between the growth-rate and export is 0.68 for Argentina, -0.13 for Brazil and 0.30 for Mexico suggesting that export leads GDP growth in Brazil with an a-cyclical relationship but a cyclical relationship in Argentina and Mexico\(^4\). Descriptive statistics are presented in Table 1 where the null hypothesis of normality is rejected at the 1 percent significance level for exports in all countries and GDP in Mexico but not for GDP in Argentina and Brazil.

### Table 1

**Descriptive Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
<th>JB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Argentina</td>
<td>0.006</td>
<td>0.07</td>
<td>-0.14</td>
<td>0.15</td>
<td>2.95</td>
</tr>
<tr>
<td>Export Argentina</td>
<td>0.020</td>
<td>0.09</td>
<td>-0.15</td>
<td>0.22</td>
<td>9.98**</td>
</tr>
<tr>
<td>GDP Brazil</td>
<td>0.007</td>
<td>0.09</td>
<td>-0.03</td>
<td>0.05</td>
<td>5.07</td>
</tr>
<tr>
<td>Export Brazil</td>
<td>0.019</td>
<td>0.06</td>
<td>-0.23</td>
<td>0.25</td>
<td>37.48**</td>
</tr>
<tr>
<td>GDP Mexico</td>
<td>0.006</td>
<td>0.07</td>
<td>-0.08</td>
<td>0.09</td>
<td>8.61**</td>
</tr>
<tr>
<td>Export Mexico</td>
<td>0.022</td>
<td>0.07</td>
<td>-0.31</td>
<td>0.19</td>
<td>20.15**</td>
</tr>
</tbody>
</table>

Source: Quarterly GDP at constant prices and export of goods and services at constant prices are collected from the EcoWin database.

Notes: S.D. denotes standard deviation; JB denotes Jarque-Bera test for normality; the notation ** and * implies significance at the 1 percent and 5 percent level, respectively.

Table 2 reports the results of the unit root tests without a possible structural break. The \(t\)-statistics reported for the ADF-test corresponds to the statistic with the longest significant lag. The null hypothesis of a unit root is by the ADF-test and PP-test not rejected for the series in log level but are found to be stationary in first difference implying integration of order one.

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\(^3\) The difference in number of observations is due to availability.

\(^4\) This is also confirmed by a visual inspection of data. Graphs are not reported here to conserve space.
Table 2 reports the result of the ZA-test allowing for a structural break. The results point out that all variables are integrated of order one except for GDP in Mexico. However, the ZA-test for GDP in Mexico is a borderline case at the 5 percent significance level with a critical value of −5.08. With the only exception in GDP in Mexico, the results of the unit root tests are consistent also allowing for a structural break in the data.

Table 3 reports the result of the ZA-test allowing for a structural break. The results point out that all variables are integrated of order one except for GDP in Mexico. However, the ZA-test for GDP in Mexico is a borderline case at the 5 percent significance level with a critical value of −5.08. With the only exception in GDP in Mexico, the results of the unit root tests are consistent also allowing for a structural break in the data.

### TABLE 2
ADF AND PP UNIT ROOT TESTS

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF at level</th>
<th>ADF at first difference</th>
<th>PP at level</th>
<th>PP at first difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Argentina</td>
<td>−0.77 (3)</td>
<td>−6.70 (2)**</td>
<td>−3.30 (4)</td>
<td>−12.38 (4)**</td>
</tr>
<tr>
<td>Export Argentina</td>
<td>−0.40 (4)</td>
<td>−2.94 (3)*</td>
<td>−1.95 (4)</td>
<td>−10.71 (4)**</td>
</tr>
<tr>
<td>GDP Brazil</td>
<td>−1.75 (9)</td>
<td>−3.22 (8)*</td>
<td>0.05 (4)</td>
<td>−9.16 (4)**</td>
</tr>
<tr>
<td>Export Brazil</td>
<td>2.76 (4)</td>
<td>−5.56 (3)**</td>
<td>0.72 (4)</td>
<td>−10.48 (4)**</td>
</tr>
<tr>
<td>GDP Mexico</td>
<td>0.71 (9)</td>
<td>−3.56 (8)**</td>
<td>−0.32 (4)</td>
<td>−23.55 (4)**</td>
</tr>
<tr>
<td>Export Mexico</td>
<td>0.34 (2)</td>
<td>−9.13 (1)**</td>
<td>−0.54 (4)</td>
<td>−15.82 (4)**</td>
</tr>
</tbody>
</table>

Notes: Figures in parentheses are the lag order selected based on the AIC where * and ** indicates significance at the 5 percent and 1 percent level, respectively.

### TABLE 3
ZA UNIT ROOT TESTS

<table>
<thead>
<tr>
<th>Variable</th>
<th>ZA at level</th>
<th>Date of break</th>
<th>ZA at first difference</th>
<th>Date of break</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Argentina</td>
<td>−4.36(1)</td>
<td>2001 quarter 3</td>
<td>−11.25 (2)**</td>
<td>2002 quarter 4</td>
</tr>
<tr>
<td>Export Argentina</td>
<td>−3.76(2)</td>
<td>1998 quarter 3</td>
<td>−15.03 (2)**</td>
<td>1998 quarter 3</td>
</tr>
<tr>
<td>GDP Brazil</td>
<td>−4.88(3)</td>
<td>2000 quarter 4</td>
<td>−8.29 (3)**</td>
<td>1997 quarter 4</td>
</tr>
<tr>
<td>Export Brazil</td>
<td>−3.96(2)</td>
<td>1997 quarter 3</td>
<td>−11.26 (1)**</td>
<td>1996 quarter 4</td>
</tr>
<tr>
<td>GDP Mexico</td>
<td>−3.26(3)</td>
<td>1985 quarter 4</td>
<td>−5.02 (3)</td>
<td>2000 quarter 4</td>
</tr>
<tr>
<td>Export Mexico</td>
<td>−4.24(1)</td>
<td>1994 quarter 4</td>
<td>−15.31(0)**</td>
<td>2000 quarter 4</td>
</tr>
</tbody>
</table>

Notes: Figures in parentheses are the lag order selected based on the AIC where ** indicates significance at the 1 percent level.

### 3. EMPIRICAL RESULTS

Prior to performing the cointegration test, test for structural breaks by Recursive Least Square (RLS) and the step-wise Chow (1960) test are performed for the one percent significance level. Dummy variables are included in the VAR-model underlying the cointegration test to represent possible structural breaks and
external shocks to the markets. One possible structural break is found related to
the first quarter 2002 to the second quarter 2002 (D02) for Argentina related by
the RLS-graphs to export representing a possible delayed effect of the 9/11 attack
in the USA. After imposing the D02 dummy variable, the RLS estimation and the
Chow-test reveals no structural break in Argentina. For Brazil by RLS, an outlier
related to export is related to the period from the second quarter 1999 to the fourth
quarter 1999 (D99) but a structural break related to export is by the Chow-test
related to the period from the second quarter 2002 to the third quarter 2002. Export
of goods and services in relation to GDP in Brazil was between 25-28 percent
during 2002-2006 but only between 7-12 percent during 1991-2001\(^5\). By RLS
and the Chow-test for Mexico, estimates reveals an outlier related to GDP from
the fourth quarter 1989 to the second quarter 1990 (D90) representing a possible
delayed effect from the financial crisis in 1988. However, a structural break is
related to GDP from the first quarter 1995 to the second quarter 1995. This break
might be related to the introduction of the NAFTA in beginning of 1995 more than
to the financial crisis in 1994, i.e. the tequila crisis, as the NAFTA is more of a
permanent shock relative to the financial crisis that is more temporary by nature\(^6\).
Export of goods and services in relation to GDP in Mexico was between 27-32
percent during 1995-2006 but only between 10-20 percent during 1980-1994\(^7\).

### TABLE 4

<table>
<thead>
<tr>
<th>Variables</th>
<th>VAR-model reduction, F-test</th>
<th>Hypothesis</th>
<th></th>
<th>Trace-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Null</td>
<td>Alternative</td>
<td></td>
</tr>
<tr>
<td>GDP, Export Argentina</td>
<td>29.10 (5)*</td>
<td>(r = 0)</td>
<td>(r \geq 1)</td>
<td>29.10*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(r &lt; 1)</td>
<td>(r &gt; 2)</td>
<td>5.56</td>
</tr>
<tr>
<td>GDP, Export Brazil</td>
<td>2.82 (2)*</td>
<td>(r = 0)</td>
<td>(r &gt; 1)</td>
<td>15.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(r &lt; 1)</td>
<td>(r &gt; 2)</td>
<td>3.55</td>
</tr>
<tr>
<td>GDP, Export Mexico (pre-break</td>
<td>11.12 (5)**</td>
<td>(r = 0)</td>
<td>(r &gt; 1)</td>
<td>17.67*</td>
</tr>
<tr>
<td>period)</td>
<td></td>
<td>(r &lt; 1)</td>
<td>(r &gt; 2)</td>
<td>2.34</td>
</tr>
<tr>
<td>GDP, Export Mexico (post-break</td>
<td>5.66 (5)**</td>
<td>(r = 0)</td>
<td>(r &gt; 1)</td>
<td>33.17**</td>
</tr>
<tr>
<td>period)</td>
<td></td>
<td>(r &lt; 1)</td>
<td>(r &gt; 2)</td>
<td>2.15</td>
</tr>
</tbody>
</table>

Notes: The cointegration test with critical values according to Osterwald-Lenum (1992). The notation
* and ** denotes significance at the 5 percent and 1 percent level, respectively. In parentheses, optimal
lag according to the F-test. The \(r\) denotes the maximum number of cointegrating vectors.

\(^5\) Data from World Development Indicators (WDI) at www.worldbank.org and author’s own
calculations.

\(^6\) For each country, test for seasonal dummies (Seas) as well as a trend in the data was performed where
results support seasonal dummies for Argentina and Mexico and a trend for Brazil. To conserve space,
results of the Chow-test and tests for seasonal dummies and trend are not reported here.

\(^7\) Data from World Development Indicators (WDI) at www.worldbank.org and author’s own
calculations.
The results of the cointegration test following the Johansen procedure are outlined in Table 4 where lag structures in the VAR-model were chosen according to the $F$-test. The test statistics indicate one cointegrating vector at the 5 percent level for Argentina. The pre-break period up to the first quarter 2002 was estimated for Brazil indicating no cointegration and long-run relationship between export and GDP\(^8\). For Mexico, the test statistic indicate one cointegrating vector at the 5 percent level for the pre-break period leading up to the fourth quarter 1994 and one cointegrating vector at the 1 percent level for the post-break period from the third quarter 1995 onwards. Thus, revealing a closer relationship in Mexico between export and GDP in the post-break period represented by an increased statistical significance. This period includes the introduction of the NAFTA in Mexico not experienced by Argentina or Brazil indicating that the structural break is not related to a general structural break in the countries concerning this period.

The test for the inclusion of each variable in the cointegrating space for Argentina reveals that export is significantly different from zero at the one percent level but GDP is insignificant. Thus, indicating that export is the leading variable in the cointegration between GDP and export for Argentina. For Mexico in both the pre-break and post-break period, GDP is significantly different from zero at the 1 percent level but export is insignificant\(^9\). Thus, indicating that GDP is the leading variable in the cointegration between GDP and export for Mexico in both periods.

The results from the causality tests outlined in Table 5 for Argentina reveals that both GDP and export causes each other at the 1 percent level. For Brazil, a short-run causality test excluding the error-correction term reveals a unidirectional short-run relationship from export to GDP. However, the export-GDP nexus is by its very nature a long-run relationship. Thus not to lose much of its meaning, Granger-type causality tests should incorporate such a long-run co-movement as argued in Ahmad and Harnhirun (1995). Absence of a long-run relationship, results from short-run causality tests such as for Brazil should be interpreted with caution as argued in Granger (1988). For Mexico in the pre-break period, there is a unidirectional relationship from export to GDP at the one percent level. For the post-break period, both GDP and export causes each other at the one percent level.

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\(^8\) There are too few observations in the post-break period to test for cointegration and causality. However by visual inspection of the data, the relationship is much closer between export and GDP in the post-break relative to the pre-break period in Brazil. Thus, the liberalising and deregulating trade-policy might have increased the importance of export in the growth-process and, thus, might explain the structural break in early 2002 related to a shock that is by nature permanent. However, it might as well be related to a shock that is by nature temporary such as a delayed 9/11-effect.

\(^9\) To conserve space, results are not reported here.
TABLE 5
GRANGER CAUSALITY TESTS BETWEEN GDP AND EXPORTS (X).

<table>
<thead>
<tr>
<th>Causality</th>
<th>F-test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Granger-causes GDP Argentina</td>
<td>10.70**</td>
<td>0.00</td>
</tr>
<tr>
<td>GDP Granger-causes X Argentina</td>
<td>9.14**</td>
<td>0.00</td>
</tr>
<tr>
<td>X Granger-causes GDP Brazil #</td>
<td>4.10*</td>
<td>0.05</td>
</tr>
<tr>
<td>GDP no Granger-causes X Brazil #</td>
<td>2.25</td>
<td>0.11</td>
</tr>
<tr>
<td>X Granger-causes GDP Mexico #</td>
<td>10.85**</td>
<td>0.00</td>
</tr>
<tr>
<td>GDP no Granger-causes X Mexico #</td>
<td>2.40</td>
<td>0.11</td>
</tr>
<tr>
<td>X Granger-causes GDP Mexico ¤</td>
<td>46.60**</td>
<td>0.00</td>
</tr>
<tr>
<td>GDP Granger-causes X Mexico ¤</td>
<td>23.64**</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Notes: * and ** denotes significance at the 5 percent and 1 percent level, respectively, and # (¤) denotes pre-break (post-break) period, respectively.

4. CONCLUSIONS

This paper has examined the role of export in the economic growth process in Argentina, Brazil and Mexico using causality tests within an error-correction framework. The empirical results indicate a cointegrating relationship for Argentina and Mexico both in a pre-break and post-break period but no such relationship for Brazil. The results indicate that export is the leading variable in the cointegration between GDP and export in Argentina but that GDP is the leading variable in Mexico in both periods. Furthermore, results reveal a closer relationship in Mexico in the post-break period including the NAFTA introduction.

The causal relationship is, furthermore, bi-directional for Argentina and Mexico in the post-break period but unidirectional from export to GDP in the pre-break period. A short-run causality test for Brazil reveals a unidirectional link from export to GDP. Thus, the result that export causes growth render support to the export-led growth hypothesis in accordance with a large body of previous research on both industrial and developing countries. Hence, the findings lend support to an export-oriented growth strategy in promoting an enhanced growth potential in the countries such as a liberal and market-oriented strategy avoiding the use of regulatory and restrictive policy measures.

REFERENCES


