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# Trade and Growth Relationship: Some Evidence from Comoros, Madagascar, Mauritius and Seychelles[1)]

HAMORI Shigeyuki* and Ivohasina F. RAZAFIMAHEFA**

## Abstract

This paper applies time-series analysis to examine the effects of trade on growth for four African countries (Comoros, Madagascar, Mauritius, and Seychelles). Results might suggest that the size of the economy and the importance of trade relative to the GDP markedly determine the effects of trade on growth.

## 1. Introduction and Review of Literature

The net effect of trade openness on economic growth has been and remains a subject of controversy. Two issues are at the center of the debate: theoretical elaboration and empirical investigation.

On the theoretical side, since the time of Smith through Ricardo and Solow, trade has been shown to allow a country to reach a higher level of income since it permits a better allocation of resources. The growth effects of trade openness are made more explicit by the use of the new growth theory led by Romer [1986] and Lucas [1988]. Within such framework, Grossman and Helpman [1991] establish that openness enhances economic growth through the following channels. Trade enlarges the available variety of intermediate goods and capital equipment, which can expand the productivity of the country's other resources. Trade permits developing countries the access to improved technology in developed countries, in the form of embodied capital goods. Trade allows intensification of capacity utilization that increases products produced and consumed. Openness offers a larger market for domestic producers, allowing them, on one hand, to operate at minimum required scale, and on the other hand, to reap benefits from increasing returns to scale.

Skepticism about the effect of trade openness on income is based essentially on two premises, as put forward by Prebisch [1950] and Singer [1950]. First, incessant decrease in the international price of raw materials and primary commodities would lead, without industrialization in developing countries, to more profound differences between developed and developing countries. Second, for their indus-

* 羽森茂之，Graduate School of Economics, Kobe University
** Graduate School of Economics, Kobe University
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trialization, developing economies require short or medium term protection of their infant industries. Furthermore, the structure of trade, under which exports are concentrated on a few primary products and imports are constituted mostly by manufactured goods, renders developing countries overly dependent and vulnerable. Due to the low price elasticity of developing countries' export products and the fact that demand for primary products is rather contained in the international market, these small economies face continuously deteriorating terms of trade.

Levine and Renelt [1992] show that trade openness may affect growth through investment. Continuous openness may lead to faster long-run growth since openness allows larger access to investment goods. Trade liberalization provides incentives for foreign direct investment; nevertheless, foreign investment may crowd-out domestic investment. In sum, the impact of trade openness on income is rather uncertain. Rodriguez and Rodrik [1999] also emphasize the indefinite sign of the effects of trade on growth. Net effects are positive if the resource allocation driven by trade policy promotes sectors that generate more long-run growth, but are negative otherwise.

As for the empirical investigation, disagreement concerning the analysis of the effects of trade on growth usually turns around the three following issues: the construction of a single appropriate trade openness index, the use of cross-section analysis and the direction of causality. Measures vastly used, among other proxies, are ratio of trade (sum of imports and exports) to GDP, the importance of tariffs and the coverage of non-tariff barriers. Rodrik [1995] argues that in most studies of openness and growth, indicators used inappropriately reflect the trade regime.

Edwards [1997] tests, for a data set of 93 countries, the robustness of the impact of trade on growth by introducing, first alternatively and then simultaneously, nine measures of openness. He concludes that each proxy for openness is correlated positively with economic growth and the composite index from those proxies also enters with a positive coefficient in the growth regression.

Krueger [1978] finds a positive effect of openness on growth through testing two hypotheses: more liberalized regimes result in higher rates of growth of exports, and a more liberalized trade sector has a positive effect on aggregate growth.

Feder [1982] from a cross-sectional analysis of a set of 31 semi-industrialized countries discovers that exports have positive externality effects on economic growth. Esfahani [1991] extends Feder's work by introducing the idea that apart from the externality effects, the contribution of exports to growth appears more substantial through its effect of reducing import shortages. Esfahani tests the robustness of his findings by running a cross-sectional analysis of a set of semi-industrialized countries. He concludes that the significant impact of exports on growth is the alleviation of scarcity of imports faced by those countries. When the second channel is taken into account, the coefficient of the

externality effects drops rather remarkably.

Coe, Helpman and Hoffmaister [1997] show that trade allows developing countries to benefit from research conducted in developed countries. Imports of a larger variety of intermediate and capital goods, which incorporate the outcome of research led in the developed trading partners, can increase the productivity of the developing economy. From a cross-sectional study of 77 developing countries, the work shows that R&D spillovers through trade are transmitted from 22 industrial countries to the former group.

To address the controversy related to the endogeneity between trade variables and growth, Frankel and Romer [1996] introduce geographic factors to derive instrumental variables. They argue that those factors substantially determine conditions of trade and are unlikely to be directly correlated to growth. They conclude that trade has a significant positive effect on growth, and that results from ordinary least squares underestimate that effect.

Wacziarg [2001] suggests a new trade openness indicator, namely a composite index of the usual measures. He studies the trade and growth relationship in a set of 57 countries. To deal with the direction of causality problem, he estimates the effects of the new openness indicator on six principal sources of economic growth: macroeconomic policy, government size, price distortion, factor accumulation, technology transfer and foreign direct investment. He concludes that, depending on the specification, between 46% and 63% of the impact of trade openness on growth occurs through the accumulation of physical capital. Furthermore, he argues that the analysis thoroughly captures the impact of trade on growth.

The cross-sectional approach vastly used, until recently, for the analysis of the trade and growth relationship contains two main shortcomings. First, as pointed out by Harrison [1996], long-run averages are unsatisfactory measures of openness since they do not reflect the significant fluctuations in trade policy over time. Second, according to Jin [2000], cross-sectional analysis cannot distinguish the specific characteristics of each country, and it might be misleading to generalize the effect of trade on openness in one economy to other economies even of rather similar characteristics.

Harrison [1996] provides ways to address the measurement error and cross-sectional analysis controversy. Seven different measures are used to proxy the degree of openness of each country. The analysis covers the period 1960-88 for 51 countries. Both long-run average cross-sectional analysis and cross-country time series panel analysis are conducted. It is shown from the former method that i) only one of the seven openness indices enters the growth regression with a positive and statistically significant coefficient, ii) three out of seven indices affect growth positively when average five-year data are analyzed and iii) six from the seven indices become statistically significant when annual data are

taken in consideration. Hence, the study accentuates on the importance of a time-series approach in analyzing the trade and growth relationship.

Jin [2000], by analyzing time-series data for each country, studies the short-run dynamics of trade openness and economic growth in six East Asian economies. A five-variable Vector Auto Regression (VAR) model is employed incorporating GDP, money supply, government spending, foreign price and openness. Impulse Response Functions (IRF) and Variance Decompositions (VDC) are computed to look at the effects of trade on growth. From the IRFs, he finds that short-run output impacts of trade are positive but small and insignificant for five countries. From the VDCs, the forecast error variance of GDP explained by the trade openness innovation is also small and insignificant for the five countries. Effects of the shocks on government spending and foreign price are more substantial.

Hatemi and Irandoust [2001] study the direction of causality between export and productivity in five OECD countries. First, the Johansen method suggests the existence of one cointegrating vector between export and productivity. Then, the Granger causality test augmented with the error-correction term is carried out for each country. Although results are rather disparate, causality generally runs from export to productivity. VDCs between export and Total Factor Productivity (TFP) are also computed. The export innovations explain around 3% of the forecast error variance of TFP in France, 48% in Germany, 42% in Italy, 80% in Sweden and 86% in the UK.

Van Den Berg [1996] addresses the causality controversy in six Latin American countries by comparing results from single equation and simultaneous equation models. He argues that, first, both imports and exports have positive and distinct effects on economic growth; second, there exists a simultaneity between trade and growth; and finally, impacts of openness on growth are higher and more significant through a simultaneous over a single equation model.[2)]

Finally, for the case of Africa, Rodrik [1998] suggests that the effect of trade openness on economic growth seems to be indirect and small. The exports share of GDP, the Sachs-Warner openness index, import taxes and the black market premium do not enter the growth equation significantly. He shows that trade policy plays a rather secondary role in output growth, after human capital, physical infrastructure, macroeconomic stability and rule of law.

The present paper is motivated by three main issues. First, although the thought that trade openness enhances economic growth seems to be dominant nowadays, results of theoretical and empirical investigations still show disparate conclusions. Our study tries to bring more insights into the debate. Second, the trade and growth relationship in the case of African economies remains, comparatively,

2) However, Afxentiou and Serletis [2000] do not find any causal relationship between exports or imports and growth.

insufficiently investigated. We attempt to reduce that gap. To our knowledge, there has not yet been a specific study of openness and income growth focusing on the four countries presented here. Finally, the preponderant empirical studies in the field employ cross-sectional methodology. Given the limits of such a method, as mentioned earlier, we apply a time-series analysis to examine the effects of trade on growth in each of the four countries.

## 2. Data

The choice of the four African countries of Comoros, Madagascar, Mauritius and Seychelles to form the objects of the present analysis was driven by the fact that these four economies possess rather similar geographical and historical conditions. The four countries are islands, and distances from the major international markets are almost equal. The four countries have strong historical ties with large economies in Europe. Therefore differences in the effects of trade on economic growth in the four countries may be considered as results of policy measures rather than other conditions. Moreover, the four countries constitute, with La Réunion, a regional economic cooperation named "Comité de l'Océan Indien" (Indian Ocean Committee). Since La Réunion is classified as part of France, it is not included in the present analysis.

This paper uses the annual data for Comoros, Madagascar, Mauritius and Seychelles. The sample period for each country is as follows: 1980 through 2000 for Comoros, 1960 through 2000 for Madagascar, 1960 through 2000 for Mauritius, and 1976 through 2000 for Seychelles. The model variables include real GDP in 1995 prices and the trade share as a proxy of the openness measure (OPEN) of each country. Although the use of trade share as a measure of the openness of an economy receives continuously severe criticisms, we take the proxy for two reasons. First, alternative measures are not available on a long-term basis to conduct an appropriate time-series analysis, which is the core of the present paper. Second, among trade openness indexes, trade share appears to be the measure that has the highest correlation coefficients with other proxies.[3] The logs of variables are used for empirical analysis. The sources of all data are explained in the Appendix.

## 3. Empirical Results

Prior to specification and estimation of the VAR, the unit root test developed by Phillips and Perron [1988] is carried out to see if each variable includes a unit root or not. Table 1 and Table 2 show the

3) As in Harisson [1996], trade share shows, generally, the largest correlation coefficients with high significance level. Stryker and Pandolfi [2000] also choose the trade share for analyzing the case of Sub-Saharan African economies.

**Table 1. Unit root test (Level)**

| Country | Variables | Unit root test | |
|---|---|---|---|
| | | Specification | Test statistics |
| Comoros | GDP | Constant and Trend | −2.404 |
| | | Constant | −3.533* |
| | Trade Share | Constant and Trend | −2.491 |
| | | Constant | −2.255 |
| Madagascar | GDP | Constant and Trend | −1.944 |
| | | Constant | −0.735 |
| | Trade Share | Constant and Trend | −2.622 |
| | | Constant | −1.899 |
| Mauritius | GDP | Constant and Trend | −2.226 |
| | | Constant | 0.054 |
| | Trade Share | Constant and Trend | −2.744 |
| | | Constant | −1.209 |
| Seychelles | GDP | Constant and Trend | −2.259 |
| | | Constant | −0.803 |
| | Trade Share | Constant and Trend | −0.502 |
| | | Constant | −1.575 |

Note: "Constant and Trend" shows that the auxiliary regression includes a constant and a time trend.
"Constant" shows that the auxiliary regression includes a constant only.
* shows that the null hypothesis of a unit root is rejected at the 5% significance level.

**Table 2. Unit root test (First difference)**

| Country | Variables | Unit root test | |
|---|---|---|---|
| | | Specification | Test statistics |
| Comoros | GDP | Constant and Trend | −4.982** |
| | | Constant | −4.321** |
| | Trade Share | Constant and Trend | −4.936** |
| | | Constant | −5.093** |
| Madagascar | GDP | Constant and Trend | −5.120** |
| | | Constant | −5.200** |
| | Trade Share | Constant and Trend | −7.441** |
| | | Constant | −7.435** |
| Mauritius | GDP | Constant and Trend | −7.301** |
| | | Constant | −7.172** |
| | Trade Share | Constant and Trend | −6.925** |
| | | Constant | −7.010** |
| Seychelles | GDP | Constant and Trend | −4.185* |
| | | Constant | −4.165** |
| | Trade Share | Constant and Trend | −4.593** |
| | | Constant | −3.777** |

Note: "Constant and Trend" shows that the auxiliary regression includes a constant and a time trend.
"Constant" shows that the auxiliary regression includes a constant only.
* shows that the null hypothesis of a unit root is rejected at the 5% significance level.
** shows that the null hypothesis of a unit root is rejected at the 1% significance level.

results for the level of the logs of each variable and the first difference of them. As is clear from these tables, each variable is found to include only one unit root, i.e., I (1) variable.

Then, the cointegration test developed by Johansen and Juselius [1990] is carried out to see if variables are cointegrated for two variables in each country. As is clear from Table 3, there is no clear evidence of cointegration for all countries.[4] Thus, it is not necessary to include an error correction term. The model is estimated using the log difference of system variables. Regarding the selection of the VAR lag order, all information criteria suggest VAR(1) for Comoros, Madagascar and Seychelles. For Mauritius, the sequential modified likelihood ratio test, the final prediction error test, the Akaike information criterion and the Hannan-Quinn information criterion recommend VAR(5), while the Schwarz Bayesian information criterion proposes VAR(1). Therefore, VAR(1) is opted for Comoros, Madagascar and Seychelles, and VAR(5) for Mauritius. However, given the limited sample size, a lag order of five seems rather long. Hence, shorter lag lengths were also investigated for the case of Mauritius in order to assert the robustness of the findings. Except for VAR(1), all lower lag lengths produced similar conclusions to those presented hereafter, for both the IRF and VDC.[5] To check the model specification, this paper reports, in Table 4, the results of VAR residual portmanteau tests for serial correlation, which is shown by Q(10) and its P-value. The null hypothesis is that there is no autocorrelation up to lag 10. This test is valid only for lags larger than the VAR lag order. As is clear from the table, there is no evidence of

**Table 3. Cointegration test**

| Country | Null hypothesis | Maximum eigen-value test | Trace test |
|---|---|---|---|
| Comoros | R=0 | 16.752 | 21.928 |
| Madagascar | R=0 | 8.034 | 13.178 |
| Mauritius | R=0 | 15.944 | 26.557* |
| Seychelles | R=0 | 10.705 | 17.777 |

Note: R is the number of cointegrating vector.
* shows that the null hypothesis of a unit root is rejected at the 5% significance level.

**Table 4. Model specification and diagnostics**

| | Comoros | Madagascar | Mauritius | Seychelles |
|---|---|---|---|---|
| Model | VAR(1) | VAR(1) | VAR(5) | VAR(1) |
| Q(10) | 22.208 | 42.705 | 28.973 | 19.735 |
| P-value | 0.9653 | 0.205 | 0.088 | 0.987 |

Note: Q(10) and P-value are the portmanteau test statistic for VAR residuals and its associated probability value.

4) The trace test shows that there can be one cointegrating vector for Mauritius. Since the maximum eigen-value test does not support this result, however, we simply assume that there is no cointegration for Mauritius.

5) Results are available from the authors on request.

serial correlation and thus the model specification used in this paper is empirically supported.

Based on the estimated VAR model, the IRF and VDC are computed. Here the variables are ordered as OPEN and GDP. The placement of GDP after OPEN allows the former to respond to current-period as well as previous-period shocks to the latter. Moreover, based on theoretical elaborations, historical considerations of the four countries here and previous literature, trade openness can be considered as preceding output, not vice versa.

Figures 1, 2, 3 and 4 show the IRF for each country. In each figure, the point estimates are plotted with a solid line, whereas the dotted lines represent a two standard deviation band around the point estimates. These show the response of GDP to the innovation of tariff share (OPEN). In the case of Comoros, the IRF begins with negative response. Then it fluctuates around zero and becomes zero in five years. For Madagascar, the IRF starts with positive response, then fluctuates around zero and

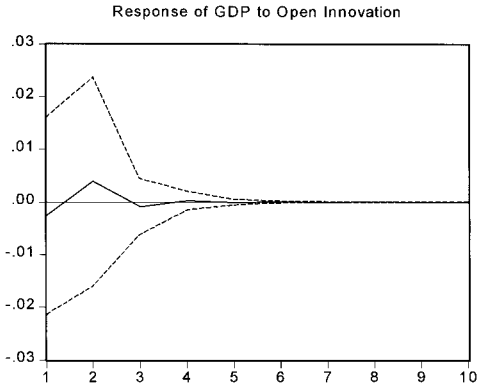


**Fig. 1. Impulse response function: Comoros**

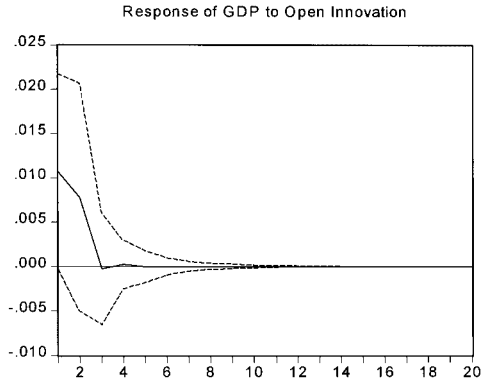


**Fig. 2. Impulse response function: Madagascar**

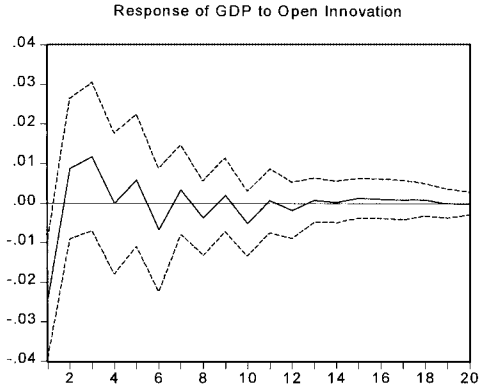


**Fig. 3. Impulse response function: Mauritius**

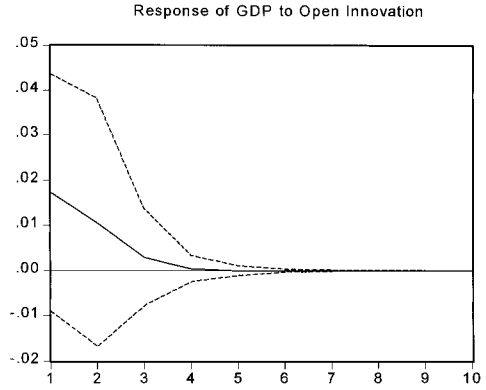


**Fig. 4. Impulse response function: Seychelles**

finally becomes zero in five years. For Mauritius, the IRF begins with negative response and fluctuates around zero up to the 19th period. For Seychelles, the IRF starts with positive response and monotonically decreases to zero in five years. It is interesting to see the response differs from country to country. In particular, the GDP in Mauritius has a relatively long response to the innovation of trade share.

Table 5 shows the results of VDC. The ten-period forecast error variance of GDP explained by OPEN innovation is 1.353% for Comoros, 13.617% for Madagascar, 29.324% for Mauritius and 9.792% for Seychelles. Thus, these large values are consistent with the view that OPEN shock is an important source of economic growth, especially for Madagascar and Mauritius but not for Comoros.

The results might suggest two conclusions. First, the extent of the effects of openness on economic growth depends on the size of the economy and the importance of trade in GDP. And second, the size of the economy seems to be more determining.

Computation of the VDC displays that innovation in the openness variable accounts for 29.324%, 13.617%, 9.792% and 1.353% of the ten-period forecast error variance of GDP in Mauritius, Madagascar, Seychelles and Comoros, respectively. Classifying the four countries based on country size and importance of trade in GDP produces similar ranking. The GDP of Mauritius varies between 35% and 137% of that of Madagascar, and the trade share increases from 74% in 1960 to 130% in 2000. For

**Table 5. Variance decomposition**

| Country | Horizon | GDP explained by innovations in | |
|---|---|---|---|
| | | Trade share | GDP |
| Comoros | 1 | 0.391 | 99.609 |
| | 3 | 1.350 | 98.650 |
| | 5 | 1.353 | 98.647 |
| | 10 | 1.353 | 98.647 |
| Madagascar | 1 | 9.407 | 90.593 |
| | 3 | 13.614 | 86.386 |
| | 5 | 13.617 | 86.383 |
| | 10 | 13.617 | 86.383 |
| | 20 | 13.617 | 86.383 |
| Mauritius | 1 | 25.427 | 74.573 |
| | 3 | 28.785 | 71.215 |
| | 5 | 29.022 | 70.978 |
| | 10 | 29.324 | 70.676 |
| | 20 | 28.431 | 71.569 |
| Seychelles | 1 | 7.261 | 92.739 |
| | 3 | 9.791 | 90.209 |
| | 5 | 9.792 | 90.208 |
| | 10 | 9.792 | 90.208 |

Madagascar, trade represents 26% of GDP at the beginning of the period of our analysis and reaches 59.42% at the end of the period. Concerning Seychelles, the GDP fluctuates between 4% and 16% of that of Madagascar, and trade share is within the range of 107% and 165%. As for Comoros, the GDP is between 5% and 8% of the GDP of Madagascar and trade amounts for 51.398% to 73.51% of GDP.

Hence, from those findings, it appears that in a larger economy with a higher trade share, in this case Mauritius, effects of openness on growth are more considerable. Openness effects are more significant in a larger economy with a lower trade share, i.e. Madagascar, than in a smaller economy with a higher trade share, i.e. Seychelles. Effects of openness are least important in the smallest economy with the lowest trade share, i.e. Comoros.

Moreover, IRFs show that the response of GDP to the openness innovation last the longest (19 periods) in the larger economy with the larger trade share. Results in the present paper put two contrasting thoughts together. On one hand, openness to international trade is advocated to policy makers, mainly in developing economies, as an indispensable way for economic development. On the other hand, it is asserted that the small size of the economy and the trade structure do not allow developing countries to reap benefit from openness, and to use trade as an instrument for economic growth. In line with the first theory, the countries in our analysis are all developing economies, and indeed, we can confirm that trade openness contributes to output enhancement, mainly in Mauritius and Madagascar. Along with the second thought, we find that the size of the economy is an important factor determining the gain that a country can obtain from trade.

## 4. Some Concluding Remarks

Although a large bulk of studies has focused on the relationship between trade and growth, the subject remains a topic of intense debate for economists. We attempted to offer further insights into the discussion. We studied the case of four economies of Africa, a region where examination of this topic is largely insufficient. Instead of the period-average cross-sectional method, vastly used up to now, we applied a time-series analysis for each country. The latter approach allows us to analyze significant fluctuations in trade openness during the period, and to distinguish specific characteristics for each country. Results of the VDCs show that openness innovation explains 29.324% of the ten-period forecast error variance of GDP in Mauritius, 13.617% in Madagascar, 9.792% in Seychelles and 1.353% in Comoros. Results might suggest that the size of the economy and the importance of trade relative to the GDP determine markedly the effects of trade on growth.

As a policy suggestion, despite the initial small size of the economy, it would still be advisable for a developing country to intensify participation in international trade, i.e. to increase the share of trade in

GDP. Such measures would enhance, probably slowly but steadily, the size of economy. Thereafter, the larger the size of the economy becomes, the more substantially trade openness will contribute to growth.

To close the paper, we would like to notice the following two points. First, we recognize that the sizes of the samples are relatively small, mainly for Comoros and Seychelles. Data of a larger span or higher frequency are not available. This might imply a limited robustness of the conclusions, however, the present analysis provides, at least, an insight into the investigated subject. Second, the present study is based on bivariate VARs. Since results of IRFs and VDCs are sensitive to the variables included in the model, using a trivariate model might offer more pertinent conclusions. Such a framework would extend the study for future research.

## Appendix

The GDP, exports and imports of goods and services of the four countries are in Constant 1995 USD. Data on GDP, exports, imports and trade share were taken from the World Development Indicators 2002, World Bank.

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