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The Effect of World Income on the Economic Performance of African Countries

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ABSTRACT

This paper examines how the output growths of 37 African countries' are affected by the output growth of the world. The connection between the world output growth and that of each African country is represented by a block recursive VAR model allowing that world output growth affects each African countries' output but not vice versa. The response of each African country's output growth is analyzed when one standard deviation shock is given to the world's output growth. Our results indicate that in 6 of the 37 countries, there exists a statistically significant and permanent effect for four periods (years), and the effect is positive for 5 of them. The statistically significant effect of the shock is observed starting from the first period for 16 countries, of which the effect is positive in 13. The initial (contemporaneous) effect of the shock can be observed in the output growths of 13 African countries of which the effect is positive in 9. For the output growths of 9 countries, a statistically significant effect could not be observed.

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1. INTRODUCTION

With globalization, world economies have become more interconnected. More and more research is being conducted to assess this interconnection. Even if there is considerable literature, like Arora and Vamvakidis (2001), and Vozlioublennaia (2001) assessing a possible long-run relationship among the income levels of various economies by using co-integration techniques, this does not suggest that there is no relationship in the short run. This paper analyzes the possible dynamic effect of world economic performance on small economies in the case of a set of African countries.

In particular, studies such as Schmitt-Grohe (1997) and Henry, Olekalns and Shields (2002), Vozlioublennaia (2001), and Hollanders, Soete and Weel (1999) examine co-movements across countries. Schmitt-Grohe (1997) studies the effects of US economic performance on Canada

by using impulse response estimates from Vector Auto regression. In her work, it is argued that if a shock directly affects the output of a large country, then it may affect the small country as well but not vice versa. As a result of her work, it is reported that Canadian output, employment, investment, exports, imports and terms of trade respond positively to a positive innovation in the US GNP. Henry, Olekalns and Shields (2002) investigated the co-movement between the rate of economic growth in the US and the growth rate in Australia, pointing out that there is the tendency for the countries' outputs to co-move positively. The non-linear model in their work indicated that the dynamic response to a shock differed depending on whether one or both of the economies were in recession. Vozlioublennaia (2001) has studied long run relationships of outputs among Latin American countries. She has found a long run relationship exists when these countries are grouped according to geographical and per capita income criteria. Like Vozlioublennaia (2001), Hollanders, Soete and Weel (1999) have also investigated the long run convergence of per capita income towards the United States within various regions, including Sub-Saharan and North Africa. They report that the GDP's of Sub-Saharan countries diverge from the United States except for certain small countries. They have also found that the GDP's of North African countries converge to the United States.

There are also specific studies examining the role of external shocks on African countries. Kose and Riezman (2001) examined the role of external shocks in African countries' macroeconomic fluctuations. In their work, they used a quantitative stochastic dynamic multi-sector equilibrium model of a small economy setup which represents the African economy. Their results indicate that external trade shocks account for roughly 45% of the economic fluctuations in aggregate output. Oteng (2002) examined the impact of the GDP of South Africa and Nigeria on the GDP of Sub-Saharan Africa. They investigated the effect by dividing the Sub-Saharan into two groups as SADC[1] and ECOWAS[2]. In the analysis, the pooled least squares estimation method is used for the 1960-1997 period. In this paper, besides the impact of Nigeria and South Africa, they also analyzed the impact of economic growth of the world, the United States, the United Kingdom, Japan and selected members of SADC on the economic growth of SADC and ECOWAS regions. It was found that the world GDP affects the GDP of African groups. Arora and Vamvakidis (2001) analyzed the impact of US economic growth and direct trade on the growth of other countries. In their estimation, they tested the impact of US long run economic growth on 36 industrial and developing countries, including South Africa. As a result of their panel data estimation, they concluded the existance of a significant positive impact of the US growth on growth in the rest of the world, especially for developing countries.

This paper attempts to examine how African countries' income is affected by the income of the rest of the world by using a dynamic model. We assess short-run relationship between world growth and the growth of each of 37 African economies rather than long-run relationship, as most of the earlier studies did. The connection between the incomes of each African country and the world income is represented in a block recursive VAR model as in Cushman and Zha (1997), in which the data from industrialized countries are used. This clearly imposes the restriction that world income affects individual African countries growth but not vice versa. Unlike Cushman and Zha (1997), we use the data from the developing countries in Africa. One of the reasons for choosing Africa is its being the world's poorest continent. In many parts of Africa, poverty is still widespread. Although economic growth rates are improving and there is an increasing number of countries, especially in Sub-Saharan Africa, which show signs of economic progress, the economic and social situation in Africa is fragile to external shocks. In this work, the effect of world economic growth is taken as the external shock and its effect on the economic growth of Africa is examined. Our study differs from the other African studies cited above in that we examine how external shocks affect each individual

[1] SADC refers to the Southern African Development Community, which includes 15 countries: Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritus, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

[2] ECOWAS refers to the Economic Community of West African Studies also made up of 15 countries. Benin, Burkina Faso, Cape Verde, Cote D'lvoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo are members of this group.

African country rather than how these countries are affected jointly using a pooled sample. In that sense, our study is the first among the studies made on African countries. The results that we obtain from this study may seem to contradict the findings of Hollanders, Soete and Weel (1999) but our study cannot be compared with theirs, which assesses long run relationships.[3] Moreover, our analysis did not take into consideration just the sub-Saharan countries. It was more extensive, analyzing the effects on a total of 37 countries.

The outline of the paper is as follows; the second section elaborates on the methodology while the third section provides the empirical evidence. Finally, the paper is concluded in the last section.

2. METHODOLOGY AND MODEL SPECIFICATION

During the process of revealing the effect of the world economy's output on a small economy, a structural vector autoregressive (SVAR) model, similar to the model suggested by Cushman and Zha (1997), is used. Specifically a block recursive model, in which foreign economic performance is determined by its own dynamics (an AR process is used as a proxy) and the African countries' macroeconomic variables follow a near VAR model, is constructed. This system differs from a 2 variable standard VAR setup in that none of the lag variables of the African countries' income variables enter the world output specification, but African economic performance is affected by the current and lag values of the world income.

Capturing the dynamic relationships among variables of interest and having a higher predictive power than single equation specifications are the advantages of using the VAR model instead of the conventional single equation model. Thus, a VAR model is utilized. In order to overcome the possibility of African economic variables affecting the world economy with their lags, which would appear in the case of the standard form of VAR, an identified VAR model with block exogeneity is constructed. In addition, the analysis is done for each country individually.

The general specification of the identified VAR model of Cushman and Zha (1997) is;

$$A(L)y(t) = e(t) \qquad (1)$$

In which the A(L) is an *mxm* matrix polynomial in the lag operator L, *y(t)* is the *mx1* observations vector, and ε(t) is the *mx1* vector of structural disturbances. Equation 2 shows the specification of the model.

$$y(t) = \begin{bmatrix} y_1(t) \\ y_2(t) \end{bmatrix}, \quad A(L) = \begin{bmatrix} A_{11}(L) & 0 \\ A_{21}(L) & A_{22}(L) \end{bmatrix}, \quad e(t) = \begin{bmatrix} e_1(t) \\ e_2(t) \end{bmatrix}. \qquad (2)$$

Here, $e(t)$ s are assumed to be uncorrelated with $y(t-j)$ for $j > 0$ and *A(0)* is non-singular. Moreover, the block (y_2(t)) exogeneity is represented by $A_{12}(L)$, which is zero. That is to say, $y_1(t)$ is exogenous to the second block both contemporaneously and for lagged values. The computation of the maximum likelihood estimation (MLE) and the inference for the system are done with the modified error bands of Bernanke, Hall, Leeper, Sims and Zha (1996). The reason for this is that the MLE of the VAR model is not applicable to the identified VAR model with block exogeneity[4].

The observation matrices are such that y_1 = *[World's output growth]*, y_2 = *[African countries' output growth]* and the lag order of the identified

[3] In our study, we test the existence of unit root in the output data of 37 African countries and the world. We test unit root by adding only the constant term, by adding both constant and trend terms and by adding the variable's first difference to the model. The findings of the test results, when including only the constant term, suggest that the coutries have unit roots, except for Burundi, Ivory Coast, Kenya, South Africa and Togo. When we consider the trend effect in the model, we observe all the countries except Cape Verde have unit roots. Finally, the results of the first differences of the series suggest that none of the African countries have unit roots, except for Liberia. When we look at the cointegration of these countries with the world, we find that only Congo, Gambia, Guinea Bissau, Malawi, Niger and Zimbabwe are cointegrated. These results are not reported here to save space but are available from the authors upon request.

[4] See Sims (1986) and Gordon and Leeper (1994).

VAR model is 1 for each country, which is suggested by the Bayesian Information Criteria. In this study, the GDP growth of each country at time t (GDPt) is calculated as follows:

$GDP_t = [(X_t / X_{t-1}) - 1]\ 100$

Where; Xt is the real GDP of each African country at time *t*.

The real gross domestic product (GDP) data for the world and the 37 African countries in this study (Algeria, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Egypt, Gabon, Gambia, Ghana, Guinea Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Tunisia, Zambia and Zimbabwe) are compiled from the World Development Indicators (WDI) databank of the World Bank for the 1960-2002 period.

3. ESTIMATES

In this section, the impulse response functions of each African country's GDP to a 1 standard deviation shock (1.36) in the world GDP is estimated by using annual data for the period 1960-2002.

The impulse responses are reported in the figure. The results suggest that there exists a statistically significant and permanent effect for four periods on the output growths of Botswana, Ivory Coast, Kenya, Lesotho, Sudan and Togo. The effect is positive for all of these countries except Sudan. For 16 countries the statistically significant effect of the shock is observed starting from the first period. The effect is positive for Algeria, Burundi, Central African Republic, Ghana, Madagascar, Malawi, Mauritania, Nigeria, Sierra Leone, South Africa, Swaziland, Zambia and Zimbabwe; whereas it is negative for Cape Verde, Chad, and Senegal. For Morocco and Niger, the positive statistically significant and permanent effects are observed starting from the second period; for Swaziland, the significance is observed starting from the third period; in Mali, the effect of the shock is observed only in the second period, but this time the effect is negative. The initial (contemporaneous) effect of the shock can be observed in the output growths of 13 African countries. The effect is positive for Botswana, Cape Verde, Guinea Bissau, Ivory Coast, Kenya, Lesotho, Seychelles, Togo and Tunisia; whereas it is negative for Algeria, Burkina Faso, Niger and Sudan, but the effect dies out over time for all 13 of these countries. For the output growths of 9 countries, (namely Benin, Cameroon, Congo, Egypt, Gabon, Gambia, Liberia, Rwanda and Tunisia) no statistically significant effect of the shock could be observed during this period.

Among the African countries, some have shared a common currency and monetary policy for several decades, like the CFA Franc zone countries in Western and Central Africa[5]. The impulse responses suggest that in 2 of the 14 Franc zone countries, Ivory Coast and Togo, a statistically significant and permanent effect on output growths was found. For Central African Republic and Chad, this effect is positive, and for Senegal it is negative. In Niger, starting from the second period, positive statistically significant and permanent effects are observed. In Mali, the effect of the shock, which is negative, is observed only in the second period. When the initial (contemporaneous) effect of the shock is observed, the effect is positive for Guinea Bissau, Ivory Coast and Togo; while negative for Burkina Faso and Niger. In the output growths of Benin, Cameroon, Congo and Gabon, no statistically significant effect of the shock can be observed.

We also calculated impulse responses by using a VAR specification with 3 lags to test the robustness of our results. These impulses are reported in the Appendix. There are some differences between the Figure in the text and the Figure in the Appendix. The results with the three lags are mostly parallel with the results with 1 lag but the persistence of the impulses decreases.

4. CONCLUSION

In this paper the effects of world output growth on the output growths of the 37 African countries

[5] There are 14 countries who are member of the CFA Franc zone. These countries are; Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal, Togo, Cameroon, The Central African Republic, Chad, Congo, Equatorial Guinea and Gabon.

are examined for the 1960-2002 period. The connections between the world output growth and that of each African country are represented in a block recursive VAR model. Moreover, each African country's output growth response is analyzed when one standard deviation shock is given to the world output growth. The results of our study indicate that in 6 countries, a statistically significant and permanent effect is observed for four periods. For 16 countries the statistically significant effect of the shock is observed starting from the first period. The initial (contemporaneous) effect of the shock is observed on the output growths of 13 African countries. For the output growths of 9 countries no statistically significant effect of the shock is observed during the whole period. When the impulse responses are calculated for 3 lags, the findings are found to be consistent with the findings for 1 lag, but a few differences.

Figure 1.
Impulse responses of the GDP's of African countries to a shock in the world GDP

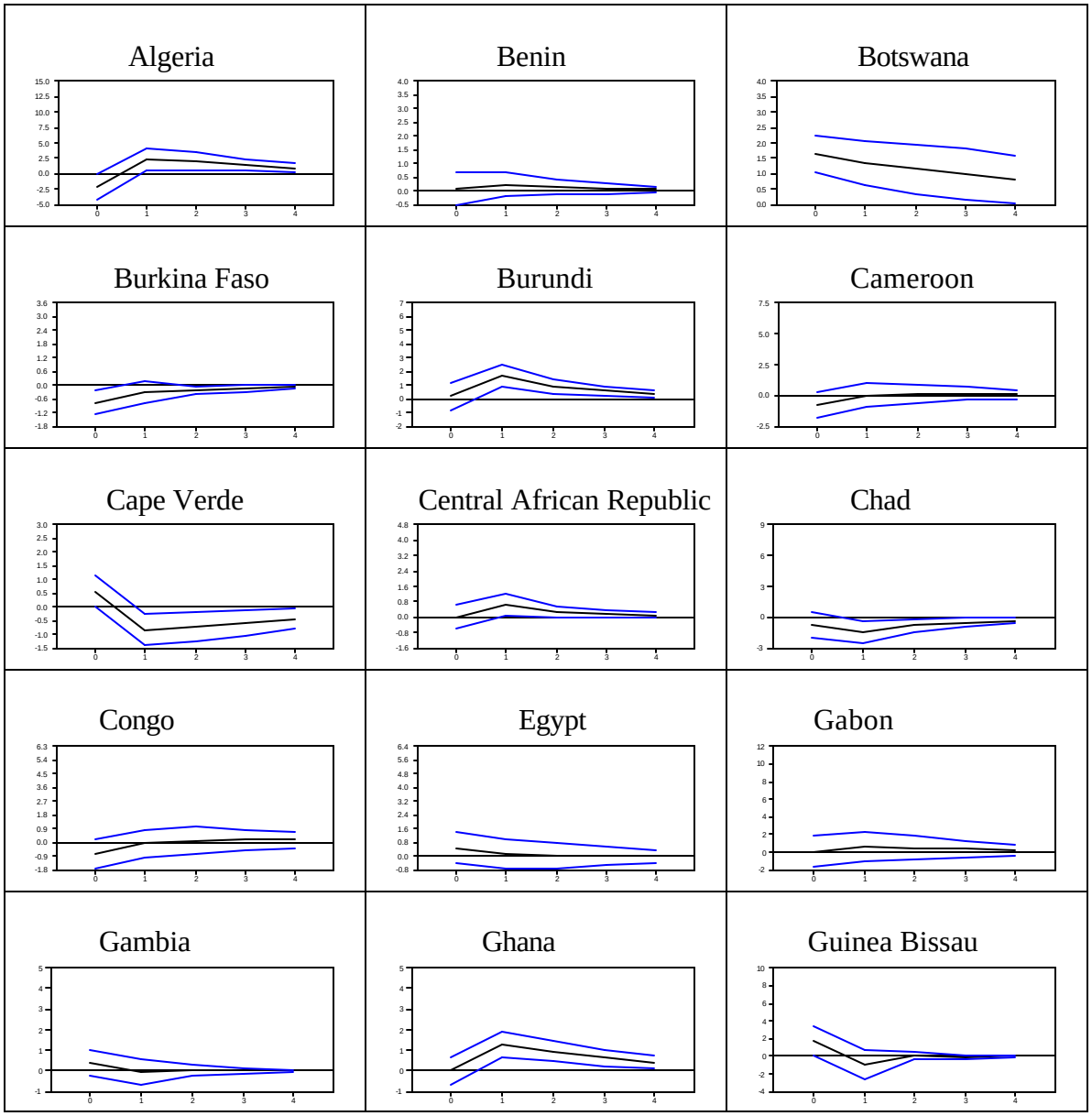


Figure 1 (continued).
Impulse responses of the GDP's of African countries to a shock in the world GDP

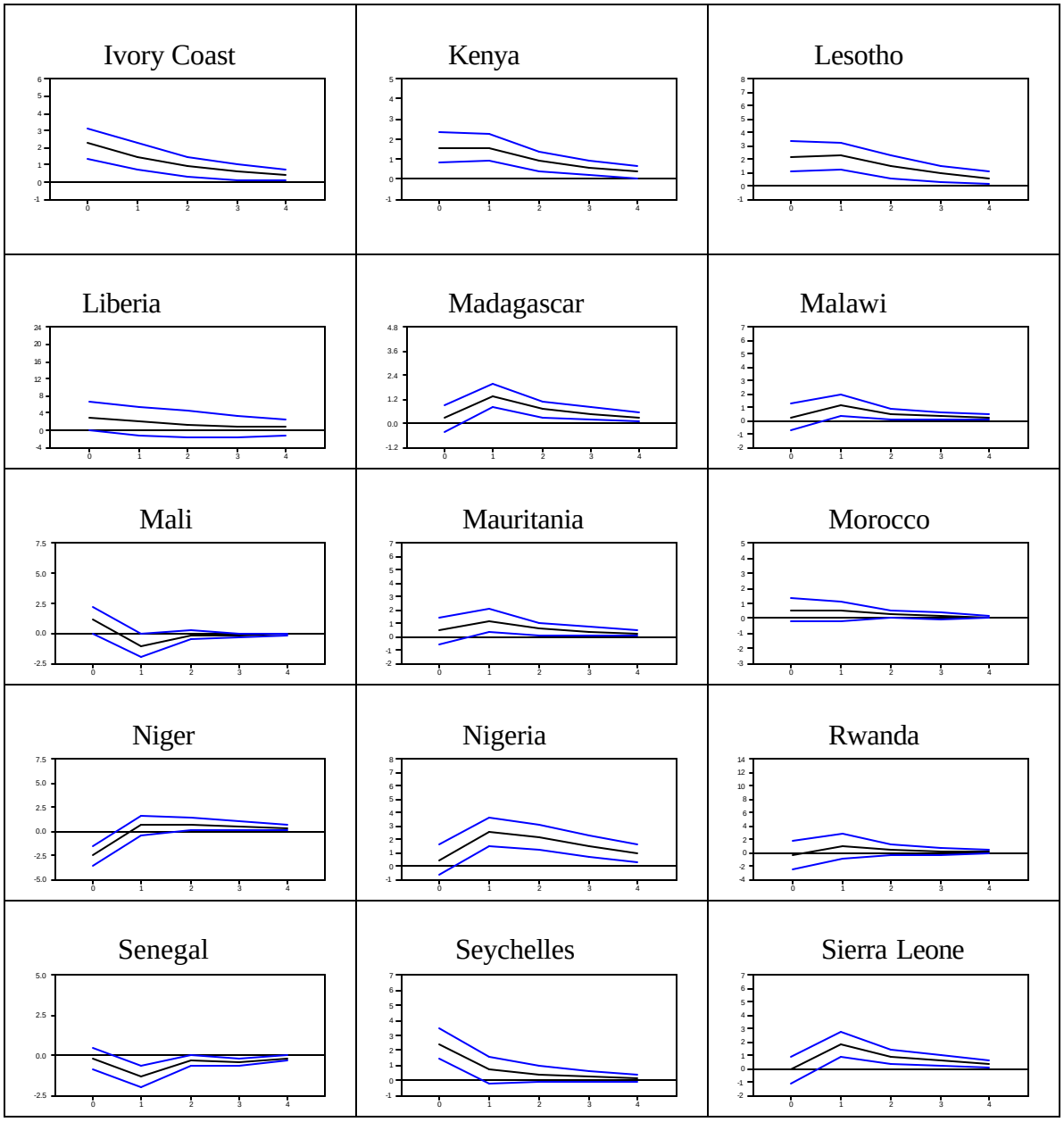
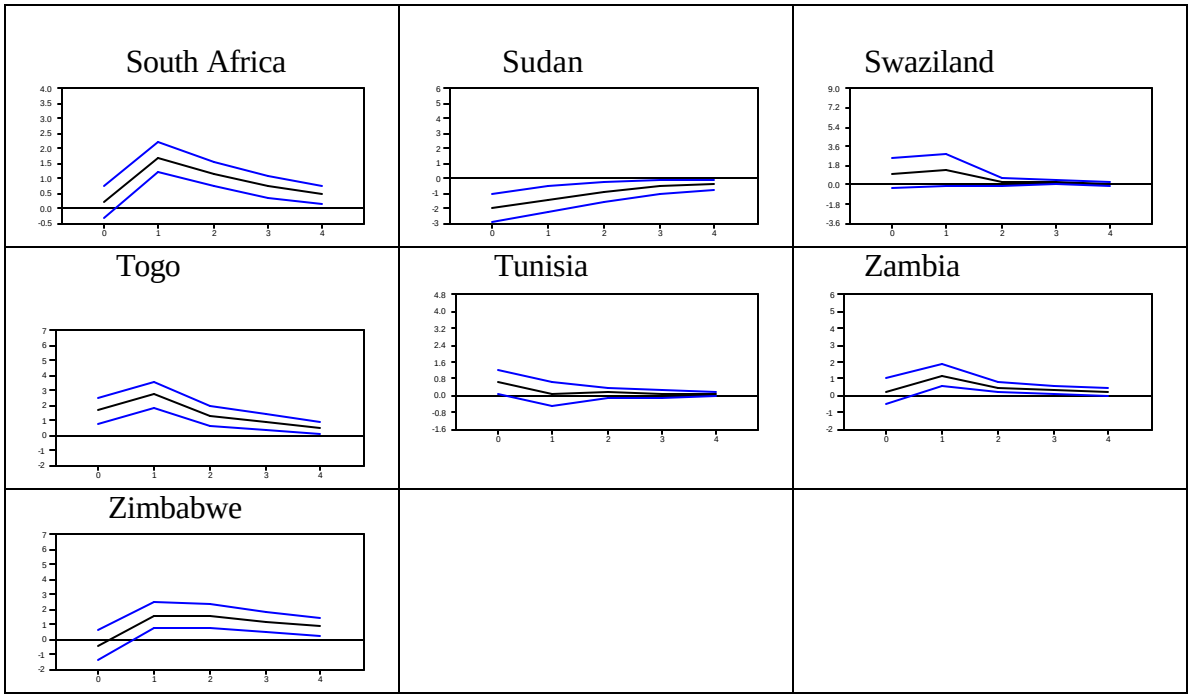


Figure 1 (continued).
Impulse responses of the GDP's of African countries to a shock in the world GDP



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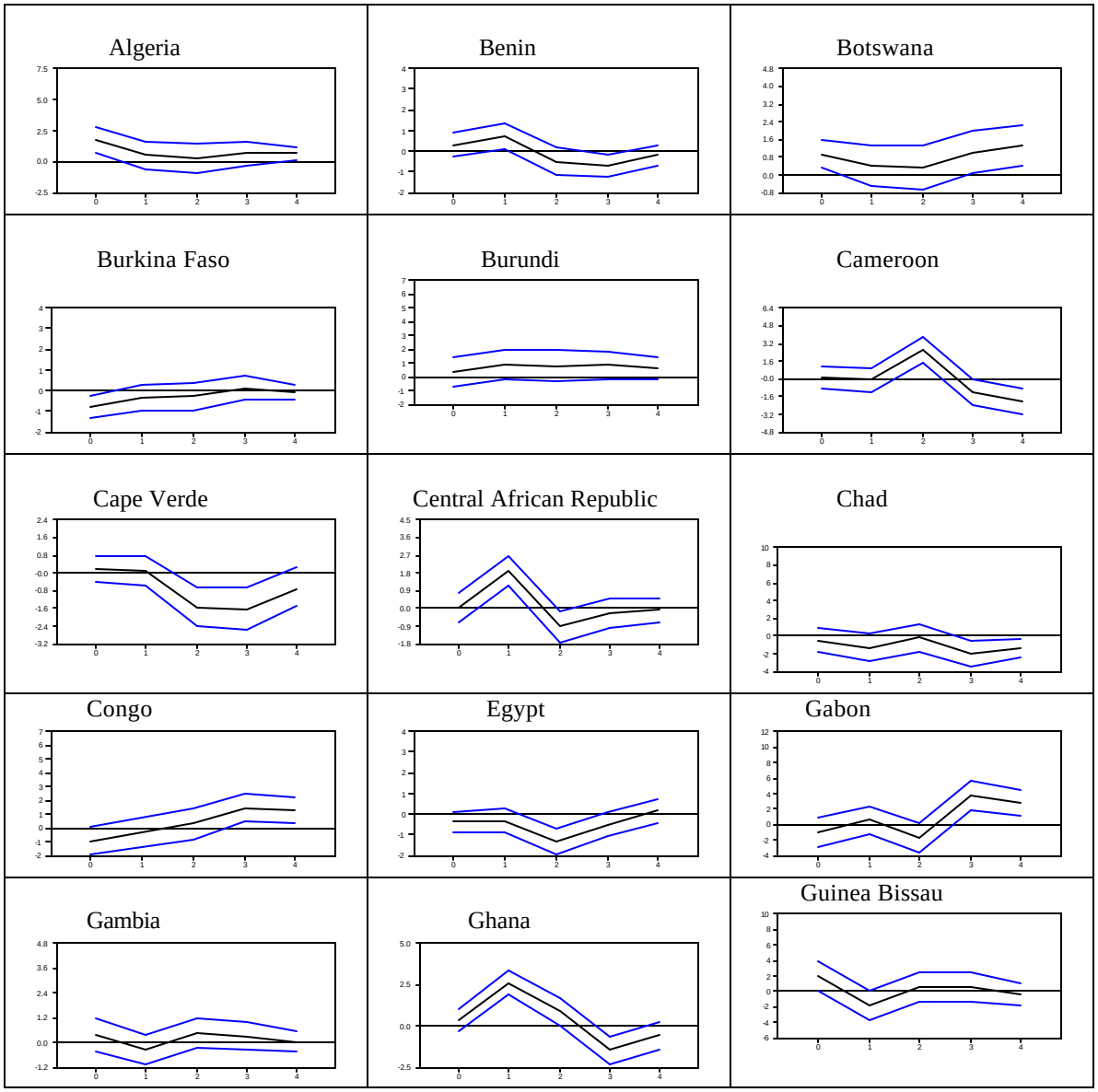
APPENDIX

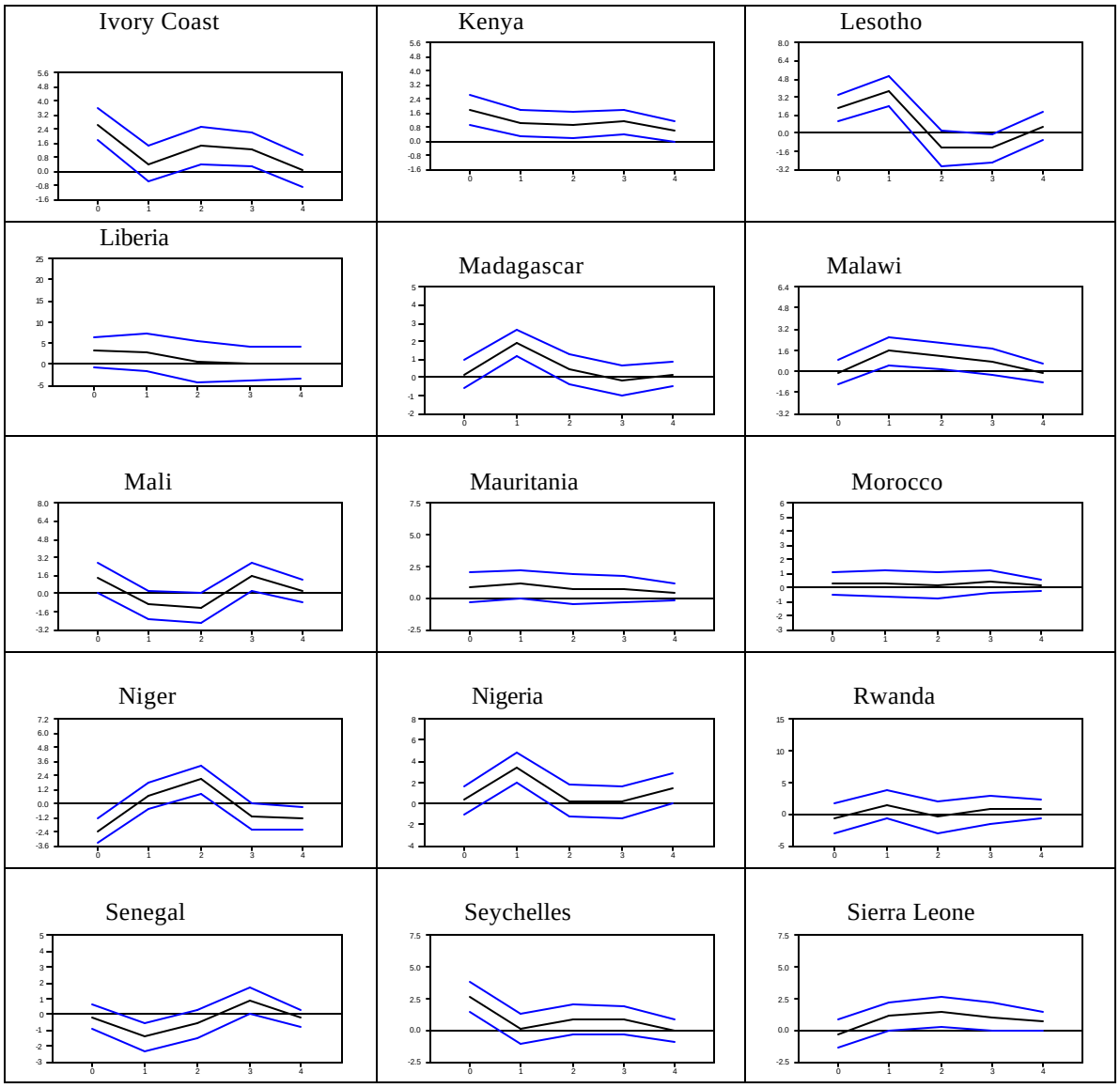
Impulse responses of the GDP's of African countries to a shock in the world GDP with three lags



APPENDIX

(continued)

Impulse responses of the GDP's of African countries to a shock in the world GDP with three lags



APPENDIX

(continued)

Impulse responses of the GDP's of African countries to a shock in the world GDP with three lags