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The Impact of the Global Financial Crisis on the Economy of Sierra Leone:

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Summary of Results

This report gives the preliminary results of a study to assess the effects of the global financial crisis on the economy of Sierra Leone. A review of writings on the impact of the crisis will appear in the final paper. Here, we assume the simple case in which the crisis results in a ten percent decline in foreign exchange earnings in 2009, a fall taken from the estimate by the WTO of the average impact across developing countries.

Monetary tools are not effective instruments of macroeconomic management in Sierra Leone. This leaves the government with two policy instruments for it to manage the economy in the short run and mitigate the effects of the global crisis, the nominal exchange rate and net government expenditure (expenditure minus revenue). Both of these instruments have constraints on their effective use.

The statistical results indicate that the exchange rate would be effective in stimulating output by increasing exports and reducing imports. Its use is constrained by its inflationary effect. Because the economy is open, nominal devaluation results in an increase in the price level via import prices. Further, the statistical results should be interpreted as indicating outcomes for marginal changes. A 'large' devaluation might generate instability which could induce unmanageable inflation. Therefore, we set the policy constraint that to be viable a policy response should not generate an aggregate price increase more than ten percent.

Use of government expenditure to compensate for a fall in export demand is constrained by its financing. On the conservative assumption that official development assistance would not increase, more public expenditure would be financed by the government borrowing directly from the Bank of Sierra Leone. Because the economy is open, this borrowing would have a limited inflationary impact because the excess supply of money would go to purchases of imports and domestic goods. Already suffering from a large trade deficit, the economy could be destabilized by a surge in imports. This effect dictates the policy constraint that the policy response to the export decline should not cause the trade deficit as a share of GDP to exceed its initial level.

The most effective policy package would be a combination of devaluation and increased public expenditure. The binding policy constraint would be the inflation

outcome. To return to the initial level of the trade deficit as a share of GDP, a nominal devaluation of at least 14.5 percent is required, which implies inflation marginally above the policy rule of ten percent. When this is combined with an increase in public expenditure of 6.4 percent, GDP returns to its initial level. The fiscal deficit is not a constraint. On the contrary, the effect of devaluation and inflation is to increase public revenue sufficiently to lower the fiscal deficit from minus six to -4.3 percent of GDP.

To summarise, this preliminary study suggests that the appropriate and effective policy response to the global crisis is for the government of Sierra Leone to combine a moderate devaluation with a moderate increase in public expenditure. This combination could stabilize the level of output at its pre-shock level, maintain the initial trade deficit, and reduce the fiscal deficit while avoiding excessive inflation. On the negative side, a ten percent decline in export earnings (or, more generally, a ten percent decline in foreign exchange inflows) is close to the limit of what policy could compensate. A larger decline would require a devaluation that would be excessively inflationary and/or an unsustainable fiscal deficit. The policy response to a larger external shock would need to be phased over more than one year, implying a short term decline in GDP.

Developing country governments, even those of low income countries are not helpless in the face of global decline. By careful use of available and effective policy instruments governments can partially or completely mitigate the effects of the crisis. The use of the instruments should be based on careful statistical analysis of the behaviour of the economy. The policy response should be constrained by rules based on an understanding of the vulnerability of the economy to balance of payments instability and inflationary pressures.

1 Introduction

After a disastrous civil war in the 1990s that resulted in terrible human suffering, the economy of Sierra Leone began to recover in the early 2000s. Inflows of development assistance and rejuvenation of the export sector fostered growth. The economy remained quite fragile, especially with regard to the balance of payments, whose stability depended on official capital flows and remittances from abroad.

In 2008 the gathering global crisis manifested its impact on Sierra Leone. Production of diamonds and other mining products fell in response to declining global demand. At the time this report was prepared there was no evidence on behaviour of agricultural exports after the second quarter of 2008, but it is probable that they ceased to increase or declined.

In recognition of the seriousness of global decline for the economy and welfare of the population, the Ministry of Finance requested support from UNDP to execute a study to focus on: 1) the likely short-term impact of the global downturn on the domestic economy; and measures which the government could take to mitigate that impact. This report provides the preliminary results of that study. While it seeks to rigorously treat these two tasks, it should be considered a first step.

Because of its underdeveloped financial sector, the purely financial effect of the global crisis, short term capital flows and commercial bank weakness would be insignificant for Sierra Leone. However, the global crisis would and has affected Sierra Leone through three other mechanisms: 1) its impact on export quantity and prices, 2) on direct foreign investment, and 3) on remittances from abroad. It was not possible at this stage to consider FDI or remittances, though these will be treated in the final report.

A few general remarks are necessary to place this report in context. First, monetary policy is not an effective instrument for short term macroeconomic management. This is primarily the result of the limited scope for public bond transactions and the limited role of commercial banks in funding investment. These points will be explained in detail in the full report. Second, at the margin the economy has a high import propensity, which implies that domestic inflation is very sensitive to the nominal exchange rate and international prices, especially of petroleum. Third,

public finances are also very sensitive to the exchange rate, via the domestic currency value of development assistance and *ad valorem* trade taxes.

And fourth, because of underdeveloped and the disruption of the civil war, economic statistics are limited, even by comparison with other low-income countries. Indeed, it is impressive what the various public agencies have been able to achieve in the marshalling of economic and social statistics. As should be obvious, the availability of statistics has conditioned the method which this study can use to assess the impact of the global downturn.

2 Data, Assumptions and Model Structure

Estimation of the Impact of the Global Crisis

Sierra Leone has a small economy, confirmed statistically by the non-significance of variables measuring global demand when estimating its export supply function. Similarly, the country's demand for imports is negligible on the world scale. However, it is reasonable to assume that changes in demand at the global level would be transmitted to the economy. The WTO estimates a decline in world trade in 2009 of nine percent and ten percent for developing countries.[1] The estimations of this study assume that the impact on Sierra Leone's exports will be the developing country average, minus ten percent.

The ten percent decline could be considered a conservative estimate because of the special circumstances of the country's economy. The most important of these is the recovery from the civil war of the 1990s, when exports of all commodities fell to an extremely low level (see Figure 1). While exports of diamonds could be expected to fall in response to world demand, it is possible that cocoa and coffee exports could stabilize or even increase slightly as they continue to recover from a low base.

In this preliminary report, no estimate is attempted of the likely decline in remittances from abroad. It is implicitly assumed that any decline in remittances is part

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[1] 'The collapse in global demand brought on by the biggest economic downturn in decades will drive exports down by roughly 9% in volume terms[1] in 2009, the biggest such contraction since the Second World War, WTO economists forecast today. The contraction in developed countries will be particularly severe with exports falling by 10% this year.' For further discussion, see http://www.wto.org/english/news_e/pres09_e/pr554_e.htm.

of the ten percent fall in export earnings. The complex issue of remittances will be treated in the final report.

The method used to calculate the impact of the global downturn is to construct a simple macroeconomic model with parameters derived from regression analysis. The regressions are presented in an annex to which the reader can refer for behavioural assumptions and statistical details.

Figure 1: Commodity Export Value by Quarter, 2000Q1 - 2008Q2
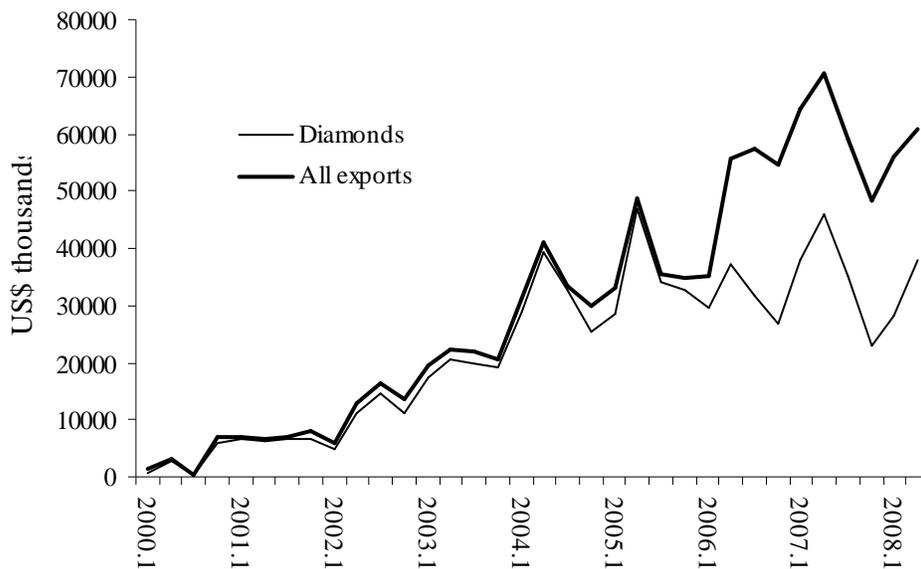
Source: Government of Sierra Leone

Characteristics of the Model

In order to calculate the impact of the specified fall in exports, it is necessary to generate a key statistic and several assumptions about the behaviour of the domestic and international economies. These are listed below.

1. Quarterly GDP

Gross national production statistics are calculated by the statistics office on an annual basis. Government expenditure and exports are available by quarters. These quarterly data can be used to produce a series for GDP. The following national income identity becomes an equilibrium condition if inventory change is assumed to be zero ($\Delta inv = 0$).

C = household consumption, I = business investment, G = government expenditure, X = exports, N = imports, and Y = national income:

$C + I + G + (X - N) + \Delta inv \equiv Y$, identity

$C + I + G + (X - N) = Y$, equilibrium

Applying standard behavioural functions:

$C = a_1(Y - T) = a_1(1 - a_2)Y$

$N = a_3Y$

a_1 is the propensity to consume, a_2 is the propensity to tax and a_3 is the propensity to import.

$Y = \beta(I + G + X)$,
$\beta = 1/[1 - a_1(1 - a_2) + a_3]$ = the autonomous expenditure multiplier

Quarterly GDP is calculated as $\beta(G + X)$, with the annual value of β applied to each quarter, adjusted so that

[calculated]$(GDP_{tq1} + \ldots + GDP_{tq4})$ = [actual](GDP_t).

Investment is implicitly assumed to be a constant portion of GDP. This calculation produces a quarterly nominal GDP series that is used in some of the regressions, and is shown in Figure 2.

Figure 2: Index of Quarterly Nominal GDP, 2001Q1 - 2008Q2
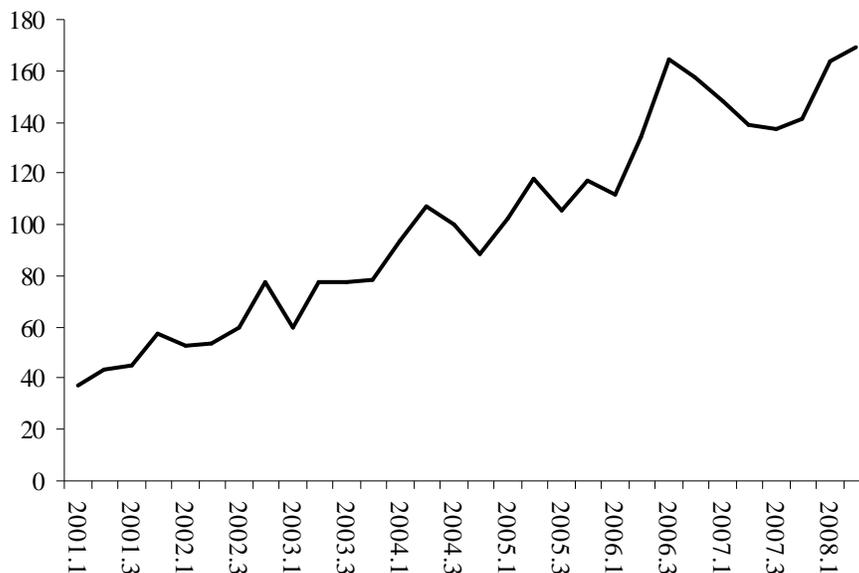
Source: See text.

2. Assumptions

a. The import price of petroleum is constant at its January 2009 average.

b. The policy choices are constrained by the rules that the trade deficit should not increase as a share of GDP, that the fiscal deficit should not increase, and that inflation should be no more than ten percent.

c. An increase in government expenditure is financed by monetizing the deficit and induced public revenue.

d. No change in aid commitments by donors.

3. Key behaviour parameters

The regression equations in the annex produce the following key parameters that determine the calculation of the impact of the export decline.

a. There is a structural rate of inflation of five percent per annum (the statistically significant intercept of the inflation equation); otherwise, inflation is determined by the nominal exchange rate and petroleum prices.

b. The elasticity of export earnings with respect to the real exchange rate is approximately unity (from the export equation).

c. The marginal propensity to import is .54, and the elasticity of import value with respect to the real exchange rate is approximately .9 (from the import equation).

d. Domestic revenue is determined by GDP (elasticity .22), the nominal exchange rate (via trade taxes, .90), and the domestic price level (via taxes on domestic commodities, .84).

3 Calculation of the Impact of Crisis

As pointed out above, monetary tools are not effective instruments of macroeconomic management in Sierra Leone. This leaves the government with two policy instruments by which it can manage the economy in the short run and mitigate the effects of the global crisis, the nominal exchange rate and net government expenditure. Both of these instruments have constraints on their effective use.

The regression results in the annex indicate that the exchange rate would be effective in stimulating output by increasing exports and reducing imports. However, its

use is constrained by its inflationary effect. Because the economy is open, nominal devaluation results in an increase in the price level via import prices. Further, the regression results should be interpreted as indicating outcomes for marginal changes. A 'large' devaluation might generate instability which could induce unmanageable inflation. Therefore, we set the policy constraint that to be viable a policy response should not generate an aggregate price increase more than ten percent.

Use of government expenditure to compensate for a fall in export demand is constrained by its financing. On the conservative assumption that official development assistance would not increase, more public expenditure would be financed by monetizing the deficit (the government borrowing directly from the Bank of Sierra Leone). Because the economy is open, this borrowing would have a limited inflationary impact because the excess supply of money would go to purchases of imports and domestic goods. Already suffering from a large trade deficit, the economy could be destabilized by a surge in imports. This effect dictates the constraint that the policy response to the export decline should not cause the trade deficit as a share of GDP to exceed its initial level.

Table 1 presents the estimate of the impact of the global crisis if its effect is limited to a ten percent fall in export earnings. The column To gives the initial position and column T1 the outcome in the absence of a policy response. Via the demand effect, the ten percent fall in exports reduces GDP by 7.2 percent, the trade deficit rises to over twenty percent of GDP, and the fiscal deficit increases slightly. The decline in GDP is equal to the fall in export earning times the autonomous expenditure multiplier. Public revenue falls, but by less than GDP, so the revenue share in GDP rises slightly. Imports fall, but like revenue less than GDP, so the import share increases. The structural element in inflation increases the price level by five percent, which causes a real appreciation of the constant nominal exchange rate, adding to the export decline (for a total decrease of 14 percent).

In column T2a the policy response is a nominal devaluation sufficient to return GDP to its initial level. Due to structural inflation of five percent and the inflation induced by devaluation itself, an exchange rate adjustment of over 25 percent is required to return to the initial level of GDP. This provokes inflation of almost fifteen percent, which is well above the policy constraint. It is likely that in practice a devaluation of this

size would generate uncontrollable inflation, as well as destabilising the formal credit market.

In the next column, T2b, fiscal policy is used to stimulate demand with a constant nominal exchange rate. An increase in public expenditure of over fourteen percent is required, which raises the fiscal deficit to over eight percent of GDP. As well as generating a deficit that might be unsustainable, this policy response violates the rule on the trade deficit, which rises from below nineteen to over twenty-three percent of GDP.

Devaluation and increased public expenditure are combined in calculation T2c, where the binding policy constraint is the inflation outcome. To return to the initial level of the trade deficit as a share of GDP, a nominal devaluation of at least 14.5 percent is required, which implies inflation marginally above the policy rule of ten percent. When this is combined with an increase in public expenditure of 6.4 percent, GDP returns to its initial level. The fiscal deficit is not a constraint. On the contrary, the effect of devaluation and inflation is to increase public revenue sufficiently to lower the fiscal deficit from minus six to minus 4.3 percent of GDP.

These calculations suggest that the appropriate and effective policy response to the global crisis is for the government of Sierra Leone to combine a moderate devaluation with a moderate increase in public expenditure. This combination could stabilize the level of output at its pre-shock level, maintain the initial trade deficit, and reduce the fiscal deficit while avoiding excessive inflation. On the negative side, a ten percent decline in export earnings (or, more generally, a ten percent decline in foreign exchange inflows) is close to the limit of what policy could compensate in one year. A larger decline would require a devaluation that would be excessively inflationary and/or an unsustainable fiscal deficit. The policy response to a larger external shock would need to be phased over more than a year, implying a short term decline in GDP.

Table 1: Alternative Policy Responses to a 10 percent
        fall in export earnings

	To	T1	T2a	T2b	T2c	Notes:
GDP* =	100.0	92.8	100.0	100.0	100.0	level (index)
exports =	19.0	16.3	19.0	16.2	17.8	level (index)
imports =	37.8	37.9	34.5	39.5	36.6	level (index)
(X-M)/GDP =	-18.8	-23.4	-15.5	-23.2	-18.8	percentage
Dm rev =	13.0	13.3	18.1	13.5	16.0	level (index)
Pub Exp =	19.0	19.0	19.0	21.8	20.2	level (index)
Deficit/GDP =	-6.0	-6.1	-0.9	-8.2	-4.3	percentage
Price level =	100.0	105.0	114.5	105.0	110.3	level (index)
Changes:						
Exchange rate		0%	+26.8%	0%	+14.5%	percentage
Public spending		0%	0.0%	+14.2%	+6.4%	percentage

*GDP is adjusted for inflation in outcome T1 through T2c.

To is the initial level of output with trade and public sector shares equal to those of 2008.

T1 is the calculated impact of a ten percent decline in export earnings.

T2a is a policy response in which the nominal exchange rate is devaluated sufficiently to return to
    the initial level of GDP (by 26.8%). This generates inflation of almost fifteen percent, above
    the policy constraint.

T2b is a policy response in which public expenditure is increased sufficiently to return to the
    initial level of GDP. This violates the policy rule that the trade deficit in GDP should not rise.

T2c is a policy response that seeks to maintain at lest the initial trade deficit (-18.8% of GDP) and
    no higher than ten percent, achieved by a 15% devaluation and an increase in pubic
    expenditure of 6.2%. The inflation constraint is slightly over-run.

4 Statistical Annex

This annex reports the regression estimations that provide the coefficients for the model estimating the impact of an export decline. The data were provided by the Ministry of Finance and Statistics Sierra Leone (http://www.statistics.sl/). The calculation of quarterly GDP is explained in the text, above.

Export and Import Functions

The export and import functions indicate an elasticity of the real exchange rate that is not significantly different from unity in both cases (negative for imports). The estimated marginal propensity to import with respect to GDP is considerably higher than the average (.54 compared to .42).

Domestic Revenue Function

The domestic revenue function conforms to theoretical prediction: while low, the elasticity of revenue with respect to GDP is positive and significant (.22); devaluation increases revenue via its effect on the domestic price of imports and exports; and increases in the domestic price level increase revenue via the ad *valorem tax* on the domestic price of commodities. There is a significant difference across quarters, perhaps due to the agricultural production cycle.

Price Level and Inflation Functions

Sierra Leone has a highly open economy. The price level and, therefore, inflation are determined by the exchange rate and the most important import, petroleum. As theory would predict, the coefficient for the exchange rate is not significantly different from the average propensity to import. The inflation equation suggests a structural inflation rate of five percent per annum (the intercept, which is highly significant).

Note on Exchange Rate Changes

As theory would predict, a nominal devaluation/appreciation does not generate an equal real devaluation/appreciation. For example, a ten percent devaluation/appreciation results in a 2.7 percent increase/decrease in the domestic price level, which makes the real exchange rate increase/decrease by 7.3 percent. To achieve a desired real devaluation, the nominal devaluation must be large enough to overcome structural inflation and the exchange rate induced increase of the price level.

Table 4.1: Export Function (quarterly, 2001 Q1 through 2008 Q2)
A. Summary statistics

R stat	R Square	Adjusted R Square	Std Error	Durbin-Watson*
.972	.945	.939	.190	1.866

Sum of	Squares	Degrees of freedom	Mean Sq	F	Sig.
Regression	15.625	3	5.208	143.515	.000
Residual	.907	25	.036		
Total	16.532	28			

*No evidence of positive or negative autocorrelation.

B. Coefficients

	Coeff	Std. Error	T stat	Sig of T
Constant	5.568	2.283	2.439	.022
LnRUSDt1	1.034	.513	2.014	.055
Time	.066	.006	10.838	.000
D1	-.466	.146	-3.195	.004

Variables:
The dependent variable is commodity export value in US dollars.
LnRUSDt1 is the natural log of the 'real' exchange rate lagged one quarter, defined as the nominal rate to the US dollar multiplied by the Freetown cost of living index ('domestic prices') and divided by the US wholesale price index ('international' prices).
Time is a trend variable.
D1 is a 'dummy' variable, equal to 1 for 2001.

Table 4.2: Import Function (quarterly, 2001 Q1 through 2008 Q2)
A. Summary statistics

R stat	R Square	Adjusted R Square	Std Error	Durbin-Watson*
.883	.781	.753	.132	1.853

Sum of	Squares	Degrees of freedom	Mean Sq	F	Sig.
Regression	1.488	3	.496	28.452	.000
Residual	.418	24	.017		
Total	1.907	27			

*No evidence of positive or negative autocorrelation.

B. Coefficients

	Coeff	Std. Error	T stat	Sig of T
Constant	11.629	1.754	6.629	.000
LnGDPt1	.535	.106	5.054	.000
LnRUSDt1	-.897	.348	-2.576	.017
D1	-.256	.098	-2.617	.015

Variables:
The dependent variable is commodity import value in US dollars.
LnGDPt1 is the natural log of nominal GDP lagged one quarter. See text of the annex for the method of estimation of quarterly GDP.
LnRUSDt1 same as for Table 4.1.
D1 is same as for Table 4.1.

Table 4.3: Domestic Revenue Function (quarterly, 2001 Q1 through 2008 Q2)
A. Summary statistics

R stat	R Square	Adjusted R Square	Std Error	Durbin-Watson*
.988	.976	.970	.062	1.882

Sum of	Squares	Degrees of freedom	Mean Sq	F	Sig.
Regression	3.538	6	.590	151.740	.000
Residual	.085	22	.004		
Total	3.624	28			

*No evidence of positive or negative autocorrelation.

B. Coefficients

	Coeff	Std. Error	T stat	Sig of T
Constant	-5.149	2.283	-10.907	.000
lnGDPt	.217	.513	2.111	.046
LnUSDnmt	.908	.006	4.499	.000
LnDnCPIt	.847	.146	5.786	.000
q1	.070	.033	2.097	.048
q2	.189	.034	5.624	.000
q3	.058	.034	1.717	.100

LnGDPt1 see Table 4.2.
LnUSDnmt is the nominal exchange rate to the US dollar, lagged one quarter.
LnDnCPIt is the domestic price level (Freetown consumer price index).
q1, q2, q3 assume the value of one for the specified quarter. The fourth quarter is the omitted variable.

Table 4.4: Price Level and Inflation Functions
(quarterly, 2001 Q1 through 2008 Q2)
A1. Summary statistics (Price level)

R stat	R Square	Adjusted R Square	Std Error	Durbin-Watson*
.974	.948	.945	.053	1.711

Sum of	Squares	Degrees of freedom	Mean Sq	F	Sig.
Regression	1.579	2	.790	284.064	.000
Residual	.418	31	.017		
Total	1.907	33			

*No evidence of positive or negative autocorrelation.

B1. Coefficients (Price level)

	Coeff	Std. Error	T stat	Sig of T
Constant	1.541	.387	3.977	.000
LnUSDnmt	.364	.106	3.417	.002
LnOilPrt1	.395	.034	11.706	.000

LnUSDnmt see Table 4.3.
LnOilPrt1 is the import price of petroleum, lagged one quarter.

Table 4.4: Price Level and Inflation Functions (continued)
A2. Summary statistics (Inflation)

R stat	R Square	Adjusted R Sq	Std Error	Durbin-Watson*
.580	.336	.287	.052	.579

	Sum of Squares	Degrees of freedom	Mean Sq	F	Sig.
Regression	.037	2	.019	6.838	.004
Residual	.073	27	.003		
Total	.111	29			

*Evidence of positive autocorrelation.

B2. Coefficients (Inflation)

	Coeff	Std. Error	T stat	Sig of T
Constant	.050	.012	4.102	.000
DExRUSDt1	.267	.103	2.590	.015
DOilPrt1	.122	.041	3.009	.006

DExRUSDt1 is the logarithmic first difference of the nominal exchange rate lagged one quarter.
DOilPrt1 is the logarithmic first difference of the import price of petroleum lagged one quarter.

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