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Growth with imported resources: On the sustainability of U.S. growth and foreign debt

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Abstract. We provide a growth model with imported resources and foreign debt accumulation providing the basis for two questions and regression equations. 1) Under what conditions do growth rates of per capita income remain positive if imported inputs such as oil have increasing real prices? 2) Is accumulation of foreign debt driven by a current account deficit of which two percent of the GDP stem from oil imports, sustainable? For both questions we provide estimates for the USA with the following results. Oil price growth rates have only a marginal impact on those of GDP per capita as long as they exceed inflation rates by not much more than they did in the past. The US foreign debt/GDP ratio follows an unstable difference equation and therefore is not sustainable. We briefly discuss possible future stabilization through the market and through policies.

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1. Introduction

Ricardo derived a problem of growth based on a model with a non-augmentable resource, land, and the implied decreasing returns to scale of the augmentable factors. In Ricardo's model the growth rate was equal to that of labour augmenting technical change minus the product of population growth and the measure of decreasing returns (one minus the degree of returns to scale in regard to the augmentable factors). In a three sector model with industry, export agriculture and domestic agriculture, Zarembka (1972) showed that Ricardo's problem may also come up intermediated through trade: If export agriculture is growing strongly the demand for land reduces the land available for domestic agriculture and drives up food prices and decreases real wages in terms of food.

In this paper we formulate a third variant of Ricardo's problem stemming from imported resources at exogenous market prices with a positive time trend. In our model the rate of technical change is diminished by the growth rate of the price of the imported resource and its elasticity of production. This result for the growth of the GDP per capita is obtained without a transition to a steady state as we assume that there are perfect capital movements. The dynamics of the model then appears in the debt/GDP ratio or the debt/capital ratio. The debt cycle theory according to which a country goes full cycle from a creditor to a debtor is shown to be only one of three possible outcomes of this model of a good debtor as in the simpler case of a Solow model with perfect capital movements.[1]

The equations for both results can be estimated. The estimation results show how much oil price growth rates reduce the growth rate of the GDP per capita and suggest which way the debt/GDP ratio will go according to current data. We do the estimation for the USA, because the US oil bill for imports makes up two percent of the current account as a percentage of the GDP and its current account is strongly negative and contributes to accumulation of debt since the 1930s (see Engel and Rogers 2006). The estimation confirms that only a mild form of the Ricardian growth problem is present, but rejects the hypothesis that the US debt/GDP ratio converges according to the model of a good debtor in a stable manner towards a constant debt/GDP ratio.

[1] The model can also be viewed as a synthesis of the models by Amano (1965), Borts (1968), which do not consider imported resources, and Kemp/Long (1982), who do not consider debt dynamics.

In the debate on the sustainability of the current account the optimists have pointed out that (i) there is no net capital income flow, (ii) there is a lot of dark matter not counted in the statistics, and (iii) devaluations and adjustments of stock valuations correct the net international investment position. Pessimists have emphasized that (i) the net interest payments must become positive some day, (ii) the dark matter story is probably wrong, and (iii) the corrections through valuation changes are small and uncertain.[2] Xafa (2007) has pointed out that whatever the truth on these details is, there is no non-arbitrary definition of a sustainable rate of the current account/GDP ratio. We think the criterion is stability of the debt/GDP ratio or the NIIP/GDP ratio (see also Bertaut et al. 2008). What is missing is an explicit stability analysis.[3] It is the purpose of this paper to derive a simple but clear (in)stability result. As we do worry about instability as long as the market does not show signs of stabilizing it, we also briefly discuss possibilities of future stabilization through the market and through policies. This stabilization through a transition to falling growth rates from a path with a significantly positive time trend logically precedes that of a transition of levels of the debt/GDP ratio to a stable value which is the basis for the discussion on a possible dollar crisis (Krugman 2007).

The next section sets up the model. The third section derives the growth rate of the model for the GDP per capita, the fourth analyses the debt dynamics. The estimation of the growth equation is contained and discussed in section 5, and that of debt dynamics in section 6. The last section summarizes and concludes with policy recommendations to stabilize the instability and provides suggestions for further research.

2. The model

We introduce natural resources into a Cobb-Douglas production function with exogenous technical change[4]:

$$Y = e^{bt} K^{\beta} L^{\alpha} R^{\gamma} \qquad \alpha + \beta + \gamma \leq 1 \tag{1}$$

[2] See Higgins et al. (2006).
[3] In Bertaut et al. (2008) there are some data plots though which also point to instability.
[4] Note that in a CD function it does not matter whether the technical progress is attributed to labour or any other factor or is neutral because each of them can be transformed into the other. In case of a more general function we would prefer to combine labour and resource augmenting technical change.

Y is output, K is the capital stock, L is exogenous employment and R denotes imported resources. We assume that the country in question is small in regard to the world capital market and that capital and output consist of identical goods. Profit maximization leads to the equality of the exogenous interest rate, r, and the marginal product of capital (ignoring depreciation):

$$r = \beta Y/K \qquad (2)$$

Similarly, with w as the real wage and p as the price of the imported resource, both in terms of real output, we get

$$w = \alpha Y/L \qquad (3)$$

$$p = \gamma Y/R \qquad (4)$$

Second-order conditions require excluding increasing returns by assumption, as we want to avoid increasing the complexity of the model by introduction of imperfect competition. The capital stock changes through domestic and foreign savings:

$$\dot{K} = S + \dot{D} = s(Y - pR - rD) + \dot{D} \qquad (5)$$

s is a constant average saving ratio from saving out of domestic capital and wage income. D is cumulated foreign debt, which is the sum over past current account deficits or the sum over past differences between investment and savings. The change in net foreign debt then equals the current account:

$$\dot{D} = pR - X + rD \qquad (6)$$

X denotes net exports without the imported inputs. As all variables are measured in terms of goods there is no need to include valuation changes for shares or nominal exchange rates. Employment is assumed to grow at a constant exogenous rate:

$$L(t) = L(0)e^{\varepsilon t} \tag{7}$$

Equations (1)-(7) solve for the seven variables: After insertion of *L* from (7), *Y, K, R* and *w* are obtained from the first four equations and the dynamics of *D* follows from (5) and other net exports, *X*, from (6). In addition we might assume therefore that X= X(e,Y,Y*), i.e. net exports are a function of the exchange rate, *e*, domestic GDP, *Y*, and foreign GDP, *Y**. For a given Y* and Y already solved for, the solution for the path of X involves one for the path of the exchange rate. This latter separation of solving for *D* and *X* is typical of models with no imports of machinery, and absence of debt problems with the exception of interest shocks[5], from which we prefer to abstract here in order to concentrate on long-run trends.

3. The impact of the terms of trade on the long-run growth rate

Rewriting equations (1)-(4) in growth rates using $\hat{L} = \varepsilon$ yields

$$\hat{Y} = b + \beta\hat{K} + \alpha\varepsilon + \gamma\hat{R} \tag{1'}$$

$$\hat{Y} = \hat{K} \tag{2'}$$

$$\hat{w} = \hat{Y} - \varepsilon \tag{3'}$$

$$\hat{p} = \hat{Y} - \hat{R} \tag{4'}$$

Equations (2') and (4') can be combined to yield

$$\hat{Y} = \hat{K} = \hat{p} + \hat{R} \tag{4''}$$

Using this to eliminate the growth rates of *Y* and *K* in (1') and solving for that of *R* yields

[5] In order to be logically consistent they would have to be perfectly non-anticipated and expected to be permanent. Otherwise the introduction of expectations for subsequent shocks would be inevitable.

$$\hat{R} = \frac{(b + \alpha\varepsilon - \hat{p}(1-\beta))}{1-\beta-\gamma} \tag{8}$$

Using this in (4’’) yields the growth rate for the central variables

$$g \equiv \hat{Y} = \hat{K} = \hat{p} + \hat{R} = \frac{b + \alpha\varepsilon - \hat{p}\gamma}{1-\beta-\gamma}$$

In per capita terms the growth rates are as follows.

$$g - \varepsilon \equiv \hat{Y} - \varepsilon = \hat{w} = \hat{K} - \varepsilon = \hat{p} + \hat{R} - \varepsilon = \frac{b - (1-\alpha-\beta-\gamma)\varepsilon - \hat{p}\gamma}{1-\beta-\gamma} \tag{9}$$

Under constant returns to scale we have $\alpha + \beta + \gamma = 1$ and the labour growth term, which is the Ricardian closed economy part of the growth rate in a Solow model with decreasing returns, drops out. The Ricardian open economy part is the negative terms of trade effect. If prices of imported inputs increase more than the GDP deflator they reduce the long-run growth rate, because resource scarcity comes from the outside of the economy. On the other hand, if the terms of trade are falling there is more growth. To the extent that the terms of trade for natural resources did fall in the past, not all steady-state growth should be attributed to the technical change. Because of the assumption of perfect capital movements the growth results are obtained without any transition and the dynamics of debt are completely separated from these growth results.

4. Dynamics of foreign debt

Solving (5) for the change of D and using the constant growth rates of Y, K, and pR, we get

$$\dot{D} = gK(0)e^{gt} - s[Y(0)e^{gt} - p(0)R(0)e^{gt} - rD] \tag{5’}$$

All variables taken at time zero are those after allowing for perfect capital movements. Abbreviation of the sum of all terms containing initial values as $A \equiv gK(0)-s[Y(0)-p(0)R(0)]$ and using (2) and (4) yields $A = K(0)[g\text{-}sr(1\text{-}\gamma)/\beta]\ (>, <)\ 0$. Using this in (5') we get the differential equation

$$\dot{D} = Ae^{gt} - srD$$

Integration yields the solution

$$D(t) = D(0)e^{srt} + A\frac{(e^{gt} - e^{srt})}{g - sr}$$

By implication debt will have the asymptotic growth rate g if $g > sr$ and the growth rate sr if $sr > g$. The dynamic process can be better understood by looking at the debt/GDP ratio. Dividing (5') by D and subtracting g yields

$$\hat{D} - g = gK / D - s(Y - pR - rD) / D - g$$

Defining $d \equiv D/Y$, multiplication by d yields

$$\dot{d} = gK / Y - s(1 - pR / Y - rd) - gd = A/Y(0) - (g\text{-}sr)d \qquad (5'')$$

The intercept and the slope can have any sign. But for small cost shares of resources, i.e. assuming $(1\text{-}\gamma)/\beta > 1$, we get $sr(1\text{-}\gamma)/\beta > sr$. Then, g can be larger or smaller than both of these terms or be between them. The three possible outcomes are drawn in Figure 1. $g - sr > 0$ is a stability condition for this equation. This case is drawn as falling functions with $A(>, <)\ 0$ in Figure 1. If the stability condition is not fulfilled, the slope is positive and then the intercept must be negative. Only the case under the horizontal axis is logically admissible in the unstable case, because the upper right arm would imply a debt growing more quickly than output and capital. In the long run this would lead to $D > K$, implying that domestic current wealth $W = K - D < 0$. As savings are always positive though, the economy cannot be in this region, unless $W(0) = K(0)$ -

D(0) <0, i.e. the economy has less capital then foreign debt right from the beginning.[6] If the intercept and slope are negative - a regime called *SC*, stable creditor - ending in point *I*, the economy converges to a value $d^*<0$, which means that it goes from a debtor to a creditor position, a path traditionally called the debt cycle. If the intercept is positive though - a regime called SD, stable debtor - the economy converges to a value $d^* > 0$ at point *II*. In the upward sloping case and the more realistic case $K(0) - D(0) > 0$ the economy must start to the left of the stationary point *III*. Then it will move leftward. The debt/GDP ratio will be negative in the long run and increasingly so. If the absolute value of D is large enough, income from foreign interest, rD, can be larger than domestic output Y and the economy earns more abroad than at home. Amano (1965) was the first showing this without deriving the other two cases.

Estimation of equation (5’’) can show which case the country in question follows. If it follows a path of debt explosion, the upper right arm of the unstable equation, then we know that the country does not obey the assumptions of a well-behaved debtor of our model. The disadvantage of the model is, that we do not know why it misbehaves. The advantage though is that we can check the misbehavior without having to know why it occurs, which will be an issue of ongoing discussion in any empirical case. The diagnosis logically precedes the explanation though.

Equations (9) and (5’’) formulate two sustainability problems. We try to estimate both in order to get an impression how serious the problems are.

5. Growth reductions through oil price increases

Starting from equation (9) we assume constant returns to scale in the first instance. We find that the natural log of GDP per capita data taken from the World Development Indicators has no unit roots, but the log of oil prices[7] has a unit root, but the log difference has none and therefore the log of oil prices is integrated of order one.

[6] In a model under certainty like ours a country is not bankrupt then, but rather may be able to cover the debt by the sum of discounted future trade surpluses.

[7] Data are taken form *http://www.eia.doe.gov/emeu/aer/txt/stb0518.xls* .

TABLE 1 OVER HERE

We assume in the first instance that oil prices and their growth rates are exogenous in accordance with our model.[8] The result of our regression is as summarized in Table 1. The first regression can be transformed under a steady-state assumption into

$$d(\log(gdppc)) = 0.022175 - 0.029267\,\hat{p}$$

The constant then corresponds to the rate of technical progress minus the decreasing (or plus the increasing) returns terms times the labour growth rate. This result requires a yearly growth rate of oil prices, *p*, of 76% to get zero growth (d(log(gdppc)) = 0) and 34% to reduce the GDP per capita growth rate by 0.01. These are extremely high rates and therefore we consider them unlikely to cause serious growth problems. However, once growth rates for natural resource prices are higher than until 2006, the assumption of an elasticity of substitution of unity or an equivalent resource-saving rate of technical change may come under pressure if technical change cannot keep pace. A yearly reduction of 4% of the energy/GDP ratio may be the technological limit (see Steger et al. 2005, chap.5). The cost share of resources might increase then but so far we could show that we have constant recursive coefficients of the growth rate of oil prices and therefore no increasing cost shares so far.

Next, we estimate an ordinary equation including the growth rate of the lagged investment ratio and get regression 2 in Table 1 with a slightly higher impact of the oil price growth. If we use current investment in regression 3 of Table 1 (using its lag as an instrument to correct for endogeneity), the first lagged dependent gets insignificant, the adjusted R-squared goes to 0.54 and the coefficient of the oil price to 0.025. However, this equation can capture only the direct effects of oil price changes on growth. Therefore it is plausible that the coefficient is smaller than in the first regression and its long-term version. Finally, if we take the labour term into account

[8] An error correction model in these two variables has a t-value of 1.23 for the adjustment coefficient of the error correction term showing that it is far from clear that oil prices are endogenous. Therefore the literature on oil prices and the business cycle (see Bachmeier et al. 2008 and Lippi and Nobili 2008) takes the freedom to make the assumption of endogenous or exogenous oil prices arbitrarily. The bivariate error correction model shows a positive relation though, which would indicate that causality goes from GDP to oil prices and therefore the latter are endogenous. However, both results might change when other variables are added (see below). Moreover, this might depend on the available oil prices; pre-refinery prices might be given from the world market, whereas post-refinery prices might be determined domestically. As these seem to be open issues we just stick to our theoretical model in the first instance.

using the labour force in terms of persons, *lf*, as an indicator we put *log(gdppc)*, *log(gfcfgdp)*, *log(lf)* and *log(proil)* into a vector-autoregressive model (VAR) and error correction model. The VAR with a time trend is stable with three lags. The Johansen cointegration test - with two lags and a time trend in the cointegrating equation but not in the VAR - then indicates three cointegrating relations at the 5% significance level according to the trace test and at the 10% level according to the maximum-eigenvalue test. The first three variables and their long-term relation can be written as a function of *log(proil)* and a time trend. The cointegrating equation for the *log(gdppc)* after taking first differences is regression 4 in Table 1 (the complete regression output is available upon request). A consequence of this approach is that it implicitly assumes constant returns to scale, because the labour variable does not appear in the long-term relation for the growth equation. The coefficient obtained for oil prices is very similar to that of the other regressions and so is the rate of technical progress.[9] Therefore the use of the first regression for the interpretation requires no modification.

6. Estimation of debt dynamics

We interpret equation (5’’) as a differential equation in *d* the coefficients of which can be estimated for three different types of data, which are more or less good proxies for US debt as a share of GDP in terms of US goods.[10] The results are summarized in Table 2. *Debtgdp* denotes the cumulated differences of investment minus savings in nominal historical US-dollars divided by the nominal GDP. This value is almost identical to one from cumulating the current account deficits.[11] *Niipccgdp* is the net international investment position (assets minus liabilities) in current costs, which means that the historical values are replaced by current values of replacement for capital goods of foreign direct investments, land prices and gold, but not using stock prices. *Niipmvgdp* in addition uses current stock prices (*mv* indicating their market values).[12] If for example ceteris paribus the European stocks of US owners fall by more than the

[9] t-values for the adjustment coefficients of the log of the oil price are now above two for all three cointegrating equations indicating that oil prices are likely to be endogenous. For the labour force variable t-values for the adjustment coefficients are below unity indicating that the null of exogenous labour force growth as assumed in the model cannot be rejected.

[10] The slope could also be calculated by way of taking growth rates from the data and calculate adequate interest and savings rates. But then we would not get a value for the intercept.

[11] As an initial value we use the earliest value of the net international investment position for 1980 from the IMF IFS Yearbook.

[12] See Landefeld and Lawson (1991) for detailed descriptions.

US stocks of European owners the *niip* worsens for the USA. These values are divided for each year by the nominal GDP in current US dollars.

For these data for the debt/GDP ratio we carry out an Augmented Dickey-Fuller test for unit roots. We choose the one with the better adjusted R-squared among those using the Schwarz and Akaike Information Criteria for the number of lags involved.[13] Then we re-estimate the difference equations equivalent to those from the unit root test as shown in Table 2 and run a forecast for which we present the main results in the lower part of the table. In all cases a time trend is significant making the debt/GDP ratios unstable in all versions. This means that in the very long run debt and interest payments (unless interest rates are zero) will exceed the GDP. By implication the current trends are not sustainable. The predicted values for the year 2100 are (-*1.2)* and (*-1.32)* for the niip/GDP values and *2.53* for the debt/GDP ratio respectively.[14]

If we assume an interest rate of 5% (10%), such values for debt/GDP levels lead to no more than 6% (12%) to 13% (26%) of GDP as interest payments to foreign countries. Such values are no reason to worry (unless one expects the theory of sovereign risk to become valid, which is unlikely with private debtors). What *is* a reason to worry is the instability behind them. Markets will stop such instability some day, because market participants probably expect that they are not sustainable and it is disadvantageous to be the last to draw the consequences. The next crisis then hits for those who are the last to change their expectations. If people have good information and correct expectations interest rates will increase because at some sufficiently high value of the debt/GDP ratio the small country assumption may not hold anymore or there will be a risk spread to be paid.[15] Then the dollar will fall in order to bring savings and investment as well as imports and exports closer to each other. If people do not expect this, there may be sudden jumps in interest rates and exchange rate similar to those modelled by Krugman (2007) or sudden stops or credit crunches.

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[13] The significance level for the hypothesis 'no unit root' is 0.1002, 0.0966, 0.1483 respectively.

[14] The Quandt-Andrews breakpoint test indicates no breakpoints. In case of the debt/GDP data from cumulated investment-savings differences the recursive coefficient estimates show that the first lag has a slightly increasing and the second a slightly decreasing coefficient. This is not the case for NIIP variables. Ziesemer (2005, 2007) found higher steady-state values with each up-date because no time trend was employed. The missing time trend can be shown to lead to recursively higher and higher slope coefficients leading to higher and higher steady-state values.

[15] Caballero and Krishnamurthy 2009 provide a model with increasing risk premium although external debt rises by less than domestic wealth.

Why do other studies[16] come to less pessimistic conclusions in regard to the dynamics of the debt/GDP ratio? Many use the balance of payments equation (6) to derive a differential equation in the debt/GDP ratio that depends on the trade balance as share of the GDP and the interest rate net of the GDP growth rate. They then assume a value for the interest rate, the GDP growth rate and a constant long-run value of the trade balance as a percentage of the GDP. This last assumption is empirically false. The trade deficit as a share of the GDP, TDGDP, follows a trend (p-values in parentheses) and its forecast for 2050 (using data 1961-2005) is above 120%[17]:

$$
\underset{(0.046)}{TDGDP = -0.45} + \underset{(0.0000)}{0.82TDGDP(-1)} + \underset{(0.049)}{0.103T} - \underset{(0.065)}{0.005T^2} + \underset{(0.05)}{8.71\times 10^{-5}T^3} \quad \text{Adj. } R^2 = 0.92
$$

This makes prospects much bleaker. It is an open issue whether the trade deficit should be viewed as a cause or as a consequence of debt accumulation as in our simple model where it can be obtained from using the debt accumulation of equation (5’’) in equation (6). Another standard assumption is used in complex models of the trade balance (see Bertaut et al. 2008): The growth rate of the GDP of foreign countries in the export function is assumed to be constant, with an implication that things go well if it is high enough. This is a doubtful assumption as well because once the transition to the market economy is complete in emerging markets a transition to a steady state may run into falling growth rates as in the transition of a Solow growth model for the world as a whole.

7. Summary, conclusion and suggestions for further research

We have provided a growth model that provides some guidance for the empirical analysis of two sustainability problems, which are related to oil prices and imports.

The increase in oil prices will make no great problems unless perhaps if the growth rate of oil prices gets larger.

The difference equations for debt/GDP ratios have a time trend and therefore the debt/GDP ratios have no constant value to which they converge. Instability may lead to problems sooner or later. As the current crisis is unlikely to change this unstable process simply because losses of stock exchanges in Europe are larger than losses of stock exchanges in the USA this instability is

[16] See Kitchen (2007) for a survey.

[17] Theil Inequality Coefficient: 0.18; Root Mean Squared Error 0.74; bias prop. 0.000157, var. prop. 0.036; cov. prop. 0.964.

an indication for the next crisis unless future interest rate increases reduce the difference between savings and investment and faster devaluations than the current ones reduce the difference between imports and exports on current account. Crisis prevention in case of delayed price adjustments probably requires a structural reform in the USA and elsewhere that leads to higher savings ratios, lower consumption and imports and perhaps more exports. We imagine that a revision of the tax system in connection with the pension system could be useful in encouraging higher savings although this is beyond the scope of this paper. Environmental policies that reduce CO_2 would probably reduce oil imports and the importance of oil prices as well and therefore would be good for both, the current account and debt accumulation problem and the sustainability of growth rates. If interest and exchange rate adjustments have to do the equilibrating job the critical question is whether this raises mainly US spreads for risk compensation and therefore only US interest rates or, alternatively, the world market interest rate, which would raise the surpluses of countries like Sweden and the Netherlands even more.

As the debt/GDP equation derived from the model cannot have a time trend this either reveals a flaw of the model or of the trends of the USA in the period under consideration. As the model is one of a good debtor we think the problem is one of US behaviour in regard to too low savings and too high net imports. Nevertheless, if the trade balance is the cause rather than the consequence of the dynamics of debt/GDP ratios we may need a slightly different model. The trade balance has a stronger role in models with imported capital goods and a removal of the small country assumption for goods prices – at the cost of more complicated formulae though, which we postpone to future research.

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Figure 1 **Three different regimes for debt dynamics**

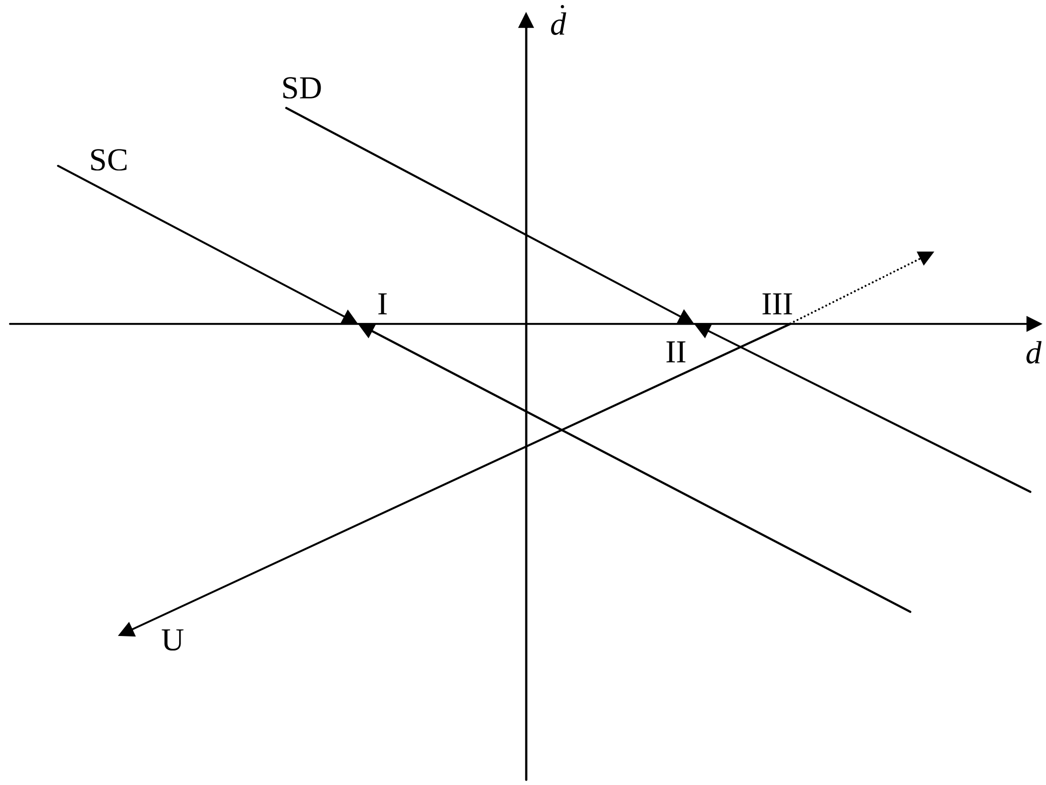

Table 1 **Growth rates of GDP per capita and oil prices**

	Regress.1	*Regress.2*	*Regress.3*	*Regress.4*
dependent var.	d(log(gdppc))	d(log(gdppc))	d(log(gdppc))	d(log(gdppc(-1)))
Regressors				
Constant	0.022	0.028	0.022	0.021
	(0.000)	(0.000)	(0.000)	(0.001)
d(log(gdppc))(-1)	0.239	-	-	-
	(0.024)	-	-	-
d(log(gdppc))(-2)	-0.249	-0.280	-	-
	(0.100)	(0.082)	-	-
d(log(gfcfgdp))	-	-	0.263	-
	-	-	(0.036)	-
d(log(gfcfgdp(-1)))	-	0.164		-
	-	(0.007)		-
D(LOG(PROIL(-1)))	-0.030	-0.033	-0.025	-0.028
	(0.019)	(0.006)	(0.014)	(3.954)
Period:	1963-2006	1963-2006	1962-2005	1983-2005
Adj. R-sq.	0.18	0.21	0.51	0.52
DW-stat.	2.22	2.13	1.87	-

Ordinary Least squares regressions; TSLS for regr.3; vector-error correction model for regr.4.
p-values in parentheses (t-values for regress.4)
Newey-West HAC Standard Errors & Covariance in regr. (1)-(3)
Instruments in regr.3 (TSLS): C, D(LOG(GFCFGDP(-1))), D(LOG(PROIL(-1)))
Labour force data are available only since 1980, all others since 1960

Table 2
Regressions for debt dynamics

Dependent variable	debt/gdp	niipcc/GDP	niipmv/GDP
Regressors			
Constant	-0.033	0.567	0.273
	(0.068)	(0.002)	(0.002)
time trend	0.002	-0.018	-0.009
	(0.008)	(0.002)	(0.001)
lag. dep.(-1)	1.364	0.593	0.929
	(0.000)	(0.004)	(0.002)
lag. dep.(-2)	-0.443	-0.740	-0.480
	(0.013)	(0.088)	(0.236)
lag. dep.(-3)	-	0.431	0.320
		(0.389)	(0.302)
lag. dep.(-4)	-	-0.662	-0.532
		(0.138)	(0.002)
lag. dep.(-5)	-	0.349	-
		(0.543)	
lag. dep.(-6)	-	-0.106	-
		(0.835)	
lag. dep.(-7)	-	-0.104	-
		(0.663)	
lag. dep.(-8)		-0.494	-
		(0.054)	
Adj.R-squared	0.999	0.947	0.907
Durbin-Watson	1.844	2.213	1.957
Period	1962-2005	1984 - 2006	1986 - 2006
Forecast 2100	2.53	1.21	1.32
Theil Index	0.036	0.086	0.176
RMSE	0.024	0.0186	0.04
bias prop.	0.016	0.0026	0.000047
var. Prop	0.04	0.0005	0.0354
cov. Prop	0.96	0.997	0.96

p-values in parentheses (Newey-West HAC Standard Errors & Covariance)

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