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Journal of International Economics 63 (2004) 321–340

Journal of INTERNATIONAL ECONOMICS

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Savings and the terms of trade under borrowing constraints

Pierre-Richard Agénor[a,*], Joshua Aizenman[b,c]

[a] *The World Bank, 1818 H Street, NW, Washington, DC 20433, USA*
[b] *Department of Economics, University of California at Santa Cruz, Santa Cruz, CA 95064, USA*
[c] *NBER, USA*

Received 6 October 2000; received in revised form 19 November 2002; accepted 9 March 2003

Abstract

This paper examines the extent to which permanent terms of trade shocks have an asymmetric effect on private savings. The first part uses a simple three-period model to show that, if households expect to face binding borrowing constraints in bad states of nature, savings rates will respond asymmetrically to favorable movements in the permanent component of the terms of trade—in contrast to what conventional consumption-smoothing models would predict. The second part tests for the existence of asymmetric effects of terms of trade disturbances while controlling for various standard determinants of private savings. The results, based on panel data for non-oil commodity exporters of sub-Saharan Africa for the period 1980–1996, indicate that periods of increases in the permanent component of the terms of trade tend indeed be associated with higher rates of private savings.

Keywords: Savings; Terms of trade shocks; Borrowing constraints; Habit formation; GMM

JEL classification: D91; F41; O55

1. Introduction

It is well recognized that the macroeconomic effects of terms of trade shocks can be very significant in developing countries. As documented, for instance, by Agénor et al. (2000), terms of trade disturbances are highly correlated with output fluctuations and can

* Corresponding author. Tel.: +1-202-473-0954; fax: +1-202-676-9810.
E-mail address: pagenor@worldbank.org (P.R. Agénor).

0022-1996/$ - see front matter © 2003 Published by Elsevier B.V.
doi:10.1016/S0022-1996(03)00069-2

be a major source of aggregate economic volatility. Such disturbances tend also to have a large impact on savings (both private and public), in part because of their large income effects. Moreover, there is some informal evidence suggesting that terms of trade shocks can entail an asymmetric response in savings, as a result, for instance, of the existence of borrowing constraints on world financial markets. Specifically, the experience of the past few years suggests that households (and governments) from poor countries may be able to deposit their windfall savings on the international capital market in good times, but that they may be unable to borrow as much as they would like in bad times because of collateral problems or a (perceived) high risk of default (see World Bank, 1999, Chapter 2). As emphasized by Deaton (1992), among others, this asymmetry can create an incentive for precautionary saving, because in the case of a negative shock consumption can be smoothed only by running down previously accumulated assets.

There is relatively scant empirical evidence on whether terms of trade shocks can generate an asymmetric response in private savings. This paper attempts to fill this void by using cross-section econometric regressions for a group of countries for which movements in the terms of trade have traditionally represented a key source of macroeconomic shocks, non-oil exporters of sub-Saharan Africa. It is organized as follows. Section 2 discusses analytical issues. It reviews briefly the conventional, consumption-smoothing approach to assessing the effects of terms of trade shocks on savings, and considers the role of borrowing constraints in explaining an asymmetric consumption and savings response by private agents to this type of shocks. It elaborates, in particular, on the role of expected borrowing constraints in bad states of nature. Section 3 provides some informal evidence on the asymmetric response of private savings during recent episodes of upswings and downswings in prices of commodities exported by non-oil sub-Saharan African countries. Section 4 specifies a regression model in order to assess the existence of an asymmetric effect of terms of trade movements on private savings and describes the estimation technique. Section 5 presents the empirical results, based on panel data covering the period 1980–1996 for non-oil exporters of sub-Saharan Africa. The last section summarizes the results and provides some directions for further research.

2. Analytical issues

Early contributions to the analysis of the effect of terms of trade shocks on saving include those of Harberger (1950) and Laursen and Metzler (1950). The Harberger–Laursen–Metzler (HLM) effect predicts a positive relationship between (transitory) changes in the terms of trade and saving, as a result of consumption smoothing[1]. An adverse transitory movement in the terms of trade, for instance, leads to a decrease in a

[1] The initial formulation by Harberger (1950) and Laursen and Metzler (1950) relied on a Keynesian-type open economy framework. It was later extended to an intertemporal setting, notably by Obstfeld (1982) and Svensson and Razin (1983), and subsequently Edwards (1989) and Gavin (1990); see also Obstfeld and Rogoff (1997). These contributions also highlighted the distinction between permanent and transitory shocks, and the importance of an endogenous rate of time preference for movements in the terms of trade to generate transitory movements in savings.

country's current level of income that is larger than the decrease in its permanent income. Consumption smoothing behavior leads, therefore, to a fall in domestic saving. On the contrary, a permanent deterioration in the terms of trade, to the extent that it leads to a concomitant reduction in both current and permanent income, will have no effect on saving. Evidence supporting this view has been provided in a variety of studies. Bevan et al. (1993), for instance, analyzed the impact of the 1976–1977 coffee boom (caused by a frost in Brazil) on rural saving in Kenya. They found that proceeds from this boom were fully passed on to farmers, and that about 60% of the income windfall was saved[2].

In this paper we focus on a different issue, which is the possibility that permanent terms of trade shocks may have an asymmetric effect on savings, depending on whether they are favorable or unfavorable. To explore this idea analytically, we consider a model in which consumers (or households) are identical and live for three periods. They may also be subject to borrowing constraints during some periods of their life when faced with bad shocks[3].

Suppose that the representative consumer has a quadratic utility function, and that both the rate of time preference and the real interest rate are set to zero. Specifically, assume that total utility over the lifespan of the typical household, V, is given by

$$V = u(c_0,\ c_1) + u(c_1,\ c_2) + u(c_2,\ c_3), \tag{1}$$

where

$$u(c_{h-1},\ c_h) = c_h - 0.5\phi c_h^2 - 0.5\tau(c_h - c_{h-1})^2, \tag{2}$$

where c_h is consumption in period h and ϕ, $\tau \geq 0$. We assume that ϕ is small enough to ensure that in the relevant region, the marginal utility of consumption is positive. Eq. (2) allows for the presence of habit formation—changes in the current level of consumption relative to the previous level entails disutility, proportional to τ. We assume that prior to period 1, both income and consumption are stable, and were expected to remain such. Hence, the initial level of assets at period 1 is zero, and consumption is equal to income, y:

$$y_0 = c_0 = 1.$$

Suppose now that, at the beginning of period 1, there is a change in the underlying stochastic process of income. First, a permanent shock increases income by ε. Second, an adverse transitory shock (induced, for instance, by an adverse movement in the terms of

[2] As discussed for instance by Ostry and Reinhart (1992) and Cashin and McDermott (1998), if households consume both tradables and nontradables, there will be both intratemporal and intertemporal substitution effects associated with a terms-of-trade shock; these effects may be large enough to offset the conventional effect associated with consumption smoothing considerations. However, Ogaki et al. (1996) found that in low-income countries (where levels of income are near the subsistence level) both intratemporal and intertemporal substitution effects have a relatively limited impact on savings; overall, their empirical results supported the view that transitory adverse movements in the terms of trade in these countries tend to lead to a reduction in private saving—as predicted by the HLM effect.

[3] Life-cycle models with borrowing constraints include Hubbard and Judd (1986) and Zeldes (1989). In both of these models, liquidity constraints are imposed exogenously in the form of simple non-negative wealth constraints.

trade) may occur in the second period with probability q, reducing second-period income by δ. Hence, the revised income path is anticipated to be

$$y = \begin{cases} y_h = 1+\varepsilon, \quad h = 1,\ 2,\ 3 \quad \text{with prob. } 1-q \\ y_1 = y_3 = 1+\varepsilon, \quad y_2 = 1+\varepsilon-\delta \quad \text{with prob. } q \end{cases}. \tag{3}$$

A convenient feature of the model described by Eqs. (1) and (2) is that, in the absence of habit formation ($\tau = 0$), and with a well-functioning capital market, the consumer would behave according to the permanent income hypothesis. That is, if indeed consumers face an adverse transitory shock in period 2, they will borrow in that period in order to smooth their consumption path. A key issue, however, is whether borrowing is at all feasible. In what follows we evaluate the impact of credit constraints on savings by contrasting two scenarios: the first assumes that consumers have full access to the international capital market, whereas the second considers the case where consumers are unable to borrow, due for instance to perceptions of country sovereign risk.

With full access to the capital market, consumers borrow in period 2 in bad states of nature and repay fully in period 3. The representative consumer's problem is thus, with $x = 1+\varepsilon$:

$$\max_{s_1, s_2^{\mathrm{L}}, s_2^{\mathrm{H}}} \begin{cases} u(1;\ x - s_1) + \\ q[u(x - s_1;\ x - \delta + s_1 - s_2^{\mathrm{L}}) + u(x - \delta + s_1 - s_2^{\mathrm{L}};\ x + s_2^{\mathrm{L}})] + . \\ (1-q)[u(x - s_1;\ x + s_1 - s_2^{\mathrm{H}}) + u(x + s_1 - s_2^{\mathrm{H}};\ x + s_2^{\mathrm{H}})] \end{cases} \tag{4}$$

where S_2^{L} (respectively S_2^{H}) denotes second-period savings if the adverse income shock is indeed positive (zero).

The first-order conditions of the above problem provide three linear equations in s_1, s_2^{L}, s_2^{H} from which we can infer that

$$s_1 = \frac{\delta q(1+3\theta)(1+\theta) + \varepsilon\theta(2+5\theta)}{3 + 14\theta(1+\theta)}, \tag{5}$$

where $\theta = \tau/\phi$ measures the relative importance of habit formation versus the diminishing marginal utility of consumption. Note that

$$s_1 \,|_{\theta=0} = \frac{\delta q}{3}, \tag{6}$$

$$s_1 \,|_{\theta\to\infty} = \frac{3\delta q + 5\varepsilon}{14}, \tag{7}$$

Eq. (6) corresponds to the case where habit formation is absent ($\theta = \tau = 0$). In these circumstances, saving in period 1 is determined simply by the difference between endowment, given by $x = 1+\varepsilon$, and permanent income, given by

$$y_{\mathrm{P}} = \frac{x + (x - q\delta) + x}{3} = x - \frac{\delta q}{3}$$

in line with the prediction of the permanent income hypothesis. Consumption in the first period will increase by the permanent increase in income, minus the expected value of the transitory shock, smoothed over the three periods of life. Eq. (7) corresponds to the other extreme, where adjustment of consumption is extremely costly (or the marginal utility is constant). Note that habit formation implies that a fraction of the permanent shock is saved in the first period, in order to smooth the cost of adjustment across time. Applying the first-order conditions we indeed infer that, in the absence of habit formation, and if the adverse shock does hit consumers in the second period, the revised permanent income would be

$$y_{\mathrm{P}} = 0.5 s_1 \mid_{\theta=0} + \frac{(x-\delta)+x}{2} = x + \frac{(\delta q/3)-\delta}{2},$$

so that savings would be

$$s_2^{\mathrm{L}} \mid_{\theta=0} = x - \frac{\delta q}{3} - \delta - \left[x + \frac{(\delta q/3)-\delta}{2}\right] = -\frac{\delta(3-q)}{6} < 0. \tag{8}$$

Eq. (8) indicates that if an adverse transitory shock does indeed reduce second-period income, households will borrow to smooth their consumption.

In what follows, we assume that the habit formation parameter ϕ and the permanent shock are not large enough relative to the transitory shock so that $s_2^{\mathrm{L}} < 0$. Suppose, however, that borrowing is not feasible, due (as argued earlier) to country risk considerations. In these circumstances, the maximization problem of the representative household becomes

$$\max_{s_1, s_2^{\mathrm{H}}} \begin{cases} u(1;\ x - s_1) + \\ q[u(x - s_1;\ x - \delta + s_1) + u(x - \delta + s_1;\ x)] + \\ (1-q)[u(x - s_1;\ x + s_1 - s_2^{\mathrm{H}}) + u(x + s_1 - s_2^{\mathrm{H}}; x + s_2^{\mathrm{H}})] \end{cases}. \tag{9}$$

Solving this problem, we can infer that the presence of borrowing constraints modifies first-period savings to

$$\tilde{s}_1 = \frac{\delta q(1+3\theta) + \varepsilon\theta}{(2+6\theta)(2+5\theta) - (1-q)(1+4\theta)^2}(2+5\theta). \tag{10}$$

Hence, in the absence of habit formation,

$$\tilde{s}_1 \mid_{\theta=0} = \frac{\delta q}{2 - 0.5(1-q)}. \tag{11}$$

Comparing (6) and (11), we find that first-period saving are higher under borrowing constraints, as the consumer is accumulating assets to reduce the expected hardship in the second period. It follows from these equations that

$$\tilde{s}_1 \mid_{\theta=0} - s_1 \mid_{\theta=0} = \frac{\delta q(3-q)}{3(3+q)}, \quad \frac{\partial(\tilde{s}_1 - s_1)}{\partial\theta} < 0.$$

Hence, the higher the probability of an adverse shock to second-period income, and the larger the magnitude of the shock, the greater will be the gap between the saving rates with

and without borrowing constraints. In addition, greater habit formation (as measured by a higher θ) reduces the gap between the two saving rates.

For the issue at hand, and as noted earlier, the transitory shock to second-period income can be interpreted as a temporary terms of trade shock, whereas the shock ε can be viewed as a change in the permanent component. What the model predicts, therefore, is that in line with the "symmetric" HLM effect, positive (negative) transitory income shocks are entirely saved (dissaved). In addition, however, a fraction of permanent income should also be set-aside during "good" times (that is, in period 1), if there is habit formation. Indeed, as can be inferred from Eq. (10), as long as $\theta>0$, the permanent shock ε has a positive effect on first-period savings. Thus, the possibility of binding borrowing constraints in "bad" states of nature, which can be viewed in the present context as corresponding to periods of adverse terms of trade shocks, implies (under habit formation) an asymmetric response of savings to permanent income shocks.

It is worth noting that, in the foregoing discussion, we focused only on the case of an adverse transitory shock in the second period to simplify the analysis. If the transitory second-period shock is positive, the borrowing constraint will not bind. Hence, even if the transitory shock follows a symmetric distribution, the qualitative features of our analysis will continue to hold. We can illustrate this point with a simple example. Suppose that the second-period transitory shock is δ with a probability equal to one-half, and $-\delta$ with a probability one-half; suppose also that there is no habit formation ($\tau=0$). All the other assumptions continue to hold. It is easy to verify that in these conditions

$$s_1 \mid_{\theta=0} = 0, \quad \tilde{s}_1 \mid_{\theta=0} = \frac{\delta}{7}.$$

Hence, first-period saving is zero in the absence of borrowing constraints, whereas it is positive in the presence of these constraints (in fact, proportional to the standard deviation of the transitory shock).

Finally, we show in Appendix A that loss aversion magnifies the increase in saving induced by the anticipation of future binding borrowing constraints induced by terms of trade shocks. The intuition underlying this result is that under loss aversion (a particular form of asymmetric utility preferences), individuals exhibit a larger degree of risk aversion to adverse shocks to income. As a result, they tend to save more in good times, increasing their consumption by less than the increase in income. Specifically, we follow the specification of the type of preferences explored by Aizenman (1998). In this setting, loss-averse agents tend to treat the future asymmetrically, assigning a greater probability weight to bad states of nature (compared with the probability weights that they would assign in the conventional case) in measuring expected utility. As a result, saving responds asymmetrically under loss aversion, in contrast to the conventional expected utility framework.

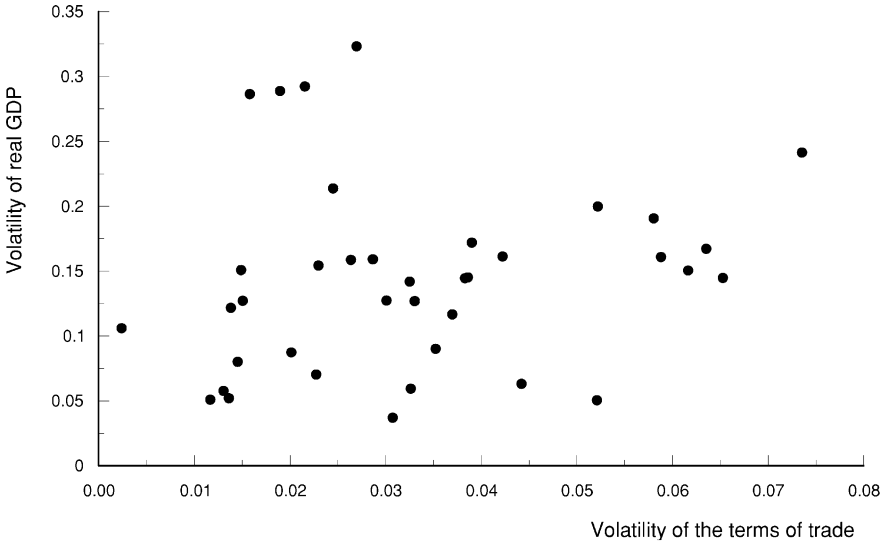
3. Some informal evidence

Before testing some of the key predictions of our model using regression techniques, we start by gauging informally whether terms of trade shocks have an asymmetric effect

on private savings. We focus on a group of 29 non-oil exporters sub-Saharan Africa countries, over the period 1980–1996. This group of countries provides indeed an interesting sample for assessing the possibility that terms of trade shocks may exert an asymmetric effect on private savings. In almost all of these countries, terms of trade shocks are generally the result of sharp changes in world commodity prices, and many of these countries derive a large share of their export earnings from primary commodities. More specifically, primary commodities account on average for about three-fourths of total exports in most of them, and the share of commodities in some countries' exports exceeds 90% (see World Bank, 2000, Chapter 4). Fluctuations in the terms of trade have also represented a major source of macroeconomic volatility for these countries; Fig. 1 for instance shows the correlation between the volatility of real GDP and the volatility of the terms of trade for all the countries in the sample[4]. The figure does suggest a positive association between these variables. In addition, there is also some anecdotal evidence that access to world capital markets by many of these countries (which, to begin with, are relatively closed financially) tends to be asymmetric; it is often in "good times" (periods characterized in particular by high commodity prices and improvements in the terms of trade that private capital tends to flow to low-income countries (see World Bank, 1999, Chapter 2).

Because all non-oil exporters in sub-Saharan Africa can be classified as either agricultural exporters, or metal and mineral exporters, we examine in Fig. 2 the behavior of the real values of the world prices of agricultural goods and metals and minerals, during the period 1980–1998. The figure suggests that downswings in agricultural prices occurred during 1980–1982 and 1986–1993, and upswings during 1983–1985 and 1994–1996. For metals and minerals, downswings occurred during 1981–1986 and 1990–1993, whereas upswings occurred during 1987–1989 and 1994–1996. On the basis of these sub-samples, we calculated the average values of the private savings ratio for each individual country, as well as the average for each group. For an asymmetric effect to be present according to our analysis, the private savings ratio should be higher during upswings, to the extent that agents anticipate borrowing constraints in downswings. The results are shown in Table 1. Looking at averages for the first group of countries (exporters of agricultural goods), average private savings ratios are indeed higher in upswings, following a downswing. A similar result holds for exporters of metals and minerals during upswings; for instance, the average savings ratio rose to 14.5% of GDP during the upswing of 1987–1989, compared with 10.2% recorded during the 1981–1986 downswing in prices. There are several individual country cases for which the "average" result holds very well; this is the case for Côte d'Ivoire, (comparing 1983–1983 and 1980–1982), Ethiopia (same period), Ghana, Mauritius (comparing both episodes of upswings and downswings), Botswana, Mauritania, Togo and Zambia (comparing 1980 and 1981–1986). However, there are also several cases for which the "average" pattern does not hold. In Madagascar (comparing 1994–1996 and 1986–1993), Mali, Uganda, and

[4] Appendix B, which contains detailed information about our dataset and our list of countries, is available upon request. Also available upon request is Appendix C, which provides a description of the correlation between the cyclical components of savings and the terms of trade, and the relative importance of the cyclical component in accounting for the fluctuations of the "raw" series for the countries in the sample.



Source: World Bank.

Note: Volatility is measured by the coefficient of variation over the whole sample period.

1/ See Appendix B for the complete list of countries.

Fig. 1. Non-oil sub-Saharan Africa: volatility of output and the terms of trade (see Appendix B for the complete list of countries). Source: World Bank. Note: Volatility is measured by the coefficient of variation over the whole sample period (average for 1980–1996).

Zimbabwe (comparing 1983–1985 and 1980–1982), and Zambia (comparing 1987–1989 an 1990–1993). All in all, therefore, the informal evidence seems to support the view that there may be some asymmetric responses at play, although broad generalizations across countries are difficult to make.

The foregoing analysis, although informative, faces several limitations. First, it does not account for country-specific changes in the terms of trade. Second, it does not control for other possible influences on private savings, in addition to changes in the terms of trade, thereby making it difficult to isolate the specific effect of these changes. Third, it is not based on an explicitly distinction between permanent and temporary movements in the terms of trade, along the lines discussed earlier. All three issues are addressed in the next section, in the context of a fully specified regression framework.

4. Econometric methodology

We now turn to time-series, cross-country regression techniques to assess more formally the extent to which terms of trade shocks affect asymmetrically private savings. The permanent component of the terms of trade is measured by the trend series obtained

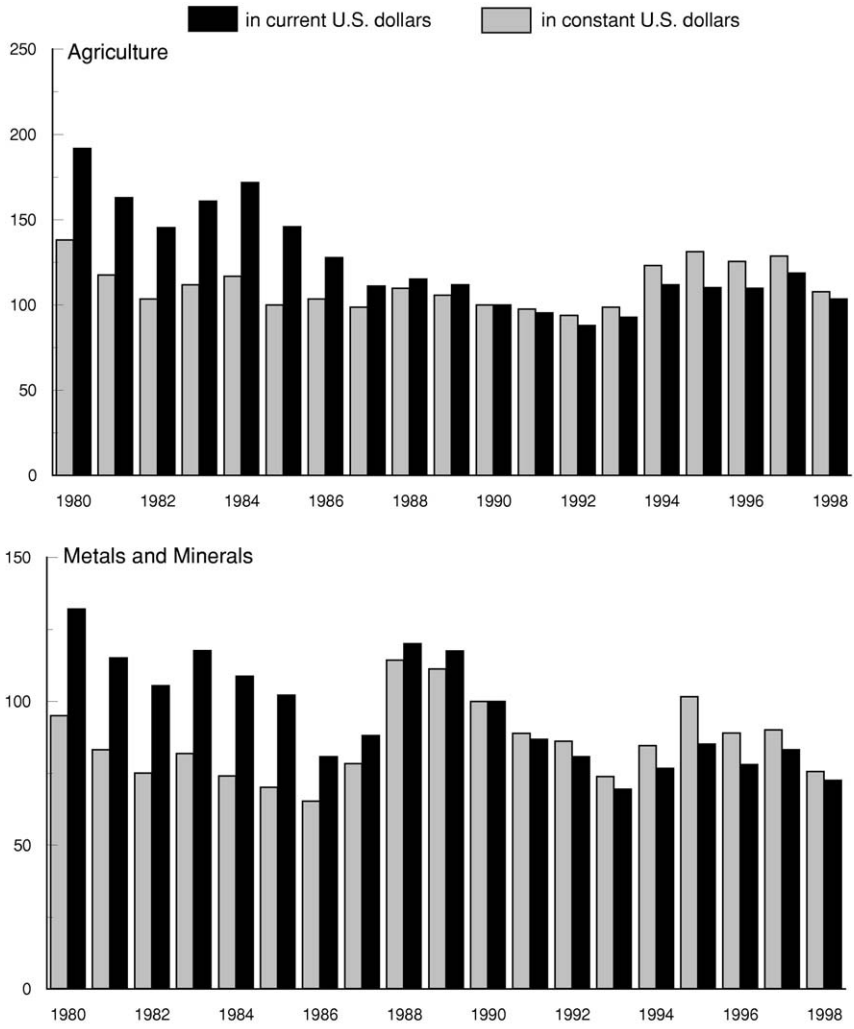


Fig. 2. Agricultural, metals and minerals prices, 1980–1998 (1990 = 100); ■, in current US dollars; ▨, in constant US dollars. Source: World Bank. Note: The real price index is calculated by deflating the current US dollar price index by an index of industrial countries' manufactures unit value index.

with a modified version of the ideal band pass filter of Baxter and King (1999). The Baxter–King filter is a linear transformation of the data, which leaves intact the components of the data within a specified band of frequencies and eliminates all other components. But applying this filter is often difficult in practice, because it requires in principle a very large amount of data. Christiano and Fitzgerald (1999) proposed a

Table 1
Non-oil sub-Saharan African countries: behavior of the private savings ratio during downswings and upswings in commodity prices (in percent of GDP)

Period	Agricultural goods exporting countries				
	Downswings		Upswings		
	1980–1982	1986–1993	1983–1985	1994–1996	
Agricultural good price (in current US dollars 1990 = 100)	119.7	101.0	109.7	126.6	
Chad	–	14.1	–	–	
Côte d'Ivoire	4.3	− 3.2	6.9		
Ethiopia	6.1	10.1	7.1		
Ghana	4.3	8.6	4.7		
Kenya	17.5	16.4	20.9	10.8	
Madagascar	0.6	5.2		2.3	
Mali	7.2	8.8	2.0	–	
Malawi	8.9	11.2	8.6	–	
Mauritius	8.8	19.7	10.5	20.1	
Senegal	− 1.1		0.9	–	
Uganda	9.1	10.8	8.0	–	
Zimbabwe	13.0	15.4	11.6	–	
Average private saving ratio	7.2	10.6	8.1	11.1	
Period	Metals and minerals exporting countries				
	Downswings		Upswings		
	1981–1986	1990–1993	1980	1987–1989	1994–1996
Metal and mineral prices (in current US dollars 1990 = 100)	75.0	87.3	95.1	101.4	91.8
Botswana	20.7	34.2	15.1	40.3	45.0
Guinea		9.4	0.0	10.1	
Mauritania	3.9		9.9	10.2	–
Niger			15.2	–	–
Togo	8.5		15.5	9.1	–
Zambia	7.7	7.5	12.4	2.9	–
Average private saving ratio	10.2	17.0	11.3	14.5	45.0

modified version of the Baxter–King filter, based on an optimal linear approximation. This method can be briefly explained as follows. Let y_t be the data created by applying the ideal band pass filter to the raw data, x_t. y_t is approximated by $\hat{y}_t$, which is a filter for x_t. The filter weights are chosen to minimize the mean square error:

$$E[(y_t - \hat{y}_t)^2 \mid x].$$

$\hat{y}_t$ can be computed as

$$\hat{y}_t = B_0 x_t + B_1 x_{t+1} + \cdots + B_{T-1-t} x_{T-1} + \tilde{B}_{T-t} x_T + B_1 x_{t-1} + \cdots + B_{t-2} x_2 + B_{t-1} x_1, \quad \text{for } t = 1, 2, 4, \ldots, T,$$

where

$$B_j = \frac{\sin(jb) - \sin(ja)}{\pi j}, \quad j \geq 1$$

$$B_0 = \frac{b-a}{\pi}, \quad a = \frac{2\pi}{p_u}, \quad b = \frac{2\pi}{p_l},$$

and $\tilde{B}_{T-1}$ and $\tilde{B}_{t-1}$ are linear functions of B_j's:

$$\tilde{B}_{T-1} = -\frac{1}{2} B_0 - \sum_{j=1}^{T-t-1} B_j,$$

and $\tilde{B}_{t-1}$ solves

$$0 = B_0 + B_1 + \cdots + B_{T-1-t} + \tilde{B}_{T-t} + \cdots + B_{t-2} + \tilde{B}_{t-1}.$$

In our case, $p_u = 6$ and $p_l = 2$.

The specification of the regression model uses private saving (calculated as the difference between gross domestic saving and government saving) in proportion to GDP as the dependent variable. Due the relatively limited number of degrees of freedom available (as discussed below), the list of explanatory variables involves a small group of control variables that have been found to matter in recent studies of the determinants of saving in developing countries[5]. A brief description of the variables used in the regressions is as follows (see Appendix B of the Working Paper version for more detailed definitions):

- The lagged dependent variable, which aims to capture habit formation effects (as suggested by Alessie and Lusardi, 1997 and as implied by our analytical model), or

[5] See Agénor and Montiel (1999) (Chapter 3) and Agénor (2000) (Chapter 1) for a detailed review of the recent evidence on the determinants of savings in developing countries. Note that, unlike others (such as Edwards, 1996; Loayza et al., 1999; Masson et al., 1998), we have excluded foreign saving, as measured by the current account surplus, from the list of regressors.

more generally partial adjustment of the desired propensity to save to its actual value[6].

- The transitory component of the log of the terms of trade, which is expected to also have a positive effect on saving.
- An index of volatility of the terms of trade (defined as the standard deviation of the log-difference of the terms of trade over the current period and three lagged periods), which may represent a proxy for income uncertainty. This can in general have either a positive or negative effect on saving.
- The log of the real gross national product (GNP) per capita, which captures the impact of the level of income (and indirectly subsistence considerations) on consumption and saving decisions, or more generally the level of development. This is expected to have a positive effect on private saving.
- Inflation (as measured by the rate of change of the GDP deflator), which exerts a negative impact on the rate of return on saving (with sluggish nominal interest rates). It also represents a proxy for income variability and macroeconomic instability, thereby capturing a precautionary motive for saving. Through both channels, inflation is expected to reduce the propensity to save[7].
- The ratio of quasi money to broad money, which is used to capture the process of financial liberalization. This variable may have either a positive or negative effect on private savings, depending on whether financial liberalization increases the rate of return on, say, bank deposits (thereby, increasing financial savings), or on the contrary takes the form of a relaxation of domestic liquidity constraints (which would tend to increase consumption and thus reduce savings).
- The age dependency ratio, defined as the ratio of the population younger than 15 years and older than 64 years old to the population between 15 and 64 years old. This variable is also expected to have a negative effect on the incentives to save.
- Government saving, as given by the fiscal surplus. As predicted by the Ricardian equivalence proposition (see, for instance, Seater, 1993), if agents fully internalize the effects of current budget deficits on future tax liabilities (and thus on future consumption), government saving should have a coefficient of minus unity in a regression where the dependent variable is the private saving rate.

In addition to these variables, and to capture the existence of an asymmetric effect of the terms of trade on saving, the permanent component of the log of that variable (calculated using the modified Baxter–King filter described earlier) is entered in the following way. The sample is split between "positive" (or favorable) and "negative" (or unfavorable) values, defined in two different ways (see Appendix B for more details). First, a positive (negative) value is defined when the permanent component of the terms of trade at t is greater (lower) than its value at $t-1$ as well as greater (lower) than its within-

[6] Loayza et al. (1999) also attempt to distinguish between short- and long-term determinants of saving rates—a distinction that appeared highly significant in their empirical results.

[7] Note that real interest rates are omitted from the regression model in light of the results obtained by Ogaki et al. (1996) and Elbadawi and Mwega (1999), which suggest a limited impact of this variable in the countries considered here, given their low levels of income.

sample mean. Second, we define a positive (negative) value when the permanent component of the terms of trade at t is greater (lower) than its value at $t-1$ and greater (lower) than its within-sample mean plus one standard deviation. This procedure allows us to test to some extent the sensitivity of the results to the way "positive" and "negative" values are defined. According to our theoretical model, the estimated coefficient on the positive values the permanent component of the terms of trade should be positive and significant, whereas the estimated coefficient on the negative values should be insignificant.

The regression model that we use includes the lagged value of the dependent variable (the savings ratio) as a regressor. As is well known, in such as case the usual approach to estimating a fixed-effects model with panel data, the least squares dummy variable technique (LSDV), generates biased estimates of the coefficients; this bias can be large when the time dimension of the panel is small. Judson and Owen (1999) compared several methods for estimating this type of dynamic panel data models with fixed effects, using a Monte Carlo approach. Their results indicate for an unbalanced panel with a time dimension that is between 10 and 20—which is the case here—the "best" estimation methods are either the GMM estimation technique of Arellano and Bond (1991), or the technique of Anderson and Hsiao (1981)[8]. In this study we use the Arellano–Bond technique, which can be briefly described as follows. Consider the following regression equation,

$$s_{it} - s_{it-1} = (\alpha - 1)s_{it-1} + \beta' Z_{it} + \eta_i + \varepsilon_{it},$$

where s is the private saving rate, α a scalar coefficient, β a vector of parameters, Z the set of explanatory variables (other than the lagged saving rate), η an unobserved country-specific effect, ε the error term, and the subscripts i and t represent country and time period, respectively. This equation can be rewritten as

$$s_{it} = \alpha s_{it-1} + \beta' Z_{it} + \eta_i + \varepsilon_{it},$$

and we can take first differences to eliminate the country-specific effect:

$$s_{it} - s_{it-1} = \alpha(s_{it-1} - s_{it-2}) + \beta'(Z_{it} - Z_{it-1}) + \varepsilon_{it} - \varepsilon_{it-1}.$$

The use of instruments is required to deal with both the endogeneity of the explanatory variables and the fact that, by construction, the new error term, $\varepsilon_{it} - \varepsilon_{it-1}$, is correlated with the lagged dependent variable, $s_{it-1} - s_{it-2}$. Under the assumptions that (a) the error term is not serially correlated, and (b) the explanatory variables are weakly exogenous (that is, the explanatory variables are uncorrelated with future realizations of the error term), the Arellano–Bond GMM dynamic panel estimator uses the following moment conditions:

$$E[s_{it-h}(\varepsilon_{it} - \varepsilon_{it-1})] = 0, \quad \text{for } h \geq 2, \quad \text{and} \quad t = 3, \ldots T,$$
$$E[Z_{it-h}(\varepsilon_{it} - \varepsilon_{it-1})] = 0, \quad \text{for } h \geq 2, \quad \text{and} \quad t = 3, \ldots T.$$

Accordingly, we choose as instrumental variables the private saving rate at $t-2$ and $t-3$ and the current values of all the other independent variables.

[8] For a detailed examination of the properties of these techniques, see Baltagi (2001) (Chapter 8).

5. Evidence for sub-Saharan Africa

The regression framework described in the previous section was used to estimate the existence of asymmetric effects of changes in the terms of trade for non-oil sub-Saharan African countries using time-series, cross-country data covering the period 1980–1996. We ended up using an unbalanced panel data set, because complete data were not available for all the countries in the sample for the whole period.

Table 2 summarizes our regression results. Regressions (1), (3) and (5) use our first procedure for distinguishing between positive and negative values of the permanent component of the terms of trade, whereas regressions (2), (4) and (6) use the second procedure. Two sets of specification test statistics are reported for each regression, as suggested by Arellano and Bond (1991). The first statistic is a Wald test of the joint significance of the regressors. The second statistic tests for first- and second-order serial correlation in the residuals, and are denoted m_1 and m_2. If the null hypothesis that the model is correctly specified is to be accepted, there should be evidence of negative first-order serial correlation (so that m_1 should be significant) and no evidence of second-order serial correlation (m_2 should be insignificant). From the above discussion, it follows that the differenced error term should be serially correlated by construction, even if the original error is not.

Consider first regression (1). Both the Wald test and the serial correlation tests indicate that the null hypothesis that the model is correctly specified cannot be rejected. The lagged dependent variable is highly significant, indicating (as noted earlier) either gradual adjustment to the desired level of saving or persistence effects associated with habit formation. The index of financial development (the ratio of quasi money to the broad money stock) has a significant and positive effect on private savings; as noted earlier, this result is consistent with the view that the relaxation of domestic liquidity constraints (resulting from increased access to bank credit, for instance) that may be associated with financial deepening had no adverse effect on the propensity to save, even if it may have stimulated private consumption. The coefficient of the inflation rate is positive but not well determined; this may reflect the importance of low-inflation, CFA Franc countries in the sample.

Government savings has a highly significant negative effect on private savings, as found in many recent studies on developing countries; government dissavings and their future tax implications tend to be internalized by private agents. The short-term coefficient of that variable is around -0.45; the coefficient of the lagged variable is about 0.7, which gives a long-term coefficient of -0.65, which is significantly different from unity. This suggests that Ricardian equivalence does not appear to hold in the long run, as found in some recent studies (see, for instance, Loayza et al., 1999; Masson et al., 1998). The age dependency ratio has the expected positive sign and is reasonably well-determined statistically, whereas per capita income is not significant.

As predicted by the consumption-smoothing view, the transitory (cyclical) component of the terms of trade is very significant and has the right sign. However, the short-term coefficient of that variable is around 0.09 whereas the long-term value is only around 0.13; both of these values are significantly different from unity, suggesting

Table 2
Sub-Saharan African countries: determinants of private savings, 1980–1996 Arellano–Bond GMM method

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(− 1)	0.703 (13.687)	0.708 (13.646)	0.701 (13.656)	0.706 (13.615)	0.707 (13.475)	0.704 (13.581)
QM%M2	0.080 (2.051)	0.078 (1.991)	0.079 (2.013)	0.077 (1.953)	0.084 (2.126)	0.076 (1.925)
INFL	0.032 (0.737)	0.028 (0.633)	0.030 (0.668)	0.026 (0.585)	0.025 (0.559)	0.028 (0.621)
SG%GDP	− 0.450 (− 4.891)	− 0.427 (− 4.673)	− 0.448 (− 4.872)	− 0.425 (− 4.650)	− 0.450 (− 4.851)	− 0.426 (− 4.653)
DEPRATIO	0.170 (1.861)	0.163 (1.773)	0.166 (1.819)	0.160 (1.736)	0.152 (1.653)	0.161 (1.745)
LGNPPC	− 0.001 (− 0.053)	0.000 (0.034)				
TLGNPPC			0.000 (0.017)	0.001 (0.099)		
RLGNPPC			− 0.059 (− 0.546)	− 0.048 (− 0.448)	− 0.056 (− 0.519)	− 0.045 (− 0.412)
RLTOT	0.087 (2.152)	0.083 (2.067)	0.086 (2.137)	0.083 (2.052)	0.088 (2.184)	0.083 (2.062)
VLTOT4	− 0.056 (− 0.732)	− 0.066 (− 0.860)	− 0.057 (− 0.745)	− 0.065 (− 0.858)	− 0.049 (− 0.636)	− 0.066 (− 0.865)
DPOS_TOTST0	0.005 (2.637)		0.005 (2.732)		0.005 (2.835)	0.005 (2.051)
DNEG_TOTST0	0.000 (0.081)		0.000 (0.156)		0.000 (0.126)	0.001 (0.260)
DPOS_TOTST1		0.005 (2.054)		0.005 (2.065)		
DNEG_TOTST1		0.001 (0.304)		0.001 (0.296)		
DPOS_GNPPCST0					− 0.002 (− 1.490)	
DNEG_GNPPCST0					− 0.000 (− 0.135)	
DPOS_GNPPCST1						0.001 (0.410)
DNEG_GNPPCST1						0.001 (0.276)
Wald test	238.301*	233.410*	237.883*	232.605*	237.764*	231.845*
Test for first-order serial correlation (m_1)	− 7.008*	− 7.029*	− 7.010*	− 7.038*	− 7.068*	− 7.037*
Test for second-order serial correlation (m_2)	− 1.900	− 1.871	− 1.954	− 1.914	− 1.881	− 1.904
Total panel observations	465	465	465	465	465	465

Note *t*-statistics are in parentheses. Private savings rate (SP%GDP) is the ratio of private savings to GDP. SP%GDP(− 1) is the lagged value of SP%GDP. QM%M2 is the ratio of quasi money to broad money INFL is the inflation rate in terms of the GDP deflator SG%GDP is the ratio of general government saving to GDP. DEPRATIO is the dependency ratio. LGNPPC is the log of per capita real GNP. TLGNPPC is the trend component of LGNPPC, obtained by using the modified Baxter–King filter as explained in the text. RLGNPPC is the residual component of LGNPPC. TLTOT is the trend component of the terms of trade. RLTOT is the residual component of the terms of trade. VLTOT4 is the volatility measure as the standard deviation of the terms of trade for periods $t-3$, $t-2$, $t-1$ and t. DPOS_TOTST0 is the dummy variable equal to 1 times TLTOT whenever $TLTOT_t$ is greater than both $TLTOT_{t-1}$, and the mean of TLTOT. DNEG_TOTST0 is the dummy variable equal to 1 times TLTOT whenever $TLTOT_t$ is less than both $TLTOT_{t-1}$ and the mean of TLTOT. DPOS_TOTST1 is the dummy variable equal to 1 times TLTOT whenever $TLTOT_t$ is greater than both $TLTOT_{t-1}$ and the mean of TLTOT plus one standard deviation of TLTOT. DNEG_TOTST1 is the dummy variable equal to 1 times TLTOT whenever $TLTOT_t$ is less than both $TLTOT_{t-1}$ and the mean of TLTOT minus one standard deviation of TLTOT. Similar definitions apply to DPOS_GNPPCST0, DNEG_GNPPCST0, DPOS_GNPPCST1, and DNEG_GNPPCST1. The instrumental variables are SP%GDP at $t-2$ and $t-3$ and the current value of the rest of the independent variables. * indicates statistical significance at 1%.

that the "pass-through" is less than complete—perhaps because households are unable (even in the long run) to assess fully the degree of persistence of terms of trade shocks. The index of terms of trade volatility performs poorly in the regression and is wrongly signed[9]. Our results, therefore, do not corroborate those of Ghosh and Ostry (1994), according to which terms of trade volatility tends to have a positive effect on private savings.

The results also indicate that favorable movements in the permanent component of the terms of trade have a positive and statistically significant effect on private savings, whereas unfavorable movements in that variable have no discernible statistical effect. These results are consistent with the main prediction of our analytical framework, according to which households facing uncertain movements in their income induced by terms of trade shocks may save a non-zero fraction of those changes that are perceived to be permanent in good times. At the same time, it should be noted that, despite being significant, the coefficient of that variable is not very large.

Regression (2), which uses our second measure of favorable and unfavorable shocks to the permanent component of the terms of trade, provide results that are qualitatively very similar to those shown in regression (1), for all the variables included in the model. In particular, Ricardian equivalence does not appear to hold in the sample, and the coefficient on favorable movements in the permanent component of the terms of trade has a significant impact on savings. In regressions (3) and (4), we tried to split the values of income per capita between permanent and transitory components (using once again the modified Baxter–King filter described above), but the results remained essentially the same. Finally, we attempted to test whether favorable and unfavorable movements in the permanent component of real income per capita, just like the terms of trade, would have an asymmetric effect on private saving rates. The results that are reported in regressions (5) and (6) indicate that this was not the case. At the same time, all the other results discussed earlier continue to hold. In addition, the specification tests also suggest that the assumption that the model is correctly specified cannot be rejected. Overall, therefore, the regression results presented here appear to provide fairly robust evidence that movements in the permanent component of the terms of trade tend to have the asymmetric effect hypothesized earlier on private savings.

6. Concluding remarks

The purpose of this paper has been to examine whether terms of trade shocks have an asymmetric effect on private savings. The first part used a simple three-period framework to argue that, in the presence of binding borrowing constraints in bad states of nature, saving rates can be sensitive to favorable movements in the permanent component of the

[9] Different numbers of lagged values were used to calculate the index of volatility; we also calculated an index based on the transitory component of the terms of trade. But the results remained largely similar to those reported in Table 2.

terms of trade—in contrast to what the conventional consumption-smoothing framework would predict. Households in developing countries (particularly those that have limited creditworthiness to begin with) may indeed be unable to smooth consumption when faced with adverse shocks to world commodity prices and the terms of trade, because they are subject to credit constraints that become tighter more binding in such situations. As a result, to maintain a smooth consumption path, domestic agents may be forced to dissave by a larger amount than they would otherwise. This argument also suggests that, to the extent that domestic agents internalize the possibility of facing tighter credit constraints in bad states of nature, they may also consume less of their permanent income, and instead save a fraction of it, in good times.

The second part provided some informal evidence, based on data for non-oil commodity exporters of sub-Saharan Africa, on the behavior of private savings during episodes of terms of trade improvements and deteriorations, as captured by movements in international commodity prices. We found indeed some support for the view that the private savings ratio may have responded asymmetrically in many cases, but that broad generalizations across countries were not warranted. We then turned to a more formal empirical test of asymmetry. The third part described the econometric methodology and the specification of the regression model, which controls for various standard determinants of private savings. The fourth part presented and discussed our empirical results, based on an unbalanced panel dataset for non-oil commodity exporters of sub-Saharan Africa covering the period 1980–1996. Overall, they suggest that transitory movements in the terms of trade have a positive effect (albeit less than one to one) on the propensity to save, as suggested by the HLM effect. We also found that the dependency ratio and the degree of financial development have positive effects on private savings, whereas the level of income per capita and inflation have no discernible effect. Most importantly for our purpose, we found that favorable movements in the permanent component of the terms of trade (defined in two different ways) tend indeed to lead to higher rates of private savings, as predicted by our analytical framework.

Our interpretation focused on the adjustment of saving to a permanent shock, in circumstances where borrowing constraints are anticipated to bind in the future and habit formation are present. It should be noted, however, that our empirical results could be consistent with another interpretation. For instance, if the permanent shock is associated with an anticipated increase in future volatility, it would raise the demand for assets needed to be used as an effective buffer stock in the future, thereby increasing private savings today. Nevertheless, it can be verified that the logic of our analysis continues to apply in this case—the increase in the demand for the buffer stock is magnified by the anticipation of future borrowing credit constraints and by greater loss aversion.

The analysis developed in this paper can be extended to study the asymmetric effects of terms of trade shocks on savings in oil-exporting countries, both public and private [10]. This

[10] An early study that attempted to test for an asymmetric effect of terms-of-trade movements on savings in oil-exporting countries is by Spatafora and Warner (1995). However, the test performed by the authors was essentially a standard stability test of the coefficient of the terms-of-trade variable across two sub-periods (1965–1980 and 1981–1989).

is important because of the policy concerns that the high degree of commodity price volatility has generated in recent years. The 1998 slump in commodity prices, for instance, generated large terms of trade effects. Although the real income effect on primary commodity exporters was moderate (of the order of -0.5% of GDP), and net importers of oil and primary commodities actually registered a gain overall, oil exporters registered a negative real income effect of the order of -6.3% of GDP (World Bank, 2000, Chapter 4). Because oil exports account for almost all of government revenues in oil-exporting countries, the public sector bore the brunt of adjustment. The ability of each country to smooth public consumption in response to the revenue shortfall was, however, limited by their ability to draw down their official reserves and to borrow, both domestically and abroad. In many cases, constraints on domestic finance and lack of access to international capital markets actually prevented governments from successfully smoothing the impact of the oil price cycle, and economic performance deteriorated[11]. The same study by the World Bank also noted that although adjustment to the oil price swings in the past few years differed significantly across oil exporters, most countries increased their aggregate saving rates during the rise in oil prices in 1996–1997 (compared with 1993–1995) and reduced them during the 1998 slump. This pattern is consistent with consumption smoothing behavior (possibly by both private households and the public sector) in the presence of transitory shocks that are perceived as such. In addition, the savings response was found to be asymmetric: on average, saving rates rose by less than half of the real income gain during the 1996–1997 boom, but fell by the full amount of the decline in real incomes during the 1998 collapse in prices. Extending the analytical framework presented in this paper to account for an asymmetric response of public savings would provide a fruitful exercise.

Acknowledgements

We would like to thank, without implication, Mustapha Nabli, William Shaw, Robert Keyfitz, and two anonymous referees for useful discussions and comments, and Nihal Bayraktar for excellent research assistance. The views expressed here do not necessarily represent those of the Bank.

Appendix A. Loss aversion, savings, and borrowing constraints

The purpose of this appendix is to show that, following Aizenman (1998), loss aversion magnifies the increase in saving induced by the anticipation of future binding borrowing constraints induced by adverse shocks to income.

[11] The World Bank report estimated that the effect of the drop in oil prices on the external earnings of oil-exporting countries in sub-Saharan Africa led to a deterioration in the fiscal balance of these countries of about 7% of GDP in 1998.

For expositional simplicity, we will assume the absence of habit formation, that is, the case in which $\tau=\theta=0$ in Eq. (2). Loss aversion modifies the maximization problem with full access to the capital market given in (4) as follows:

$$\max_{s_1,s_2^{\mathrm{L}},s_2^{\mathrm{H}}}\begin{cases} u(x-s_1)+(\omega+q)[u(x-\delta+s_1-s_2^{\mathrm{L}})+u(x+s_2^{\mathrm{L}})] \\ +(1-q-\omega)[u(x+s_1-s_2^{\mathrm{H}})+u(x+s_2^{\mathrm{H}})] \end{cases}, \tag{A.1}$$

where to simplify notations, $u(c_{t-1};c_t)$ is written as $u(c_t)$ and $1-q\geq\omega\geq 0$. The term ω is the extra utility weight attached to the bad state of nature due to loss aversion (see Aizenman, 1998 for further details). The expected utility case corresponds to $\omega=0$. With no access to the capital market, the maximization problem (9) becomes

$$\max_{s_1,s_2^{\mathrm{H}}}\begin{cases} u(x-s_1)+(\omega+q)[u(x-\delta+s_1)+u(x)] \\ (1-q-\omega)[u(x+s_1-s_2^{\mathrm{H}})+u(x+s_2^{\mathrm{H}})] \end{cases}. \tag{A.2}$$

Applying Eq. (A.1) if follows that with access to the world capital market, first-period saving is

$$s_1=\frac{\delta(q+\omega)}{3}, \tag{A.3}$$

whereas without access to borrowing and with no habit formation, saving is

$$\tilde{s}_1=\frac{\delta(q+\omega)}{2-0.5[1-(q+\omega)]}. \tag{A.4}$$

From Eqs. (A.3) and (A.4), we have

$$\tilde{s}_1-s_1=\frac{\delta(q+\omega)(3-q-\omega)}{3(3+q+\omega)}.$$

Consequently, loss aversion magnifies the increase in saving associated with future borrowing constraints.

References

Agénor, P.-R., 2000. The Economics of Adjustment and Growth. Academic Press, San Diego, CA.

Agénor, P.-R., Montiel, P.J., 1999. Development Macroeconomics, second ed. Princeton University Press, New Jersey.

Agénor, P.-R., McDermott, C.J., Prasad, E., 2000. Macroeconomic fluctuations in developing countries: some stylized facts. World Bank Economic Review 14, 251–286.

Aizenman, J., 1998. Buffer stocks and precautionary savings with loss aversion. Journal of International Money and Finance 17, 931–947.

Alessie, R., Lusardi, A.M., 1997. Consumption, saving and habit formation. Economics Letters 55, 103–108.

Anderson, T.W., Hsiao, C., 1981. Estimation of dynamic models with error components. Journal of the American Statistical Association 76, 589–606.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies 58, 277–297.

Baltagi, B.H., 2001. Econometric Analysis of Panel Data. Wiley, New York.

Baxter, M., King, R.G., 1999. Measuring business cycles: approximate band-pass filters for economic time series. Review of Economics and Statistics 81, 575–593.

Bevan, D., Collier, P., Gunning, J.W., 1993. Trade shocks in developing countries: consequences and policy responses. European Economic Review 37, 557–565.

Cashin, P., McDermott, J.C., 1998. Terms of Trade Shocks and the Current Account. International Monetary Fund Research Paper No. WP/98/177.

Christiano, L.J., Fitzgerald, T.J., 1999. The Band Pass Filter. National Bureau of Economic Research Working Paper No. 7257.

Deaton, A.S., 1992. Understanding Consumption. Oxford University Press, Oxford.

Edwards, S., 1989. Temporary terms-of-trade disturbances, the real exchange rate and the current account. Economica 56, 343–357.

Edwards, S., 1996. Why are latin America's savings rates so low? An international comparative analysis. Journal of Development Economics 51, 5–44.

Elbadawi, I., Mwega, F., 1999. Can Africa's saving collapse be reverted. In: Schmidt-Hebbel, K., Servén, L. (Eds.), The Economics of Saving and Growth. Cambridge University Press, Cambridge.

Gavin, M., 1990. Structural adjustment to a terms of trade disturbance: the role of relative prices. Journal of International Economics 28, 217–243.

Ghosh, A.R., Ostry, J.D., 1994. Export instability and the external balance in developing countries. IMF Staff Papers 41, 214–235.

Harberger, A.C., 1950. Currency depreciation, income and the balance of trade. Journal of Political Economy 53, 47–60.

Hubbard, R.G., Judd, K.L., 1986. Liquidity constraints, fiscal policy, and consumption. Brookings Papers on Economic Activity 1, 1–50.

Judson, R.A., Owen, A.L., 1999. Estimating dynamic panel data models: a guide for macroeconomists. Economics Letters 65, 9–15.

Laursen, S., Metzler, L.A., 1950. Flexible exchange rates and the theory of employment. Review of Economics and Statistics 32, 281–299.

Loayza, N.V., Servén, L., Schmidt-Hebbel, K., 1999. What drives saving across the world. In: Schmidt-Hebbel, L., Servén, L. (Eds.), The Economics of Saving and Growth. Cambridge University Press, Cambridge.

Masson, P.R., Bayoumi, T., Samiei, H., 1998. International evidence on the determinants of private savings. World Bank Economic Review 12, 483–502.

Obstfeld, M., 1982. Aggregate spending and the terms of trade: is there a Laursen–Metzler effect. Quarterly Journal of Economics 47, 251–270.

Obstfeld, M., Rogoff, K.A., 1997. Foundations of International Macroeconomics. MIT Press, Cambridge, MA.

Ogaki, M., Ostry, J., Reinhart, C.M., 1996. Saving behavior in low- and middle-income developing countries: a comparison. IMF Staff Papers 43, 38–71.

Ostry, J.D., Reinhart, C.M., 1992. Private saving and terms-of-trade shocks. IMF Staff Papers 39, 495–517.

Seater, J., 1993. Ricardian equivalence. Journal of Economic Literature 31, 142–190.

Spatafora, N., Warner, A., 1995. Macroeconomic Effects of Terms of Trade Shocks. PRE Working Paper No. 1410, the World Bank.

Svensson, L., Razin, A., 1983. The terms of trade and the current account: the Harberger–Laursen–Metzler effect. Journal of Political Economy 91, 97–125.

World Bank, 1999. Global Development Finance. The World Bank, Washington, DC.

World Bank, 2000. Global Economic Prospects and the Developing Countries 2000 Report. The World Bank, Washington, DC.

Zeldes, S., 1989. Consumption and liquidity constraints: an empirical investigation. Journal of Political Economy 97, 305–346.