

**A Proposal to Anchor Monetary
Policy by the Price of the Export
Commodity**

by
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ABSTRACT

The debate over monetary standards and exchange rate regimes for developing countries is as wide open as ever. On the one hand, the big selling points of floating exchange rates – monetary independence and accommodation of terms of trade shocks – have not lived up to their promise. On the other hand, proposals for credible institutional monetary commitments to nominal anchors have each run aground on their own peculiar shoals. Rigid pegs to the dollar, for example, are dangerous when the dollar appreciates relative to other export markets.

This study explores a new proposal: that countries specialized in the export of a particular commodity should peg their currency to that commodity. When the dollar price of the commodity on world markets falls, the dollar exchange rate of the local currency would fall in tandem. The country would thus reap the best of both worlds: the advantage of a nominal anchor for monetary policy, together with the automatic accommodation to terms of trade shocks that floating rates claim to deliver. The paper conducts a set of counterfactual experiments. For each of a list of countries specialized in particular mineral or agricultural commodities, what would have happened, over the last 30 years, if it had pegged its currency to that commodity, as compared to pegging to the dollar, yen, or mark, or as compared to whatever exchange rate policy it actually followed historically? We compute under these scenarios the price of the commodity in local terms, and we then simulate the implications for exports. Illustrative of the results is that some victims of financial difficulties in the late 1990s might have achieved a stimulus to exports precisely when it was most needed, without having to go through wrenching currency collapses, if they had been on regimes of pegging to their export commodity: South Africa to gold or platinum, Nigeria and Indonesia to oil, Chile to copper, Argentina to wheat, Colombia to coffee, and so on.

Not all countries will benefit from a peg to their export commodity, and none will benefit in all time periods. Nonetheless, the results suggest that the proposal that some countries peg their currency to their principle export commodity deserves to take its place alongside pegs to major currencies and the other monetary regimes that countries consider.

I. Introduction

One major advantage of floating exchange rates was supposed to be the possibility of discretionary monetary policy to respond to domestic needs. But discretionary monetary policy has less often been used successfully and more often abused, convincing some to return to a fixed exchange rate, or other rigid rule for monetary policy.¹ Another major advantage of floating exchange rates was supposed to be automatic adjustment to terms of trade shocks. This has worked sometimes – a currency depreciating in response to a worsening of the world market in the country's export commodity. But there have also been other, more extraneous, movements in floating exchange rates that appear unrelated to trade shocks or other observable fundamentals. They have provided another argument for giving up on exchange rate flexibility.

Unfortunately, fixed exchange rates have had their own problems. The major argument that economists have for the last two decades been making in favor of currency pegs is a credible commitment to fight inflation, a way of addressing the problem of dynamic inconsistency in monetary policy. But pegs have been implicated in most of the crises in emerging markets in the last ten years. Almost all the victims of balance of payments crises have found it necessary to devalue and move to more flexible arrangements.²

Adjusting to terms of trade shocks for emerging markets is as important now as it has ever been. In theory, access to international capital markets should help smooth fluctuations in trade. In practice, capital has fled from emerging markets in the

¹ The advantages of a rule are demonstrated in Barro and Gordon (1983) and Rogoff (1987)

aftermaths of downturns in the world markets for their export commodities. A deterioration in export revenue, particularly measured in terms of the dollar, the currency in which most of their international debts are denominated, preceded the international debt crisis of 1982 as well as the crises in Thailand, Korea, Indonesia and other Asian countries in 1997. For our purposes, it does not matter whether the withdrawal of capital can be explained by economic fundamentals or not. Each of these countries, cut off from foreign money, was forced to achieve a substantial increase in net exports in a short period of time.

This study proposes a new monetary regime: a country can peg the price of its export commodity. We argue that such a regime can deliver the best of both worlds: it combines the inflation-fighting advantages of a nominal anchor with the advantage of automatic adjustment to terms of trade shocks. After explaining the motivation for the proposal, we simulate for a number of countries what its effect would have been over the last 30 years, compared to four alternative regimes: dollar peg, yen peg, euro or DM peg, and whatever exchange rate policy the country in question actually followed.

1. Each candidate for nominal anchor has its own vulnerability

Each of the various magnitudes that are candidates for nominal anchor has its own characteristic sort of extraneous fluctuations that can wreck havoc on a country's monetary system.

² Classic contributions to the fixed versus floating debate include Friedman (1953), Johnson (1969), Kenen (1969), McKinnon (1963) and Mundell (1961). Recent surveys include Edwards (2002), Eichengreen (1994) and Frankel (1999).

?? Under a *monetarist* rule, the central bank pegs the rate of growth of M1 at, say, 3% a year (plus or minus a margin of error). The Achilles heel of this rule is fluctuations in the public's demand for money or in the behavior of the banking system, which can directly produce gratuitous fluctuations in velocity and thereby in the real economy. For example, in the United States, a large upward shift in the demand for money around 1982 convinced the Federal Reserve Board that it had better abandon the money growth rule it had adopted two years earlier, or else face a prolonged and severe recession.

?? The novel idea of pegging the currency to the price of the export good, which this study puts forward, may sound similar to the current fashion of *targeting the inflation rate* or price level.³ But the fashion, in such countries as the United Kingdom, Sweden, Canada, New Zealand, Australia, Chile and Brazil, is to target the CPI. A key difference between the CPI (or GDP deflator) and the export price is the terms of trade. When there is an adverse movement in the terms of trade, one would like the currency to depreciate. Price level targeting, however, can have the opposite implication. If the central bank has been constrained to hit an inflation target, positive oil price shocks (as in 1973, 1979, or 2000), for example, will require monetary tightenings in an oil importing country. The result can be sharp falls in national output. Thus under rigid inflation targeting, supply or terms-of-trade shocks can produce unnecessary and excessive fluctuations in the level of economic activity.

³ Among many possible references are Svensson (1995) and Bernanke, et al. (1999).

?? The need for robustness with respect to import price shocks argues for the superiority of *nominal income targeting* over inflation targeting.⁴ A practical argument against nominal income targeting is problems of timely measurement. For developing countries in particular, the data are sometimes available only with a delay of one or two years. (Targeting the price of domestically produced goods would have the same advantage of robustness with respect to import price shocks that a CPI target lacks, without the data problems.)

?? Under a *gold standard*, the central bank pegs the price of gold in terms of domestic currency. Unfortunately, the economy is then hostage to the vagaries of the world gold market. For example, when much of the world was on the gold standard in the 19th century, global monetary conditions depended on the output of the world's gold mines. The California gold rush from 1849 was associated with a mid-century increase in liquidity and a resulting increase in the global price level. The absence of major discoveries of gold between 1873 and 1896 helps explain why price levels fell dramatically over this period (53 percent in the United States and 45 percent in the United Kingdom), inflicting hardship, for example, on American farmers. In the late 1890s, the gold rushes in Alaska and South Africa were each followed by new

⁴ Velocity shocks argue for the superiority of nominal income targeting over a monetarist rule. E.g., Frankel (1995) demonstrates the point mathematically, and gives other references on nominal income targeting. One could apply this same theoretical apparatus, taken from Rogoff (1985), to demonstrate the conditions under which fixing the price of the export commodity would be superior to alternatives such as fixing the CPI.

upswings in the price level of similar magnitude. Thus the system did not in fact guarantee price stability.⁵

?? One proposal is that monetary policy should *target a basket of basic mineral and agricultural commodities*. The idea is that a broad-based commodity standard of this sort would not be subject to the vicissitudes of a single commodity such as gold, because fluctuations of its components would average out somewhat.⁶ If the basket reflected the commodities produced and exported by the country in question, the proposal could work well. But for a country that is a net importer of oil, wheat, and other mineral and agricultural commodities, such a peg gives precisely the wrong answer in a year when the prices of these import commodities go up. Just when the domestic currency should be depreciating to accommodate an adverse movement in the terms of trade, it appreciates instead. Korea, for example, should not peg to a basket that includes grain or oil.

?? Under a *fixed exchange rate*, fluctuations in the value of the particular currency to which the home country is pegged can produce needless volatility in the country's international price competitiveness. For example, the appreciation of the dollar from 1995 and 2001 was also an appreciation for

⁵ Cooper (1985) or Hall (1982).

⁶ A "commodity standard" was proposed in the 1930s – by B. Graham (1937) – and subsequently discussed by F. Graham (1941), Keynes (1938), and others. It was revived in the 1980s, as a less narrow version of proposals to return to a gold standard – e.g., Hall (1982).

whatever currencies were linked to the dollar despite the absence of any necessary connection to the fundamentals of the smaller dollar-linked economies. The problem was particularly severe for some far-flung economies that had adopted currency boards over the preceding decade: Hong Kong, Argentina, and Lithuania.

Dollar-induced overvaluation was also one of the problems facing such victims of currency crisis as Mexico (1994), Thailand and Korea (1997), Russia (1998), Brazil (1999) and Turkey (2001), even though none of these countries had formal rigid links to the dollar, and indeed only Thailand had had a peg to the dollar in the two years preceding the crisis even in de facto terms. It is enough for the dollar to exert a large pull on the country's currency (relative to the weight of the United States in the country's exports) to create strains. The loss of competitiveness in non-dollar export markets adversely impacts such measures of economic health as real overvaluation, exports, the trade balance, and growth, or such measures of financial health as the ratios of current account to GDP, debt to GDP, debt service to exports, or reserves to imports.

To recap, each of the most popular variables that have been proposed as candidates for nominal anchors is subject to fluctuations that will add an element of unnecessary monetary volatility to a country that has pegged its money to that variable: velocity shocks in the case of M1, supply or import shocks in the case of inflation targeting, measurement problems in the case of nominal income targeting, fluctuations in

world gold markets in the case of the gold standard, and fluctuations in the anchor currency in the case of exchange rate pegs.

2. The proposal to target the price of the export commodity

This study argues that for those small countries that want a nominal anchor, a peg to their export commodity may make more sense than the alternatives. The argument is that such a peg would deliver the best of both worlds: the anchor of a peg and the accommodation of a float. The automatic accommodation or insulation that is normally thought to be the promise held out only by floating exchange rates is instead delivered per force by the pegging option. For any country that happens to be concentrated in the production of a particular agricultural or mineral commodity, that is the commodity the price of which would be fixed in domestic currency. Mali might peg to gold, Chile to copper, Indonesia to oil, Ethiopia to coffee, Argentina to a basket of agricultural commodity prices, and Korea to an index of consumer electronics prices.

A profit-maximizing firm that is competitive in its product and input markets will produce in relation to the ratio of the price of the export good to the price of its variable inputs. If its production is for simplicity taken to be Cobb-Douglas, with labor the only variable factor of production, then in logs we have $\text{Log } X = ? + s (p_x - w)$, where p_x is the log of the domestic currency price of the export good in question, w is the log of the wage in local currency, and the supply elasticity s depends on labor's share. $p_x = p_x^{\$} - s_{lc}^{\$}$, where $p_x^{\$}$ is the log dollar price of the export good on world markets, which fluctuates exogenously, and $s_{lc}^{\$}$ is the log dollar value of the local currency, which depends both on the country's exchange rate policy and fluctuations in the dollar's value.

A country can get into trouble under a regime where $s_{lc}^{\$}$ is fixed, because a decline in $p_x^{\$}$ hurts exports in proportion s . (In dollar terms, which may be the most relevant measure if a country has incurred debts in dollars, the loss of export revenue is $(1 + s)$ times the fall in $p_x^{\$}$.) But the country can also get into trouble if the exchange rate $s_{lc}^{\$}$ floats, and thereby introduces its own extraneous fluctuations into the equation.

Assume that w is stable, a prospect that is more likely if expected inflation has been secured by means of one or another nominal anchor for monetary policy. Then to determine exports, whether in real terms or dollar terms, we want to focus on $p_x = p_x^{\$} - s_{lc}^{\$}$. The way to do that is to set the dollar price of the domestic currency equal to the dollar price of the export commodity: $p_x^{\$} = s_{lc}^{\$}$. Operationally, this is the way to implement a commitment to peg the domestic price of the export commodity. Intuitively, by removing fluctuations in p_x , we may stabilize exports. (In the simulations, we focus on how various regimes would affect $p_x - w$, where we represent the domestic cost of variable inputs, w , by the domestic CPI.)

II. The Counterfactual: What Would Have Happened Under Different Pegs?

The remainder of this study will address the possible pegging policies of countries for which gold, oil, wheat, or a few other mineral or agricultural products are important export commodities. It will evaluate competing pegs according to their ability to deliver external balance. Movements in exports, and such closely related variables as the current account and debt/export ratio, have been important in the origins of, and response to,

many recent crises. The simulations reported here concentrate on the ratio of exports to GDP. A more complete analysis of welfare implications would be desirable.⁷

Our major criterion for whether gold or other commodities are important to the country in question is exports (we have also considered production) as a share of total exports of goods and services (we have also looked at merchandise exports alone, and total GDP). At this stage we concentrate mostly on low-income debtor countries. Thus the Persian Gulf countries, for example, are not included among the list of oil producers in whom we are interested. Nor are we interested in large countries such as the United States and Canada, for whom production of oil, gold or wheat may rank high in absolute terms, but low as a share of their economies. Thus some of the countries that appear here do not loom especially large in the world market for their particular commodity, even though the market for their particular commodity looms large in that country.

Details regarding the choice of countries and their statistics are available.⁸

1. How Would the Export Commodity Price Have Moved Under Alternative Pegs?

The hypothetical experiment goes as follows. For each of the countries on our list, it is easy to calculate what would have been the local currency price of its major export commodity, if it had pegged to the dollar during the period 1970-2000, instead of following whatever exchange rate policy it actually followed. We can see whether the volatility of this price would have been higher or lower over these three decades under

⁷ Perhaps along the lines of Aoki (2001), Clarida, Gertler and Galli (2001), or Mankiw and Reis (2002).

⁸ The importance of particular export commodities to particular countries is reported electronically at http://ksghome.harvard.edu/~jfrankel.academic.ksg/counterfactual/rank_price.html, as

the dollar peg. Then we can do the same for a yen peg and a euro peg. This section discusses the simulated price paths under alternative currency policies. The subsequent section goes on to look at implications for export performance.⁹

To repeat from above, the key variable is p_x-w , the price of exports relative to the cost of variable inputs, which could be defined as the real exchange rate. The path under the five possible regimes is calculated as follows:

Under actual history,

$$P_x = S_{\$}^{lc} P_x^{\$} \quad \text{and} \quad w = CPI^{lc}.$$

Under a hypothetical dollar peg,

$$S_{\$}^{lc} = 1, \text{ so } P_x = P_x^{\$}, \quad \text{and} \quad w = CPI^{US}.$$

Under a hypothetical yen peg,

$$S_{\$}^{lc} = S_{\$}^Y, \text{ so } P_x = S_{\$}^Y P_x^{\$}, \quad \text{and} \quad w = CPI^J.$$

Under a hypothetical DM or euro peg,¹⁰

$$S_{\$}^{lc} = S_{\$}^{DM}, \text{ so } P_x = S_{\$}^{DM} P_x^{\$}, \text{ and} \quad w = CPI^G.$$

Under a hypothetical commodity peg,

$$S_{\$}^{lc} = P_x^x, \text{ so } P_x = I, \quad \text{and} \quad w = I.$$

The simulated path of exports under each of the alternative hypothetical regimes will be calculated as equal to the actual historical path displaced in proportion to the difference between what p_x-w would have been under the alternative regime and what it was historically.

Table Set I. Frankel (2002) elaborates on all the arguments and results, in particular for the case of gold.

⁹ For other countries and commodities, graphs of the computed prices under alternative scenarios appear as Figure Set II, available in Frankel (2002) or electronically at http://ksghome.harvard.edu/~jfrankel.academic.ksg/counterfactual/rank_price.html.

¹⁰ After 1999, the exchange rate reported as the German Mark is calculated as follows. $S(DM/\$)$ in 1999 = $S(\text{Euro}/\$)$ in 1999 ? $S(DM/\text{Euro})$ in 1999;

We use the CPI to measure the price of variable inputs, w . When the currency is hypothetically taken to be rigidly pegged to the dollar, yen, or DM, CPI_{Home} is taken to be the CPI of the US, Japan, or Germany or Japan, respectively, under the assumption that the peg is strong enough and permanent enough to achieve convergence of inflation rates.¹¹ The path of the real price of commodities under the five possible regimes is calculated as follows:

Under actual history, $RP_x = S_x^{lc} P_x^{\$} / CPI^{lc}$.

Under a hypothetical dollar peg, $RP_x = (P_x^{\$} / CPI^{US}) (K_{\$})$.

Under a hypothetical yen peg, $RP_x = (S_x^Y P_x^{\$} / CPI^J) (K_Y)$.

Under a hypothetical DM or euro peg, $RP_x = (S_x^{DM} P_x^{\$} / CPI^G) (K_{DM})$.

Under a hypothetical commodity peg, $RP_x = K_x$,

where $K_{\$}$, K_Y , K_{DM} , and K_x are constants calculated so as to make the log of the real price of the commodity on average over the 30 year period equal under each of the regimes to what it was in actual history.

Under each of the four hypothetical regimes, the path of exports is assumed to deviate from the actual history path in simple proportion to the deviation of the hypothetical real price from the historical real price. (This is the assumption of that the supply elasticity is unity.) The percentage deviation relative to actual history is given as follows:

Under a hypothetical dollar peg, $d_{\$} = \log (P_x^{\$} / CPI^{US}) / (S_x^{lc} P_x^{\$} / CPI^{lc}) + k_{\$}$
 $= \log (1 / CPI^{US}) / (S_x^{lc} / CPI^{lc}) + k_{\$}$.

S(DM/\$) in 2000 = S(DM/\$) in 1999 ? (1 + % change of the euro exchange rate)

¹¹ When calculating the real exchange rate for the euro, we continue to use the German CPI.

Under a hypothetical yen peg,
$$d_Y = \log (S^Y_{\$} P^{\$}_x / CPI^I) / (S^{lc}_{\$} P^{\$}_x / CPI^{lc}) + k_Y$$

$$= \log (S^Y_{\$} / CPI^I) / (S^{lc}_{\$} / CPI^{lc}) + k_Y.$$

Under a hypothetical DM or euro peg,
$$d_{DM} = \log(S^{DM}_{\$} P^{\$}_x / CPI^G) / (S^{lc}_{\$} P^{\$}_x / CPI^{lc}) + k_{DM}$$

$$= \log(S^{DM}_{\$} / CPI^G) / (S^{lc}_{\$} / CPI^{lc}) + k_{DM} .$$

Under a hypothetical export commodity peg,
$$d_x = \log 1 / (S^{lc}_{\$} P^{\$}_x / CPI^{lc}) + k_x .$$

Gold prices

Three countries that were highly specialized in gold exporting averaged over the period 1979-1996, according to our figures, are Burkina Faso, Ghana, and Papua New Guinea. We have also analyzed South Africa and several others

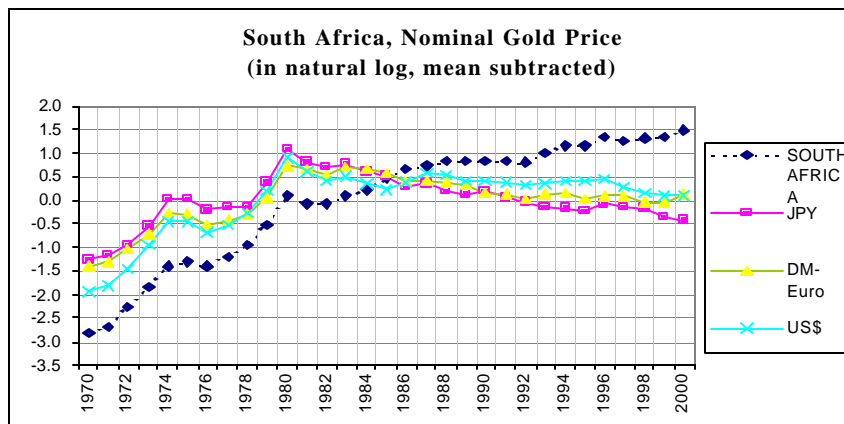
Our first simulation shows the nominal price of gold from the viewpoint of our gold-exporting countries. Figure (1a) shows the case of South Africa. The general pattern is as follows, regardless which of the major currencies is used to measure the price: sharp upward movements in the early 1970s and late 1970s, followed by a reversal of trend in 1980, with signs of an eight-year cycle over the last two decades. But the specifics depend on what is assumed about exchange rates.

Consider the example of one country where gold exports happen to have been very important over the last 30 years, Burkina Faso. Like most francophone countries in Western and Central Africa, this one is a member of the CFA franc zone, which means that its currency has normally been pegged to the French franc (and now to the euro), except for a devaluation in 1994. Consider the price of gold that Burkina Faso would have faced if it had been pegged to the dollar, compared to the price it actually experienced. The gold price increases in the 1970s would have been far sharper, as a

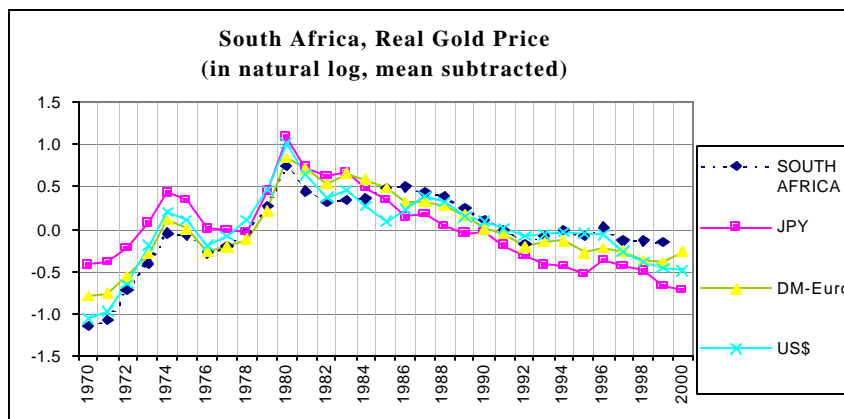
consequence of devaluation and depreciation of the dollar; the country would have been hit by a gold price decline in the early 1980s that it did not in fact experience, as a consequence of a strong dollar; and it would have missed an increase in 1994 that it in fact did experience, when the CFA franc devalued. If Burkina Faso had been pegged to either the yen or the mark, then the price of gold in domestic terms would have been more stable overall, because it would have avoided both the largest dollar swings of the 1970s and 80s and the CFA devaluation of 1994.

Figure 1: Price of Gold Simulated Under Alternative Currency Pegs

1 a.



1b.



1. Variability of Aluminum Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.37	16%
Yen	0.29	6%
DM-Euro	0.23	3%
Jamaica Dollar	1.71	87%
Suriname Guilder	2.52	100%

2. Variability of Coffee Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.47	29%
Yen	0.60	55%
DM-Euro	0.48	31%
Brazil Real	10.85	97%
Cameroon Franc	0.63	58%
Colombia Peso	1.65	87%
Costa Rica Colon	1.48	84%
El Salvador Colon	0.69	42%
Ethiopia Birr	0.66	55%
Guatemala Quetzal	0.89	45%
Honduras Lempira	0.86	48%
Kenya Shilling	0.96	48%
Madagascar Ariary	1.28	71%
Nicaragua gold cordoba	9.91	100%
Peru Inti	7.60	97%
Tanzania Shilling	1.91	94%

Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.59	42%
Yen	0.77	65%
DM-Euro	0.59	34%
Brazil Real	0.61	45%
Cameroon Franc	0.60	37%
Colombia Peso	0.43	23%
Costa Rica Colon	0.48	29%
El Salvador Colon	0.81	74%
Ethiopia Birr	0.53	23%
Guatemala Quetzal	0.44	32%
Honduras Lempira	0.48	35%
Kenya Shilling	0.47	26%
Madagascar Ariary	0.35	10%
Nicaragua gold cordoba	3.39	89%
Peru Inti	0.98	74%
Tanzania Shilling	0.37	16%

3. Variability of Copper Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.28	6%
Yen	0.30	10%
DM-Euro	0.18	0%
Chile Peso	3.50	84%
Mongolia Togrog	1.57	89%

Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.38	19%
Yen	0.58	35%
DM-Euro	0.37	19%
Chile Peso	0.33	16%
Mongolia Togrog	0.35	0%

4. Variability of Gold Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.72	35%
Yen	0.54	32%
DM-Euro	0.55	35%
Burkina Faso Franc	0.90	61%
Burundi Franc	1.11	71%
Ghana New Cedi	3.52	97%
Guyana Dollar	2.24	93%
Mongolia Tughrik	1.59	78%
P.N. Guinea Kina	0.85	55%
Rwanda Franc	0.96	58%
South Africa Rand	1.29	81%
Bolivia Boliviano	0.64	19%
Fiji Dollar	0.90	77%
Mali Franc	0.91	61%
Peru Inti	0.80	27%

Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.44	16%
Yen	0.45	23%
DM-Euro	0.42	26%
Burkina Faso Franc	0.17	0%
Burundi Franc	0.35	13%
Ghana New Cedi	0.70	55%
Guyana Dollar	0.16	0%
Mongolia Tughrik	0.30	17%
P.N. Guinea Kina	0.29	7%
Rwanda Franc	0.30	10%
South Africa Rand	0.44	13%
Bolivia Boliviano	0.22	0%
Fiji Dollar	0.38	13%
Mali Franc	0.18	0%
Peru Inti	0.20	0%

5. Variability of Oil Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.75	39%
Yen	0.67	42%
DM-Euro	0.64	39%
Nigeria Nira	2.06	94%
Indonesia Rupiah	1.43	77%
Russia Ruble	1.24	50%
Venezuela Bolivar	2.18	87%
Ecuador Sucre	2.60	90%
Mexico Peso	3.10	94%
Colombia Peso	2.03	77%

Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.55	35%
Yen	0.62	48%
DM-Euro	0.56	42%
Nigeria Nira	0.55	42%
Indonesia Rupiah	0.52	23%
Russia Ruble	0.44	38%
Venezuela Bolivar	0.54	35%
Ecuador Sucre	0.46	29%
Mexico Peso	0.60	35%
Colombia Peso	0.50	29%

6. Variability of Platinum Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.33	8%
Yen	0.37	8%
DM-Euro	0.32	12%
South Africa Rand	0.85	64%

Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.34	8%
Yen	0.45	24%
DM-Euro	0.36	12%
South Africa Rand	0.31	8%

7. Variability of Silver Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean
USD	0.54	26%
Yen	0.61	48%
DM-Euro	0.50	35%
Bolivia Boliviano	6.02	100%
Peru Inti	7.67	97%

Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.56	39%
Yen	0.71	65%
DM-Euro	0.56	42%
Bolivia Boliviano	0.39	6%
Peru Inti	0.94	71%

8. Variability of Wheat Price in Local Currency

Nominal Price	Stdev	% of years outside ± 0.5 of mean	Real Price	Stdev	% of years outside ± 0.5 of mean
USD	0.36	16%	USD	0.40	23%
Yen	0.42	32%	Yen	0.60	45%
DM-Euro	0.29	6%	DM-Euro	0.40	19%
Argentina Peso	9.66	100%	Argentina Peso	0.57	45%
Australia Dollar	0.49	19%	Australia Dollar	0.31	10%
Mozambique Metical	2.65	97%	Mozambique Metical	0.30	8%

The left panel of the table reports the corresponding summary statistics for each of eight gold exporting countries. Two measures of volatility are reported: standard deviation and percentage of years in which the price would have deviated more than 50 percent from the mean. For Burkina Faso we see that volatility, for example as measured by the standard deviation, would have been somewhat lower if it had been pegged to the dollar, and lower still if it had been pegged to the yen or mark. Of course, if Burkina Faso had been on a gold peg, the volatility of the price of gold in terms of domestic currency would by definition have been zero, and the appropriate graph in the figure would have shown a flat line.

Consider next the example of Papua New Guinea. The simulation shows that the gold price decline it suffered in 1980-82 would have been more moderate if it had been linked to the mark, as opposed to the dollar, because the dollar appreciated against the mark. The decline in the price of gold in terms of the yen or mark was again more moderate during 1996-2000 than in terms of the dollar, when those currencies weakened against the dollar. But by then the New Guinea currency was free, and depreciating. As a result, the local price of gold did not fall in the late 1990s, but instead rose substantially.

Regardless the currency in terms of which the price of gold is expressed, it can be misleading to focus solely on the nominal price. Movements in the real price of gold are more important. They determine whether resources (meaning, in particular, capital and labor) inside the gold exporting country have an incentive to shift into the production of gold from other activities, or in the opposite direction. The rising price of gold in New Guinea in the late 1990s to some extent reflected a general inflation in the economy. To that extent, it did not provide a particular incentive for resources to shift into gold production, because wages and prices in other sectors were rising as well. The same is true of South Africa throughout the 1980s and 90s. Figure 1a shows that the nominal price of gold in terms of South African rand continued to rise in those two decades, even though the trend was down if the value of gold was measured in other terms. If our goal is to evaluate the implications of alternative monetary regimes for international price competitiveness and international debt, we should focus on the real price of gold. That is, we should deflate by the general price level in the country in question.

We simulate the real price of gold for the same set of countries. The right panel of Table 4 reports summary statistics on variability of the real price of gold. In all cases, variability is lower than reported for the corresponding measures in the left panel, confirming that much of the movement in the nominal price of gold reflects movement in the general price level. But the question of interest in this table, whether pegging to a major currency would have stabilized the real price of gold in domestic terms, has a different answer in different cases.

The exchange rate path actually followed by South Africa, illustrated in Figure 1b, looks better now; the real price of gold in the 1990s more stable than would have occurred if the rand had been pegged to a major currency. The real price did not decline

in 1994-95 as it would if the rand had been pegged to the (appreciating) yen or mark, nor did it decline as much in 1996-2000 as it would have if the South African currency had been more tightly linked to the (appreciating) dollar. Similarly, the real price of gold experienced by Burundi throughout this period was considerably more stable than it would have been if the currency had been pegged to a major currency. Of eight countries, Ghana stands out in that the real price of gold was more variable than it would have been if the currency (the cedi) had been pegged to any of the major currencies (experiencing large declines in the mid-1970s and early 1980s, and a large increase during 1982-87).

Again, if any of these countries had had the stabilization of the price of gold as their overriding objective, they could have sought to peg it through monetary policy. But a fair comparison of the gold peg to the currency pegs will have to wait for the analysis of implications for exports and other economic variables below.

Oil prices

Next we look at seven major oil exporters. In each, oil exports are a high percentage of goods exports (Nigeria 95%, Venezuela 53%, Ecuador 46%, Cameroon 34%, Indonesia 32%, Mexico 31% and Russia 18%; these ratios are averages over the period). Given so many oil exporters to choose from, we have concentrated on those that have had international debt problems. Thus we have omitted some where oil constitutes more than 70% of goods exports (Libya, Saudi Arabia, Gabon, Iran, Oman), or more than 40% of GDP (Brunei, Qatar, and UAE), but that are mostly creditors rather than debtors.

The nominal price of oil tells a general story similar to the price of gold: sharp increases in 1974 and 1979, followed by declines in 1986 and 1998, and a pattern

whereby the movements in terms of marks are a little less pronounced than the movements in terms of dollars. It is interesting that the volatility is so high when the oil price is expressed in terms of dollars, because OPEC supposedly sets the price in terms of dollars. Certainly oil is indeed invoiced in dollars. But the implication of these statistics is that OPEC in fact does not succeed in stabilizing the price in terms of dollars on a yearly basis.

Many of these oil-exporting countries experienced occasional jumps in the domestic price of oil when they devalued, which they would not have experienced if their currencies had remained pegged: Nigeria in 1999, Indonesia in 1998, and Russia in the early 1990s and again in 1999. On the other hand, the Indonesian rupiah and Ecuadorian sucre, for example, appreciated against the dollar in 1980; the result is that they experienced a smaller increase in the price of oil than they would have if they had pegged to a major currency. For each of the seven oil-exporting countries the domestic nominal price of oil would have been much less variable if they had been pegged to one of the three major currencies. Needless to repeat, the variability would have been lower still if they had sought as a matter of deliberate policy to stabilize the value of their currency in terms of oil.

Some of these countries experienced substantial inflation: Ecuador, Venezuela, Mexico in the 1980s, Russia in the early 1990s, and Nigeria increasingly over time. Again, the conversion from nominal to real is necessary. A look at the real price of oil shows that the world market declines of 1986 and 1998 fully reversed the real price increases of 1974 and 1979.

Nigeria's erratic monetary history is evident; it would have experienced a more stable price of oil if it had pegged its currency to either the dollar, yen or mark. The fall

in world oil prices in 1998 hit Nigeria hard, contributing to its dire international position, which in turn produced a collapse in the currency and much higher local-currency oil price the subsequent year. The other oil exporters as well would have shown lower variability in the local price of oil if they had followed a currency peg, though little difference in variability of the real price.

Prices of other minerals

The world market in silver, as in gold, peaked in 1980, but the rise during 1978-1980 was even sharper, as was the subsequent decline. This time the price was most volatile when expressed in terms of yen. The only two countries where silver constitutes more than two per cent of exports and more than 1/3 of one percent of GDP are Bolivia and Peru. Both countries experienced hyperinflations – one ending in the mid-1980s in the case of Bolivia and another ending in the early 1990s in the case of Peru – so that a comparison of nominal prices over the span from the 1970s to the 1990s is not meaningful. Turning to the statistics on the real price of silver, we see that Peru would have reduced variability by pegging to the yen, and even more by pegging to the dollar or mark. Bolivia on the other hand experienced less variation in the real local price of silver than it would if it had been pegged to any of the major currencies.

Swings in the world copper market have tended to be somewhat more frequent, but not quite as large in amplitude, with peaks in 1974, 1980, 1989, and 1995. Each was followed by a price decline; the decline in 1975 was particularly severe and caused a recession in Chile, for example. The variability is high for the price of copper expressed in yen, particularly in the 1970s. The 1973-75 rise and fall in the world copper price happened to coincide with a cycle of depreciation of the yen, followed by appreciation.

Our two copper exporters are Chile and Mongolia. Both experienced inflation during the sample period that was too high to make the figures on nominal price variability useful. Chile succeeded in beating inflation, by means of exchange rate targets, during the course of the 1980s, after which it switched to a basket of major currencies in the 1990s (made flexible by bands that were progressively widened, until a move to floating in 1999). The figures on variability in the real price of copper appear to show that Chile did slightly better with its actual exchange rate policy than it would have from a simple dollar peg. However its actual exchange rate policy exacerbated the copper price rise of the late 1980s and the decline of the late 1990s. Here a tighter peg to a major currency, especially the yen, would have done better.

Mongolia lacks data for the 1970s and 80s. In the 1990s, we see that the copper price would have been relatively stable if Mongolia had pegged to a major currency. The monetary policy that it actually followed (classified as an independent float, but with a monetary aggregate target under an IMF-supported program as of 1999) led to a large increase in the nominal price of copper locally, and a large decrease in the real price (especially in 1996 and 1998).

The global aluminum market showed peaks in 1980, 1983, 1988 and 1995. Jamaica and Surinam are our two aluminum exporters (40% of total goods exports and 79%, respectively). Both have experienced high inflation. Both follow managed floats. Jamaica by devaluing managed to raise the local price of copper sharply in 1994-95 and 1998-2000. But it suffered declines in the real price in 1989-93 and 1996-98 that must have hurt the competitiveness of this industry. The latter decline would have been less severe if Jamaica had been pegged to a major currency. Similarly, Suriname also achieved, through devaluations, very sharp increases in the local price of aluminum in

1994-95 and 1999-2000, but suffered steady declines during 1980-1993 and 1996-98 that would have been less severe if it had been pegged to a major currency.

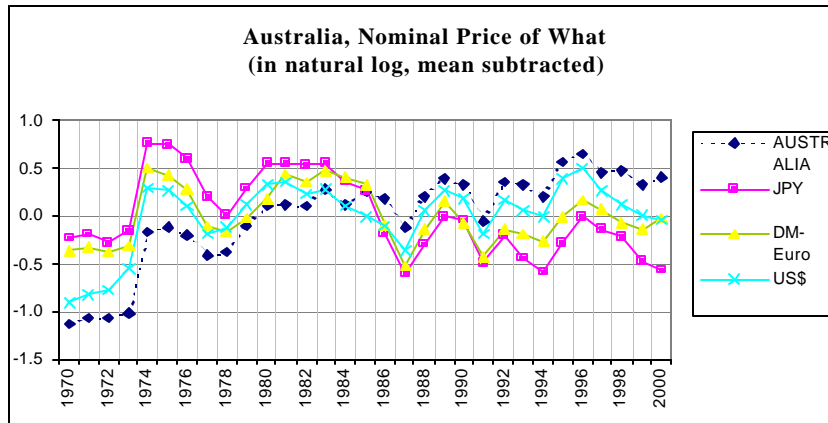
The world price of platinum has been relatively less variable than some of the other mineral prices, but for a large increase in the late 1970s and a sharp fall in 1981. The big exporter is South Africa. It succeeded with its actual exchange rate policies in stabilizing the local price of platinum somewhat, relative to what would have happened if it had pegged rigidly to a major currency.

Wheat and coffee prices

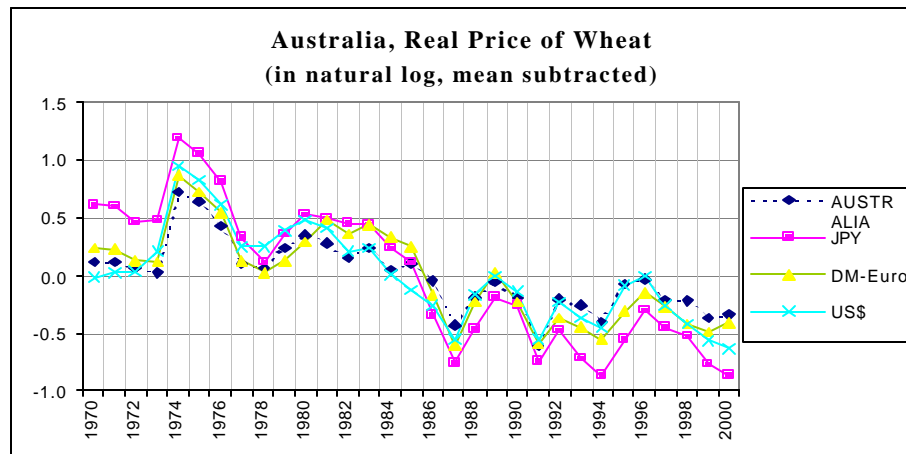
Let us turn from the minerals to consider two agricultural commodities. The world wheat market has experienced roughly four complete cycles since the early 1970s, featuring peaks in 1974, 1981, 1989, and 1996. (Figure 2a.) The variability has been highest in terms of yen, less in terms of dollars, and the least in terms of marks. Two countries have wheat exports that are more than 5 per cent of goods exports: Argentina (8%) and Australia (5 %). Argentina had a hyperinflation that was only vanquished at the end of the 1980s, definitively so in the convertibility plan of 1991. Turning to the statistics on the real price of wheat, we see that Argentina would have reduced real variability if it had pegged to the dollar (or mark) throughout, rather than only during 1991-2001. It would have not experienced very sharp peaks in 1975, 1982, and 1989, and the sharp drops that followed each. The steady decline in the dollar price of wheat that Argentina experienced during 1996-2000, on the other hand, would have been milder if it had been pegged to the yen or mark rather than the dollar. Australia achieved a more stable local real price of wheat with its flexible exchange rate than it would have experienced by pegging to a major currency, as Figure 2b shows.

Figure 2: Price of Wheat Simulated Under Alternative Currency Pegs

2 a.



2 b.



The world coffee market is especially volatile: a sharp rise in 1975-77 and sharp declines in 1978, 1987, and the late 1990s. The variance appears the greatest when the coffee price is expressed in terms of yen. But this statistic is dominated by the spike of 1977. In the last decade, the swings were greatest in terms of dollars (upward in 1993-97, and downward subsequently).

The list of countries specialized in coffee is long, and they rival the oil producers for concentration relative to exports or GDP. We focus on a set of thirteen: the five Central American countries, three in South America (Brazil, Colombia, and Peru) and five in Africa (Ethiopia, Tanzania, Kenya, Cameroon and Madagascar). All have coffee exports that exceed 4 per cent of goods exports, or 3 percent of total goods and services exports. Ethiopia is the leader, at 65 % of goods exports, followed by four of the Central American countries at 19-25 % of goods exports.

Nicaragua is the conspicuous hyperinflater in the group (1980s), though Brazil also qualified. Even in real terms, and even if the anomalous year of 1973 is excluded, Nicaragua would have had a more stable local real price of coffee if it had pegged to one of the major currencies. Most of the others, however, would have experienced variability in the local real price of coffee if they had pegged that was greater than, or similar to, what they actually experienced.

2. Implications of Alternative Currency Pegs for Export Quantities

We have seen what would have happened to the price of the principal export commodity under alternative pegs. But it would be desirable to go beyond that straightforward analysis. The relevant objective is not so simple as just minimizing variability in the real exchange rate. Rather, countries seek to maximize the long-run

growth rate, avoid financial crashes, etc. If the goal were simply to minimize the variability in the price of gold or oil, then pegging the currency to the price of gold or oil would automatically be the right answer. While we wish to consider this regime, we don't want to pre-judge its merits. It might be desirable to have some variability in the real price of the export commodity, if the price increases came during periods when the country most needed boosts to export revenue, e.g., to service debt.

Suppose we are willing to make some crude assumptions about the behavior of exports and output, particularly with regard to price elasticities. Then we can simulate what the path of the economy's international sector might have looked like with alternative exchange rates and prices, e.g., what would have happened if the country had been pegged to the dollar or to gold throughout the period, as opposed to following whatever exchange rate path it actually followed. We can simulate paths for exports, the trade balance, debt, debt service requirements, and reserves.

Our crude assumption will be that (1) for every one percent real depreciation of the local currency against major world currencies and commodities, exports in terms of dollars (or other major currencies) would have risen by one percent in that same year, and (2) GDP in terms of dollars would have been unchanged. The assumption that exports would have risen proportionately could be interpreted as arising from two premises: that the price of the exportable good is determined in terms of foreign currency (which seems the appropriate model at least for small countries that produce mineral or agricultural products¹²), and that the local elasticity of supply is one. This assumption is conservative

¹² If a substantial number of producers of a given commodity, representing a substantial fraction of global supply in that commodity, were simultaneously to implement the proposal to peg their currencies to the commodity, then we would have to recognize that the price would become endogenous. The results reported here are best understood as applying to regime decisions of an individual country.

in that it omits any effect whereby local residents respond to an increase in price by consuming less tradable goods and thereby leaving more for export (which is not unrealistic in the case of exports like gold or coffee where local consumption is relatively small, but *is* unrealistic for other products such as wheat and beef). It would be fairly easy to relax these assumptions. The second assumption, that GDP would be unchanged in dollar terms, is roughly justified by the logic of two offsetting considerations: the stimulus to export competitiveness would likely raise GDP in local terms, while the change in the exchange rate means that each unit of local output would translate into fewer dollars. If devaluations have contractionary effects on demand, this assumption might understate the increase in the export/GDP ratio. On the other hand, if there is a large positive Keynesian multiplier from exports to GDP, then our calculation might overstate the increase in the export/GDP ratio.

Specifically, the path of the real price of commodities under the five possible regimes is calculated as follows:

- Under actual history, $RP_x = S_{\$}^{lc} P_x^{\$} / CPI^{lc}$.
- Under a hypothetical dollar peg, $RP_x = (P_x^{\$} / CPI^{US}) (K_{\$})$.
- Under a hypothetical yen peg, $RP_x = (S_{\$}^Y P_x^{\$} / CPI^J) (K_Y)$.
- Under a hypothetical DM or euro peg, $RP_x = (S_{\$}^{DM} P_x^{\$} / CPI^G) (K_{DM})$.
- Under a hypothetical commodity peg, $RP_x = K_x$,

where $K_{\$}$, K_Y , K_{DM} , and K_x are constants calculated so as to make the log of the real price of the commodity on average over the 30 year period equal under each of the regimes to what it was in actual history.

Under each of the four hypothetical regimes, the path of exports is assumed to deviate from the actual history path in simple proportion to the deviation of the hypothetical real price from the historical real price. The percentage deviation relative to actual history is given by the following:

Under a hypothetical dollar peg,
$$d_{\$} = \log (P_{x}^{\$/} / CPI^{US}) / (S_{\$}^{lc} P_{x}^{\$/} / CPI^{lc}) + k_{\$}$$

$$= \log (1 / CPI^{US}) / (S_{\$}^{lc} / CPI^{lc}) + k_{\$} .$$

Under a hypothetical yen peg,
$$d_{Y} = \log (S_{\$}^{Y} P_{x}^{\$/} / CPI^{J}) / (S_{\$}^{lc} P_{x}^{\$/} / CPI^{lc}) + k_{Y}$$

$$= \log (S_{\$}^{Y} / CPI^{J}) / (S_{\$}^{lc} / CPI^{lc}) + k_{Y} .$$

Under a hypothetical DM or euro peg,
$$d_{DM} = \log (S_{\$}^{DM} P_{x}^{\$/} / CPI^{G}) / (S_{\$}^{lc} P_{x}^{\$/} / CPI^{lc}) + k_{DM}$$

$$= \log (S_{\$}^{DM} / CPI^{G}) / (S_{\$}^{lc} / CPI^{lc}) + k_{DM} .$$

Under a hypothetical export commodity peg,
$$d_{x} = \log 1 / (S_{\$}^{lc} P_{x}^{\$/} / CPI^{lc}) + k_{x}$$

We assume that the real depreciation of the currency will lead to the same percentage increase in exports. The hypothetical export can thus be calculated as:

$$\frac{X}{GDP} = \frac{X^{Actual} d}{GDP} \exp(\log X^{Actual} d)$$

where X is export, and GDP is actual GDP of the respective year. (This is the assumption that the supply elasticity is unity.)

Our primary interest is not in a comprehensive comparison of the path that the economy would have followed if pegged to the dollar with the actual path. To do so would leave out important considerations such as, on the one hand, the inflation-fighting benefits of pre-commitment to a dollar peg, and, on the other hand, the potentially stabilizing benefits of a discretionary monetary policy when the exchange rate is flexible. Our primary interest, rather, is in comparing the dollar path with the path under a peg to

gold or other candidates. We calculate, if the country had pegged to the yen instead of the dollar, what would have been the local currency price of commodities, and what would the effect on exports of movement in the local currency price of commodities. We do the same with a peg to the euro, represented during our historical period by the German mark. Then we see what would have happened to the exports of the commodity-producing country if the value of the domestic currency had been fixed in terms of that commodity, rather than in terms of a major currency. In each case, we calculate differences relative to a baseline of the actual path of exports, so as to allow fluctuations in the myriad other factors that determine exports in addition to prices.¹³

Gold exports

Burkina Faso's history shows a strong upward trend in exports from barely 6 percent of GDP in 1970 to more than twice that at times in the 1990s. Our discussion of prices already noted that Burkina Faso, with other CFA countries, underwent a real devaluation in 1994, which helped correct an overvaluation of the preceding decade. This real depreciation presumably contributed to the subsequent (small) increase in exports, peaking in 1997. More importantly, if Burkina Faso had been constrained from devaluing, as under a rigid peg to the mark/euro, then according to the simulation, the level of exports would have fallen sharply in 1994-97, to low levels not seen since the early 1970s. A rigid peg to the yen would have had the same effect. A dollar peg would have prevented the initial overvaluation from opening up, as the dollar depreciation of 1986-1993 would have boosted exports, but that favorable effect would have been

¹³ These and other results regarding the export simulations are available in detail at http://ksghome.harvard.edu/~jfrankel.academic.ksg/counterfactual/rank_price.html.

entirely reversed during the period of dollar appreciation, 1995-1999. Thus, overall, the path followed by Burkino Faso in the 1980s and 1990s looks better than the hypothetical path of pegging to a major currency.

A peg to gold looks better for Burkino Faso—the former Upper Volta—than a peg to any of the major currencies. It would have boosted exports over the period 1983 to 1993, by automatically depreciating the currency. There would have been a sharp reversal of this gain in 1994, because the necessary devaluation would have been prevented, the same as under any of the major currency pegs. There also would have been a recovery in the late 1990s. Overall, exports would have exhibited a better upward trend under a gold peg than under any of the alternative pegs to a major currency.

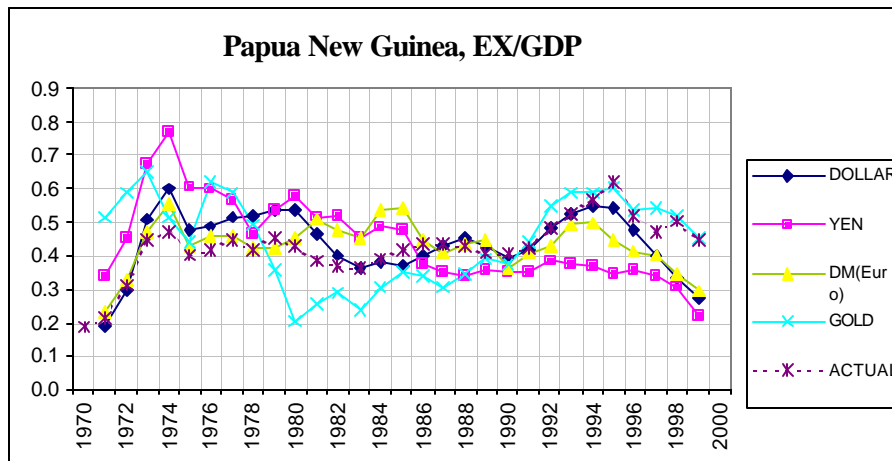
By the start of the 1980s, a gradual downward trend in Ghana's exports had left them at just a few percentage points of GDP (perhaps due in part to an overvalued currency). Over the subsequent decades, this adverse trend was reversed. The simulations show that if Ghana had pegged its currency to an external anchor, its exports would not have reached such a low level in the early 1980s, but would have been considerably more variable overall. Specifically, there would have been a sharp increase in exports that reached a high peak in 1982-83. This result holds even under the hypothesis of a gold peg, but holds more strongly for pegs to the major currencies, all of which depreciated against gold throughout the 1970s. The resulting increase in the early 1980s, and the subsequent reversal, would have been especially large if the peg had been to the yen. The upward trend in exports that Ghana actually experienced in the 1990s would have occurred as well under any of the alternative regimes. But it would not have been as strong if the country had been pegged to one of the major currencies. Only under

the gold peg would the upward trend have been comparable in magnitude to what Ghana actually experienced.

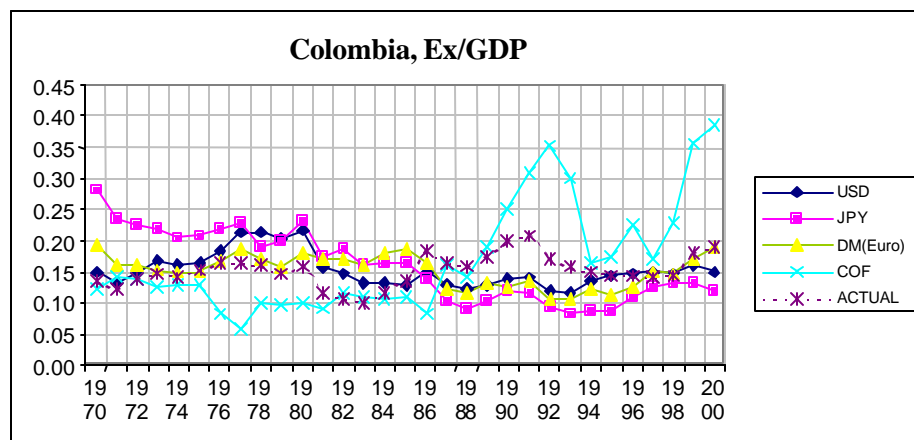
Papua New Guinea's exports were relatively stable in the 1970s and 1980s and moved upward in the 1990s, above 50 per cent of GDP in some years. (Figure 3a.) A peg to the dollar would not have been very different. A peg to the yen would have prevented the upward trend of exports from 1985 to 1994. A peg to gold would have induced steep drops in exports in the 1970s (when the gold price was soaring), but would have accentuated the upward trend subsequently.

Figure 3: Exports/GDP Simulated Under Alternative Pegs

3 a.



3 b.



South Africa's exports over the last three decades have fluctuated in the range of roughly 22 to 35 percent of GDP. The graph shows that South Africa's exports increased in the 1970s and declined in the early 1980s, mirroring the world gold price, and then returned to a gentle upward trend in the 1990s. A peg to the dollar would have engendered an upward trend in exports in the 1970s (while the dollar was depreciating), but a downward trend subsequently. A peg to the yen would have resulted in a downward trend throughout most of the period. A peg to gold would have had very different implications in the 1970s than subsequently. When the world price of gold rose sharply in the 1970s, if the South African rand had risen with it, then the loss of competitiveness would have dampened the rise in exports. This may not sound like an advantage, but the subsequent decades tested out the reverse proposition. Indeed, as the world price of gold followed a long downward trend in the 1980s and 1990s, a gold-pegged South Africa would have gradually gained competitiveness. The interesting thing is that this is true not only relative to the dollar peg, but also relative to the policy actually followed by South Africa. In other words, whatever flexibility has existed in the rand in recent years has not in practice been used to offset terms of trade shocks in the way that floating rates should in theory do automatically. At least, flexibility has not accomplished this purpose so well as a rigid gold peg would have done. Political reluctance to devalue may explain this result for South Africa, and for some other countries' experiences as well.

Similar patterns hold for Bolivia, Fiji, Guyana, Mali, Mongolia, and the other gold-producers on our list. In general, a peg to gold would have engendered losses of competitiveness and therefore declines in exports in the 1970s, but gains in competitiveness and gains in exports in the 1980s and 1990s. A peg to the dollar would have spurred competitiveness in the 1970s, but hindered it in the early 1980s and late

1990s. A peg to the yen would have contributed to a gradual loss of competitiveness during most of the period, until 1995. The story for the mark would have been broadly similar to the yen, though less extreme.

Oil exports

We turn next to oil producers. As already noted, rigid pegs to any external anchor would have eliminated the competitiveness gains that come from devaluation, such as the boosts to exports that were in fact experienced by Ecuador in 1999, Indonesia in 1998, Mexico in 1995, Nigeria in 1999 or Russia in 1998-99.

In the 1970s, many of the oil producers, such as Colombia, Ecuador, Indonesia, and Nigeria, would have experienced even bigger export booms than they did if they had been pegged to the dollar. A dollar peg would also have boosted the height of a plateau in Nigerian exports in 1996. A dollar peg for Mexico would have produced a long upward trend that was smoother, but otherwise similar in magnitude to other pegs.

There are periodic proposals that Southeast Asian countries ought to give more weight to the yen than they have in the past. A yen peg for Indonesia would have resulted in the same export booms in 1974 and 1980, but would have given a smoother path during the period after oil prices stabilized at a lower level in 1986. In the critical year 1998, the simulation results for any of the pegs eliminate the sharp upward spike in the ratio of exports to GDP that Indonesia's currency collapse in fact produced. But some would argue that if a very firm peg had been in place, that crisis might not have occurred at all. Thus the more relevant comparison is between the dollar peg and the yen peg. A yen peg would have produced some gain in competitiveness between 1995 and 1998, but the boost to exports looks small compared to the very big reduction in the early 1980s.

Of our seven oil exporters, Russia is the only serious candidate for pegging to the euro. The simulation shows that a firm peg to any of the three major currencies would have turned the historical decrease in Russia's exports/GDP during 1994-1997 into a gain, presumably because it would have reduced Russian inflation and thereby achieved a real depreciation. Perhaps the Russian devaluation and default of 1998 could have been avoided altogether. But, again, the interesting comparison is across pegs. A peg to the DM would not have produced the same 1998 peak in exports or subsequent reversal that a hypothetical yen peg would have produced. But if Russia had been tied to the euro in 1999-2000, it would have shared in that currency's depreciation and thus increased exports.

A peg to the price of oil would have had a negative effect on all oil exporters in the 1970s. Exports in Venezuela, for example, would have reached lows by 1979 that were more extreme than any other regime or year. But an oil peg would have had mostly positive effects on exports thereafter (exceptions are the years 1986 and 2000). In the critical year 1998, an oil peg would have boosted Colombia's exports to almost 30 percent of GDP, Ecuador's and Venezuela's over 40 percent, Mexico's and Russia's over 50 percent (even without discrete devaluations), and Nigeria's over 100 percent. These are striking results, as all these countries were severely affected by international financial turmoil that year, and were desperate for higher foreign exchange earnings. Only for Indonesia would the increase in oil exports in 1998 have been smaller under an oil peg than the even larger increase that it in fact experienced, because it would have foregone the very large devaluation of that year.

Among the grains of salt with which the findings must be taken is the caveat that those countries that are members of OPEC (Ecuador, Indonesia, Venezuela and Nigeria),

probably could not have taken full advantage of the simulated depreciation without violating their OPEC oil quotas. On the other hand, OPEC's real power over this set of countries is questionable. Furthermore, when such countries are hurt by international conditions, including low world oil prices, additional dollars earned through boosts to their non-oil exports (included in these export simulations) are at least as useful as dollars earned through oil exports.

Exports of other minerals

Our two silver producers, Bolivia and Peru, experienced no particular overall trends in their exports over the period 1985-2000. Bolivia experienced an export contraction in 1999-2000, however. The simulations indicate that a firm dollar peg would not have altered this picture much. A yen peg would have added some waves in both countries, including a positive effect on exports over 1995-98 but the reverse in 1999. A peg to the price of silver would have added some more waves: an upswing from 1988-91 and downswings in 1992-94 and 1997-99.

Chile, our leading copper exporter, experienced an upward trend in exports as a share of GDP, presumably related to a free-trade policy. The simulation indicates that the sharp rise of 1973-74 would have instead been a sharp fall if Chile had been rigidly pegged to any of the three major currencies, because it would have lost the ability to devalue, and it would also have missed out on a rise in the late 1980s. If the Chilean peso had been fixed to the price of copper, it would have experienced a strong upward increase in exports during the period 1994-1999, which would have been very useful given the pressures on emerging markets at that time.

Of our two aluminum producers, Jamaica has over the three decades achieved more increases than decreases in exports, and Suriname the reverse. But both countries suffered a decline in their export ratios in 1993, for example, and a fall in the real price of aluminum may be part of the reason. These countries were sufficiently closely tied to the dollar over the period 1970-1983 that a rigid dollar peg would have made little difference. But subsequently, a dollar peg would have given a smoother export path to Jamaica. The catastrophic trough in exports that Suriname had hit by 1993 would have been postponed by one year if the country had been pegged to a major currency; but the low simulated export levels during 1994-1998 – a consequence of the inability to devalue – would have been poorly timed, in light of financial pressures in emerging markets.

Our platinum producer is South Africa. A peg to the price of platinum would have imposed substantial export troughs in 1979, 1988, 1994, and 1999, but substantial boosts in 1992 and 1998.

Exports of two agricultural products

We now return to our three wheat-producers. Argentina's ratio of exports to GDP has long and famously been low. It has had a gradual upward trend, but with occasional severe downturns, particularly in 1975, 1980, and 1992. The high inflation rates, including hyperinflations, in the 1970s and 1980s make it difficult during that period to compare actual exports to what would have prevailed under a peg. A monetary stabilization was accomplished in 1990, and was locked in in 1991. Exports fell sharply from 1989 to 1992, as the real appreciation of the peso (initially attributable to residual inflation) left it overvalued in real terms, and then gradually recovered from 1993 to

1997, before suffering anew when its trading partner Brazil devalued in January 1999. According to the simulation, exports would have experienced a strong upward trend over 1989-2000 under each of the alternative pegs.

The reader might wonder why the result for the dollar peg in the 1990s differs from the actual path followed by Argentina, since the convertibility plan was precisely a tight peg to the dollar. The answer is that all our simulation results hypothesize that the local inflation rate (in this case Argentina's) converges instantaneously and fully to the inflation rate of the country of the anchor currency, in this case the United States. The experiment is thus designed to capture a fully credible and complete monetary integration. This was not exactly Argentina's experience. A currency board, while it is a meaningful political commitment, falls far short of a fully credible currency peg, as the interest rate premiums paid by Argentina in the 1990s and the occurrence in December 2001 of the long-feared collapse of the peso illustrate. Furthermore, the problem was not lack of sincerity or determination on the part of the implementers of Argentina's currency board. Nevertheless, price levels did not in fact converge.¹⁴ Thus the immediate gain in exports that the graph shows for the dollar peg during 1989-1990 probably should not be interpreted as an alternative that was available to Argentina in the short run.

The comparison of results *among* the four candidate pegs over the decade is genuinely illustrative of what might have happened if our agricultural producers had chosen alternative regimes. Upswings in exports resulting from a dollar peg would have been larger under a yen peg (in particular, during 1995-98). But they would have been followed by downturns (particularly in 1989 and 1995). In the fall of 1998, the temporary

¹⁴ Hong Kong's experience with its currency board indicate that having an open, flexible and debt-free economy is not enough to achieve full convergence of inflation rates.

reversal of a period of yen depreciation would presumably have been difficult for a yen-pegged Argentina, as it headed into what was to prove to be its period of maximum stress. A tie to the mark, or its successor the euro, would presumably have looked better during this critical period. But the graph indicates that a peg to the price of wheat would have performed the best. It would have provided the maximum increase in exports over the decade, including the critical years beginning in 1999. This is of course a consequence of the fact that world agricultural prices were depressed in the latter part of the 1990s, especially in terms of dollars. It is perhaps not a coincidence that this was a period of crisis for Argentina, as agricultural products together make up a substantial share of its exports. This simulation seems to make a strong case for pegging to the price of the export commodity.

Australia is an interesting case, because it is a major exporter of agricultural and mineral products, and follows a floating exchange rate that is often justified as a useful mechanism for accommodating terms of trade shocks. For example, it has been claimed that Australia was spared the worst of the East Asian crisis because its currency automatically depreciated along with world market conditions for its exports, and it has even been proposed that countries like Argentina should use the Australian dollar as an anchor because it is a proxy for commodity prices. Our simulation suggests that Australia's path over the last three decades would not have been all that different if it had been rigidly pegged to the dollar. (The largest differences would have been gains of competitiveness in 1974 and a loss in 1985.) A yen peg would have imposed a long downward trend. A mark peg would have sharpened the 1984 and 1997 gains in competitiveness. If the Australian dollar had been pegged to the price of wheat, its exports would have been considerably more volatile, but with an upward trend, featuring

unusually sharp increases in exports in 1987, 1991, 1994 and 1997. The Australian dollar may in fact be a very imperfect proxy for the price of wheat or other commodities.¹⁵

We conclude with our coffee producers. The sharp rise in world coffee prices in 1975-77 showed up as increases in exports in the case of the Central American countries; for the others coffee was probably not a large enough share of their exports. The sharp price decline in 1987 seems to show up as a fall in exports in some countries (e.g., Colombia, shown in Figure 3b). A currency peg would have prevented Brazil boosting exports via devaluation in 1999 and Colombia in 1999. But a peg to coffee would have induced large swings in every one of the coffee-exporters: export crashes in 1977 and 1994, and particularly sharp export rises in 1992 and the period 1997-2000. While the lesson may be that coffee prices are too volatile to make a suitable peg, the stimulus afforded by pegging to a depreciating coffee standard in the late 1990s would have been very well-timed.

III. Conclusion

The array of countries, commodities and currencies studied here is too diverse to allow a succinct summary of the export results. But it may be instructive to consider a cross-section of experiences in the late 1990s, a time of global financial pressures. Whatever the degree of exchange rate flexibility with which our countries entered this period, most gave more weight to the dollar than to other possible anchors. As a result, the appreciation of the dollar in the late 1990s added to their difficulties. During this period, a link to the DM/euro or yen would have done better. But that is largely

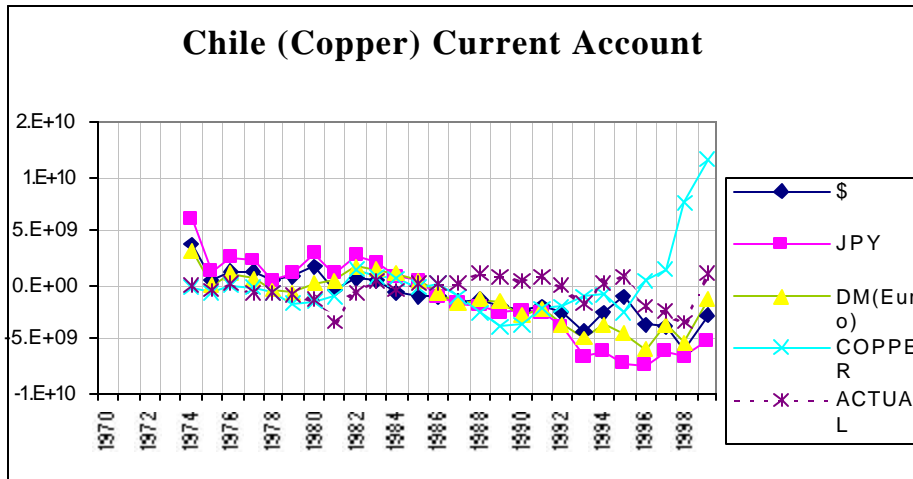
¹⁵ Chen and Rogoff (2002) find that commodity prices explain a statistically significant

coincidence. More interesting is what would have happened if they had pegged to the price of their leading mineral or agricultural export commodity. Because the prices of aluminum, coffee, copper, gold, oil, and wheat were depressed in the late 1990s, a peg to these commodity prices would have enhanced competitiveness. If the countries that were specialized in the production of these commodities had pegged their currencies to those prices, they would have boosted their exports at just the right time, when they needed to improve their trade balances and debt/export ratios. This result is not entirely coincidence, in that weak commodity prices, especially in terms of dollars, were an important component of the 1997-99 wave of crises in emerging markets, as it had also been in the international debt crisis of 1982. [We have also simulated the implications of the alternative regimes for current accounts and debt/export ratios. As examples, Figure 4a shows the current account results for copper-exporter Chile and Figure 4b for coffee exporter Kenya. Figures 5a and 5b illustrate the debt/export simulations for oil-exporters Indonesia and Nigeria.]¹⁶

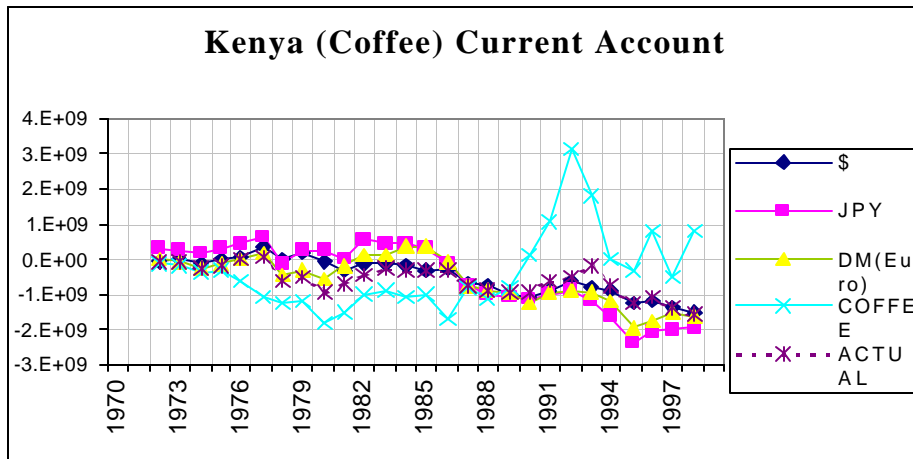
fraction of movements in the Australian dollar, but far from all.

¹⁶ Graphs of all the current account and debt/export simulations, and further details, are available in Frankel (2002), or electronically at http://ksghome.harvard.edu/~jfrankel.academic.ksg/counterfactual/rank_price.html.

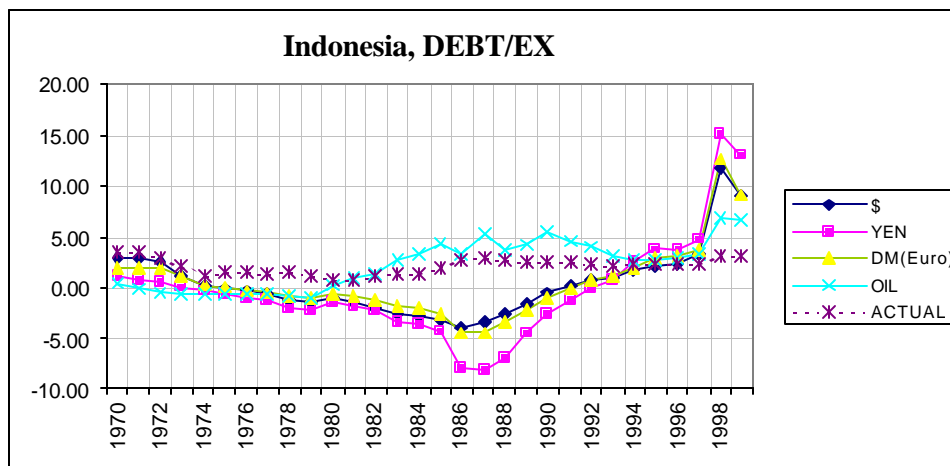
4 a. Current Account for Copper Producer Chile



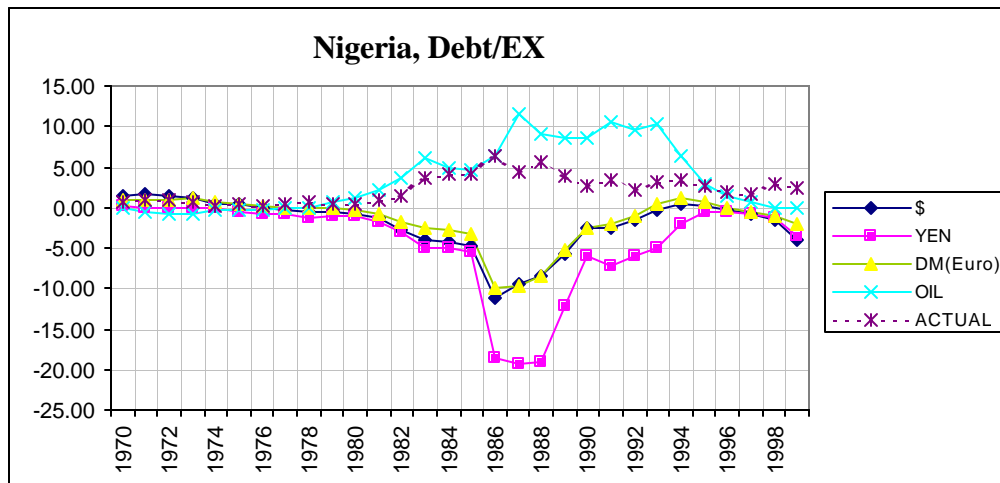
4 b. Current Account for Coffee Producer Kenya



5 a. Debt/Export for Oil Producer Indonesia



5 b. Debt/Export for Oil Producer Nigeria



Not all countries will benefit from a peg to their export commodity, and none will benefit in all time periods. One must go through the welter of simulation results developed in this paper to get a feeling for the variety of outcomes that is possible. Nonetheless, the results are suggestive. What they suggest is that, especially for countries specialized in a mineral or agricultural export commodity, the proposal that they peg their currency to their export commodity deserves to take its place alongside pegs to major currencies and the list of other monetary regimes available for countries to consider.

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On http://ksghome.harvard.edu/~jfrankel.academic.ksg/counterfactual/rank_price.html can be found more comprehensive sets of tables and figures I through V, including technical appendices.

Table Set I.

Statistics on countries specialized in the production and export of gold or other mineral or agricultural products (with detailed explanation in appendices) --

Figure Set II.

Actual and calculated paths of price of the export commodity under alternative hypothetical currency peg assumptions

Table Set III.

Statistics on variability of commodity price under alternative currency peg assumptions

Figure Set IV.

Simulated path of Export/GDP under alternative peg assumptions.

Figure Set V (a)

Simulated path of Debt/Export under alternative peg assumptions.

Figure Set V (b)

Simulated path of Current Account under alternative peg assumptions.

Titles of Tables and Figures:

Table (1): Variability of Commodity Price in Local Currency for Aluminum Exporters
(a) Nominal Price (b) Real Price

Table (2): Variability of Commodity Price in Local Currency for Coffee Exporters
(a) Nominal Price (b) Real Price

Table (3): Variability of Commodity Price in Local Currency for Copper Exporters
(a) Nominal Price (b) Real Price

Table (4): Variability of Commodity Price in Local Currency for Gold Exporters
(a) Nominal Price (b) Real Price

Table (5): Variability of Commodity Price in Local Currency for Oil Exporters
(a) Nominal Price (b) Real Price

Table (6): Variability of Commodity Price in Local Currency for Platinum Exporters
(a) Nominal Price (b) Real Price

Table (7): Variability of Commodity Price in Local Currency for Silver Exporters
(a) Nominal Price (b) Real Price

Table (8): Variability of Commodity Price in Local Currency for Wheat Exporters
(a) Nominal Price (b) Real Price

Figure 1: Price of Gold Simulated Under Alternative Currency Pegs
(a) Price of Gold for South Africa (nominal)
(b) Price of Gold for South Africa (real)

Figure 2: Price of Wheat Simulated Under Alternative Currency Pegs
(a) Price of Wheat for Australia (nominal)
(b) Price of Wheat for Australia (real)

Figure 3: Exports Simulated Under Alternative Currency Pegs
(a) Exports/GDP for Gold-Producer Papua New Guinea
(b) Exports/GDP for Coffee-Producer Colombia

Figure 4: External Balance Simulated Under Alternative Currency Pegs
(a) Current Account for Copper Producer Chile
(b) Current Account for Coffee Producer Kenya

Figure 5: Debt/Export Ratio Simulated Under Alternative Currency Pegs
(a) Debt/Export for Oil Producer Indonesia
(b) Debt/Export for Oil Producer Nigeria