SHOULD **GOLD EXPORTERS** PEG THEIR CURRENCIES TO GOLD?

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of Capital Formation and Growth

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Should Gold-Exporters Peg Their Currencies to Gold?

A study for the World Gold Council
by Jeffrey Frankel

Summary

The debate over the best choices of monetary standards and exchange rate regimes for developing countries is as wide open as it has ever been. 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 are dangerous when the dollar appreciates relative to other export markets. Money targeting doesn't work when there is a velocity shock. CPI targeting is not viable when there is a large import price shock. And the gold standard fails when there are large fluctuations in the world gold market.

Or does it? For most countries, a peg to gold translates extraneous fluctuations in world gold market conditions into needless fluctuations in local monetary conditions. But what about a country that happens to be specialized in the production of gold? For such a country, a depreciation of the currency when there is a fall in the world gold price is not an extraneous disturbance, but is precisely what is wanted. The real depreciation of the local currency stimulates production and export of gold and other commodities, just at the time when world market conditions are negative. The resulting amelioration of lost export revenue reduces the chance of a balance of payments crisis. The gold peg thus "hard-wires" the accommodation of terms of trade shocks that floating rates promise in theory but deliver only imperfectly in practice. The gold exporter gets the best of both the fixed and floating worlds: a nominal anchor and automatic adjustment to terms of trade shocks.

Only a small number of African countries have a ratio of gold to total goods exports as high as 40%. (Over the period 1979-1996, Burkina Faso's exports of gold averaged 40% of merchandise exports, according to IMF statistics. More recently, in 1997, Ghana and Mali registered shares almost that high). But the same idea could be applied to other commodities. Nigeria, Venezuela and Ecuador could peg their currencies to the price of oil. Ethiopia could peg its currency to the price of coffee. And so on. A country that exports a variety of mineral products could peg its currency to a corresponding basket of prices.

This study explores the idea that countries specialized in the export of gold or some other commodity could peg their currency to that commodity. (It is possible that this proposal would require a change in the IMF Articles of Agreement.)

The paper begins with a review of the issues. It then turns to a set of counter-factual experiments, as follows. For each of a list of gold-producing countries, what would have happened, over the last 30 years, if it had pegged its currency to gold, as compared to the dollar, yen, or mark, or as compared to whatever it actually did? We compute what would have happened to the price of gold in local terms under each of these scenarios. With very simple assumptions about elasticities, we then simulate what would have happened to total exports, under each scenario. With further simplifying assumptions, we also simulate what would have happened to such indicators of financial health as the debt/export ratio. In addition to looking at gold and gold-exporters, we also examine oil, silver, copper, aluminium, platinum, wheat and coffee, and the countries that are specialized in producing them.

An example illustrates. Imagine that Argentina, instead of following the convertibility plan that during 1991-2001 tied the peso to the US dollar, had pegged its currency to the price of a commodity such as wheat. Then the peso would have automatically depreciated in the latter half of the period instead of appreciating. Exports would have been boosted, and the Argentine crisis of 1999-2002 might never have occurred. The late 1990s were a time of severe financial pressure on most developing countries. Perhaps not coincidentally, it was also a time of weakness in commodity prices. If South Africa had been pegged to gold, Nigeria to oil, Jamaica to aluminium, Chile to copper, Colombia to coffee, Mauritania to iron ore, Mali to cotton, and Guinea-Bissau to peanuts (groundnuts), each of these countries would have seen their currencies depreciate at precisely the time when they most needed the boost to exports. This result would have obtained automatically — as is supposed to happen with a floating exchange rate — and yet without having to give up the benefits of a nominal anchor.

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, for countries specialized in a mineral or agricultural export commodity, the proposal that they peg their currency to that commodity deserves to take its place alongside dollar pegs and the other monetary regimes that countries consider.

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Introduction

Among the many travails of developing countries in recent years have been fluctuations in world prices of the commodities that they produce, especially mineral and agricultural commodities, as well as fluctuations in the foreign exchange values of major currencies, especially the dollar, yen, and euro. Some countries see the currency to which they are linked moving one direction, while their principal export commodities move the opposite direction. Immersion in stormy seas is likely to be the outcome, for someone who has a foot planted on each of two boats that are moving away from each other.

Consider the difficult position of Argentina, the victim of the worst emerging market financial crisis of 2001. As is well-known, Argentina's "convertibility plan," a rigid currency board, was very successful at eliminating very high inflation rates when it was first instituted in 1991, but later turned out to be unsustainably restrictive. Perhaps it would have been impossible in any case to obey constraints as demanding as the straitjacket of the currency board. But Argentina's problems in the late 1990s became especially severe because the link was to a particular currency, the US dollar, that appreciated sharply against other major currencies, beginning in mid-1995 . At the same time, the market for Argentina's important agricultural export products (wheat, meat, and soybeans), declined sharply. Thus the declines in the prices of these commodities expressed in terms of dollars were particularly dramatic. The combination led directly to sharp increases in the ratio of debt to exports. Although the particular strong dollar episode was not predictable when the currency regime was adopted in 1991, the likelihood that large swings of this sort would eventually occur was predictable. This is because the correlation is low between the value of the dollar and the value of commodities (expressed in some common numeraire). It was only a matter of time until they went sharply in opposite directions.[1]

Argentina's dire difficulties have encouraged some to reconsider whether a currency board is a good idea after all (and others to wonder if Argentina should go all the way to full dollarization). But perhaps more thought should be given to *what* anchor the peso has been pegged to, rather than the tightness of the peg.

Consider on the other hand, Chile, a country where exports of metals, particularly gold and copper, are important. World prices of these products fell sharply in 1997. The decline in prices was particularly strong when expressed in terms of dollars, for the same reason we have just seen: the dollar appreciated between 1995 and 1997. But, while the strong dollar was wreaking havoc on Argentina, Thailand, and other countries linked to the dollar, Chile was in a much better position. The Chilean peso was linked to a basket of currencies (dollar, yen, mark), and so automatically depreciated against the dollar. As a consequence, the adverse effects on its exports and its debt ratios was much less severe than the effects suffered by the dollar peggers.[2]

The advantages and disadvantages of various exchange rate regimes — fixed versus floating as well as various other places along the spectrum — are far too numerous to be readily captured and added up in a single model. The academic literature is very large.

Part I of this paper will review the arguments briefly.

Less thoroughly explored is a more finite question: conditional on the decision to peg (with whatever degree of firmness) to a particular anchor, what difference does it make what that anchor is, whether it is (1) one currency such as the dollar, versus (2) another currency such as the yen, versus (3) a basket of currencies, versus (4) one commodity like gold, versus (5) a basket of commodities?

Monetary theorists have in the past emphasized a particular argument in favour of regimes that fix the value of money: as a means for the central bank to establish a credible commitment against inflation. This argument usually leaves out the question whether one means of fixing the value of the money is superior to another. It is as if it doesn't matter whether the anchor is the dollar or the Swiss franc or gold, or any other stable currency or commodity. The present study argues that the choice of anchor can make an important difference. Lithuania can get into trouble if it links its currency to the dollar, when most of its trade is with Europe; the euro would be better, because so much of Lithuania's trade is with the European Union. Argentina might be better off pegging to a basket of foreign currencies, or a basket of agricultural commodity prices, than pegging to the dollar. Ghana might be better off pegging to gold. Chile might be better off pegging to copper.

The questions to be examined in this study are as follows:
What is the appropriate exchange rate regime for a country that is specialized in a particular mineral or agricultural commodity, such as gold or oil? What are the arguments in favour (and opposed to) a gold peg, reconsidered from the viewpoint of an individual gold-producing country? What about other mineral commodities?
For each of a list of major developing countries (especially producers of gold or other commodities), how would its export competitiveness and financial health have been affected over the last twenty years by alternative currency pegs: to gold, to other commodities, to the dollar, to the euro, or to the yen, as opposed to the currency regime that it actually followed? (Measures of financial health include the ratio of debt to exports.)

I. Pros and Cons of Different Exchange Rate Regimes

Much has been written on the arguments for fixed exchange rates, versus floating exchange rates, versus intermediate alternatives. [3] We summarize the arguments briefly here, though elaborating on the nominal anchor argument for fixing the value of a currency.

Arguments for Flexible Exchange Rates

There are a variety of advantages to flexible exchange rates: allowing the central bank to follow a counter-cyclical monetary policy (even with internationally integrated financial markets), automatic accommodation of terms of trade shocks, giving the government clear lender-of-last-resort capacity to rescue failing banks and the revenues from seigniorage, and avoiding the damaging speculative attacks that currency pegs have been prone to in recent years. Of these, monetary independence has traditionally been considered the most important. But the last few decades have seen widespread disillusionment, both among academics and practitioners, with the proposition that governments are in practice able to use discretionary monetary policy in an intelligent and useful way.[4] This is particularly true in the case of developing countries. As a consequence, the trend in the 1990s was away from government discretion in monetary policy and toward the constraints of nominal anchors, which are discussed below, and central bank independence.

The argument that floating exchange rates automatically accommodate adverse movements in world market conditions has held up better. Some have argued, for example, that Australia and Singapore were the two Asian/Pacific countries to come through the 1997-98 Asian crisis in relatively good shape because their currencies were free to depreciate automatically in response to the deterioration of their export markets. Canada and New Zealand, like Australia, are said to be commodity-exporting countries with floating currencies that automatically depreciate when the world market for their export commodities is weak.[5] Still, floating rates do not always work this well.

Arguments for Fixed Exchange Rates

There are also a variety of advantages to fixed exchange rates: facilitating international trade and international investment by reducing transactions costs and exchange risk premia, avoiding the speculative bubbles that floating exchange rates seem occasionally to experience, and foreswearing competitive depreciation or competitive appreciation. But in recent decades, the leading argument for firmly fixing exchange rates is as a credible commitment by the central bank, to affect favourably the expectations of those who determine wages, prices, and international capital flows by convincing them that they need not fear inflation or depreciation. The desire for a credible commitment to a

stable monetary policy arose as a reaction to the high inflation rates of the 1970s, which in the 1980s reached hyperinflation levels in a number of developing countries. But fixing the value of the domestic currency in terms of foreign currency is not the only way that a country can seek a credible institutional commitment to non-inflationary monetary policy. Fixing the value of the currency in terms of gold is another way to seek such credibility – the classic argument for the gold standard. And there are other ways as well.

The Argument for a Nominal Anchor

A gold standard is one of a number of possible nominally anchored monetary regimes. Others include monetarism, inflation targeting, nominal income targeting, and currency boards or other firm exchange rate pegs. In each case, the central bank is deliberately constrained by a rule setting monetary policy so as to fix a particular magnitude – the price of gold, the money supply, the inflation rate, nominal income, or the exchange rate. Monetary policy is automatically tightened if the magnitude in question is in danger of rising above the pre-set target, and is automatically loosened if the magnitude is in danger of falling below the target. The goal of such nominal anchors is to guarantee price stability.

Sovereign governments have been debasing their currencies through excessive money creation and inflation since the invention of fiat money. Inflationary episodes were a particular concern of the 20th century. Why do governments go down this road? One motive is seigniorage: governments get to spend the money that they print. A government that feels it needs to spend a certain amount, e.g., to pursue military endeavours, and cannot finance it by taxation or borrowing, may instead turn to the alternative of printing money. The other motive is to stimulate the national economy. A monetary expansion can have the effect in the short run, before it is fully reflected in inflation, of reducing real interest rates and thus stimulating national output and employment.

The advantages of monetary expansion eventually wear off, however. As public expectations adjust to higher levels of inflation, so does the behaviour of firms, investors, and workers. The government must print money continuously just to keep up with expectations. In the long run, only the disadvantages of high rates of inflation remain.

Many central banks would like to convince their citizens to expect no inflation. Without high expectations of inflation, workers will ask for lower wages, firms will accept lower prices, and investors will demand lower interest rates. As a consequence, the central bank can achieve any given level of output and employment with a low rate of money creation and inflation. The question is how to convince the public to lower its expectations of inflation. The day is past when it is enough for the central bank to proclaim its firm intention to pursue a low rate of money creation and inflation. Such announcements are not necessarily considered credible.

Governments can achieve credibility by being seen to tie their hands in some way so that in the future they cannot follow expansionary policies even if they want to. Otherwise,

they may be tempted in a particular period (such as an election year) to reap the short-run gains from expansion, knowing that the major inflationary costs will not be borne until the future. A central bank that would like to constrain itself, so that in the future it can resist the political pressures and economic temptations of expansion, is like Odysseus in the Greek myth. As his ship was approaching the rocks from where the seductive Sirens lured weak-willed sailors to their doom, Odysseus had his sailors tie him to the mast.

How can a central bank make a binding commitment to refrain from excessive money creation? It can tie its hands by a rule, a public commitment to fix a nominal magnitude. As already noted, popular magnitudes for this nominal magnitude, or anchor, include the money supply, the price level or inflation rate, the price of gold, or of a basket of commodities, nominal GDP, and the exchange rate.

Preventing excessive money growth and inflation is the principle "pro" argument for fixing the price of gold or some other nominal anchor. What, then, are the "con" arguments? The overall argument against the rigid anchor is that a strict rule prevents monetary policy from changing in response to the needs of the economy. The general problem of mismatch between the constraints of the anchor and the needs of the economy can take three forms: (1) loss of monetary independence, (2) loss of automatic adjustment to export shocks, and (3) extraneous volatility. First, under a free-floating currency, a country has monetary independence. In a recession, when unemployment is temporarily high and real growth temporarily low, the central bank can respond by increasing money growth, lowering interest rates, depreciating the currency, and raising asset prices, all of which to mitigate the downturn. Under a pegged currency, however, the central bank loses that sort of freedom. It must let recessions run their course. The second point is that even if the central bank lacks the reflexes to pursue a timely discretionary monetary policy, under a floating exchange rate a deterioration in the international market for a country's exports should lead to an automatic fall in the value of its currency. The resulting stimulus to production will mitigate the downturn even without any deliberate action by the government. Again, this mechanism is normally lost under a rigid nominal anchor.

A third consideration makes the pegging problem still more difficult. If a country has rigidly linked its monetary policy to some nominal anchor, exogenous fluctuations in that anchor will create gratuitous fluctuations in the country's monetary conditions that may not be positively correlated with the needs of that particular economy.

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 wreak havoc on a country's monetary system, its own Achilles heel.

- 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 vulnerability is fluctuations in the public's demand for money or in the behaviour of the banking system 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.[6] 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.

- The need for robustness with respect to import price shocks argues for the superiority of ***nominal income targeting*** over inflation targeting.[7] A practical argument against nominal income targeting that is important for developing countries is problems of timely measurement. Particularly for developing countries, the data are often 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 upswings in the price level of similar magnitude. Thus the system did not in fact guarantee price stability.[8]

- 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.[9] 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 wheat 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 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, Lithuania and Argentina. 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.

This study will argue that for those small countries that want a nominal anchor and that happen to be concentrated in the production of gold, a peg to gold may in fact make perfect sense. For them fluctuations in the international value of their currency that follow from fluctuations in world gold market conditions would not be an extraneous source of volatility. Rather they would be precisely the sort of movements that are desired, to accommodate exogenous changes in the terms of trade and minimize their overall effect on the economy. In these particular circumstances, 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. Similar reasoning applies for countries that happen to be concentrated in the production of some other agricultural or mineral commodity. A country that exports a variety of commodities could peg to a basket of their prices.

Consider further the case of pegs to the dollar or other major currencies. Each of the currency crisis victims listed above (1994-2001) has since abandoned its links to the dollar or to the basket that included the dollar — as have Chile, Colombia and others – in favour of greater flexibility. Nevertheless, they continue to exhibit a fear of floating.[10] Meanwhile, Ecuador has dollarized, and some economists urge that other countries as well should move in this direction. Some argue that either corner – free floating or firm fixing – is in general superior to the intermediate regimes, but others argue that the intermediate regimes are still often appropriate. Few countries are comfortable that they have found the right answer. Alternative suggestions are still welcome.

The aim of the present study is not to continue the extensive debate on the relative desirability of firm pegs versus free floating versus various intermediate regimes. Rather the aim is to address the question: given a degree of commitment by a country to fix the value of its currency, what anchor should it use? This question is particularly well illustrated not by those who have abandoned pegs for enhanced flexibility, nor even by those who have moved in the opposite direction, but rather by those (few) who have moved from one rigid peg to another. Lithuania – while retaining a currency board arrangement – responded to the difficulties created by the late-1990s appreciation of the dollar by switching from a dollar anchor to the euro. Argentina also debated some sort of switch. Economy Minister Cavallo, in 2001 before his resignation and the abandonment of the convertibility system, had announced an eventual move to a currency board with an anchor defined as a basket of one half dollar and one half euro. In both cases, a large part of the motivation was an overvaluation stemming from the late-90s appreciation of the dollar.[11]

This study differs from most research on currency regimes by giving consideration to a different sort of alternative: using gold or other commodities as the anchor. It has been many years since any country pegged its currency to gold or silver. (Proposals for pegs to a more complete basket of commodities, such as Graham (1937) or Hall (1982) have never been tried.) As mentioned, those who in recent times have proposed a gold peg, or broader commodity standard, generally have in mind the United States or a few other large industrialized countries leading the way, with other countries following suit. It is intended as a global monetary standard, as it once was.[12] But this study instead considers the possibility of pegging to gold or other commodities from the standpoint of a single small country.

To cite the problems created by dollar appreciation is not to say that all countries should move away from the dollar toward something else. For one thing, the strong dollar of 1996-2001 is a transitory phenomenon. From 1988 to 1995 the dollar was weak, and it will no doubt one day be weak again. When that happens, it will be the countries that are pegged to the euro that will lose competitiveness. The relevant question is the choice of regime for the longer term, when it is not known which currencies will be weak and which strong, but it is only expected that swings in both directions will eventually occur.

How to Weigh up the Costs vs. the Benefits

No single exchange rate regime is appropriate for all countries. The right choice for any

country depends on its particular circumstances. These propositions apply not only to the decision whether to peg or float, but also to the decision regarding to what currency a pegging country should peg.
We briefly review two frameworks for adding up the costs and benefits of alternative regime choices facing a country. The emphasis here is now on the choice between one currency or commodity peg versus another, not just on pegging versus floating. In a world where the prices of the major currencies and commodities are all fluctuating vis-à-vis each other, to peg to any one of them of course means to float against the others.

Optimum Currency Area Criteria

The traditional OCA criteria weigh the costs and benefits mainly as they pertain to trade and cyclical fluctuations. The advantage of pegging to the currency of a particular country is that it eases trade with that country. This advantage will be large if trade with that particular partner is naturally large, for example if it is a large neighbour. The disadvantages have to do with the constraint imposed by subordinating one's monetary policy to that of the other country. The domestic country loses the ability to respond to asymmetric shocks – cyclical fluctuations that are imperfectly correlated with those of the other country. The disadvantage of fixing to the partner will be small if asymmetric shocks are rare, or if the domestic country has alternative ways of adjusting to the shock other than monetary expansion or devaluation. (Such alternatives include ease of migration of labour across borders, between countries that are at different points of the business cycle.)

Asymmetric shocks are more likely to be rare if the two countries produce similar commodities or if they trade a lot with each other.[13] Thus two countries that have strong trade links (or strong links of labour mobility) are more likely to find that the advantages of fixing the exchange rate between them outweigh the disadvantages of giving up monetary independence.

An analogous proposition holds for the commodity composition of exports. Fixing the value of one's currency in terms of a commodity like gold carries the advantage of convenience and risk reduction if that commodity is a major product of the country. At the same time, the disadvantages of giving up monetary independence are less if the anchor is the price of the major export commodity. A period when the world market for the country's product turns down is precisely the time when it needs a real depreciation of its currency to mitigate the loss in demand; such a real depreciation will take place automatically if the currency is pegged to the price of the commodity in question.

Modern Credibility Criteria

The traditional Optimum Currency Area framework has more recently been supplemented by an additional set of criteria to determine whether a particular country is well suited to the constraints of a fixed exchange rate. A response to the experience of the crises of the 1990s, the new criteria have to do with stability in financial markets and credibility in the eyes of speculators, rather than stability in goods markets and credibility

in the eyes of price-setters. Some of the criteria are determinants of the potential benefits to importing credibility. Countries that have a desperate need to import monetary stability include those with a history of hyperinflation, those with an absence of credible public institutions, or those with large exposure to nervous international investors. Other criteria concern "initial conditions" that tend to reduce the cost to a country of giving up its currency: an already-high level of private dollarization, high pass-through of exchange rate changes to output prices, and access to an adequate level of reserves.

One bottom line is that countries that are at relatively early stages of development, are in transition from socialism, are located in unstable parts of the world, or are newly independent, are good candidates for firmly pegged currencies, particularly if they want to make use of international financial markets. The reason is that they face greater scepticism from international investors than do rich well-established countries, and stand to benefit more by importing monetary stability from abroad.

Regime Choice for a Country Specialized in Gold or Other Commodities

If a country is dependent on a particular export commodity, what exchange rate policy should it follow? Surprisingly, there is no standard textbook prescription for such a country, even as between fixed and floating exchange rates. On the one hand, the often-cited advice of Kenen (1969) is that only if a country is sufficiently diversified in the production of different commodities should it float, implying that a country where production is concentrated should peg. On the other hand, another famous prescription holds that a country where external shocks are large should float, to insulate itself against them. This advice would seem to contradict the Kenen line, in that the overall magnitude of external shocks will be larger in a specialized economy, whereas they will tend to cancel out in a diversified economy. A good reconciliation of the two viewpoints is to distinguish between the degree to which exports (or tradable goods) are concentrated in a single commodity and the importance of exports overall (or tradable goods overall) in the aggregate economy. Both ratios contribute to the ratio of exports of the particular commodity to aggregate GDP: (Commodity j / Total exports) (Total exports/GDP) = (Commodity j / GDP). Nevertheless, they can have opposite implications for the desirability of fixed versus floating exchange rates. To the extent exports are concentrated in a single commodity, or a few commodities that are highly correlated in price, then external shocks are large and floating may be desirable. This is especially true if the world price of the commodity or commodities is highly variable. But to the extent that exports or tradeables are large in GDP, the advantages of pegging are large.[14]

The Case for the Gold Peg Reconsidered for a Gold-Exporter

The idea of a gold peg is more popular at some times than others. In the early 1980s, there were proposals for a return to the gold standard, often taking the form of a proposal that the United States peg the price of gold unilaterally with other countries then joining in as they see fit. The motivation was price stability, but also, in part, nostalgia for the simpler days before 1914, or even before 1971. The current period is not one of

those in which gold standard proposals are particularly popular. In part this is because inflation has not been a major concern in recent years. In part it is because some consider the intellectual case for a global gold standard to be weak. Why should the world economy make itself hostage to the vagaries of the world gold market?

There is a much stronger, but surprisingly neglected, case to be made in favour of small individual countries for whom gold exports are a substantial source of income going on a gold peg. Many small open economies are seriously considering giving up monetary independence anyway. Some of them have already done so, from the currency boards of Hong Kong and Eastern Europe to the dollarizers of Ecuador and the Caribbean. For such countries, warnings about gold becoming a monetary straightjacket are moot. They have decided to live in straitjackets anyway. In this context, the question is what straitjacket to choose. Even in the case of anchors to currencies, much less is written on how to choose the anchor currency, than on the primary question of whether to anchor at all. The idea of a small country anchoring to the price of its major export has barely been explored.

When one comes to think of it, it is striking how the standard arguments against a gold peg melt away for the special case of a gold-producing country. One venerable argument against a worldwide gold standard is the need for a reserve asset that grows gradually over time in supply. The fear was that if gold were the sole reserve asset, the supply would not grow fast enough to keep pace with long-term growth in potential gross world product, and the resulting squeeze on reserves would create a global drag on economic growth. This is why dollars became the global supplementary reserve asset during the post-war period (even though the dollar was not given this formal role at Bretton Woods).

From the viewpoint of an individual country that is considering pegging its currency, it is no more difficult to add to reserves gradually over time by earning gold through a balance of payment surplus than by earning dollars. Indeed, a gold producer has the alternative of earning some of its gold reserves by domestic mining, rather than having to pay seigniorage to the United States, which may be galling to some countries. This may be too literal an interpretation of how the gold peg would work. The question of the currency or precious metal in which a country chooses to peg its currency is logically distinct from the question of the currency or precious metal in which it chooses to hold its reserves. After all, the country can export gold and holds its reserves in the form of dollars as easily as holding its reserves in the form of gold. And reserves held in the form of US treasury bills pay a higher interest rate than gold. But nevertheless, the pegging question and the reserve question tend in practice to go together. And there may be something "empowering" in the public mind of a gold-producing country to back its currency by gold.

For countries that are specialized in the production of commodities other than gold, analogous arguments might be made for a peg to the price of that commodity. To be sure, the arguments would never carry quite as much weight. There is something special about gold, in light both of its historical role and of the intrinsic characteristics that have qualified it for that role – storability, indestructibility, inelastic supply. (Silver has a bit of the same "lustre," but it happens that no countries are heavily specialized in the production of silver.) It is not likely that a peg to agricultural product prices, for example, could deliver quite the same hard-money credibility as a peg to a precious metal. But notwithstanding the special

place of gold, for those commodities specialized in the production of other commodities, it is worth considering the broader idea of a commodity peg.

Do the IMF Articles of Agreement Permit a Peg to Gold?

If the economic case in favour of a peg to gold were established, there would still be a possible legal question.[15] When the parties who wrote the Articles of Agreement of the International Monetary System took the world off the gold standard, they inserted language that might possibly be read as singling gold out as the single variable in the universe to which no member country may peg. The relevant passage is Article IV.2(b), which reads in its entirety as follows:

> Under an international monetary system of the kind prevailing on January 1, 1976, exchange arrangements may include (i) the maintenance by a member of a value for its currency in terms of the special drawing right or another denominator, other than gold, selected by the member, or (ii) cooperative arrangements by which members maintain the value of their currencies in relation to the value of the currency or currencies of other members, or (iii) other exchange arrangements of a member's choice.

To a non-lawyer, there appears to be more than enough latitude in this provision to allow a country wishing to peg to gold to do so. One must start out by puzzling over the meaning of the phrase "an international monetary system of kind prevailing on January 1, 1976." Is this meant to be in some way legally binding today? Secondly, the language "may include" and the third option, "other exchange arrangements of a member's choice" appear to remove any binding constraint. Albeit that gold per se seems to be precluded by sub clause (i), sub-clause (iii) gives carte blanche. Third, it would defy common sense that a member could maintain the value of its currency in terms of the price of an ounce of silver, a cup of coffee, an hour's worth of labour, the temperature in Zurich, or any other denominator, so long as it does not fix in terms of gold. Fourth, even if a simple peg to gold is barred, the next question is whether an exchange arrangement that included gold as one element among several (in a basket, alongside other commodities or currencies) would also be barred.

Only a test case of some sort could determine the legal issues. If lawyers were to decide that the language of the Article does indeed preclude a gold peg, but the economic case were accepted, then the logical course of action would be to change the language. When Milton Friedman proposed a movement to floating exchange rates in 1950, it originally seemed like a quirky idea that the international monetary establishment would never accept. There followed many years of discussion before his viewpoint eventually won official favour.

Baskets of Currencies and Commodities for Countries with Diversified Trade

Many writings on the choice of exchange rate regime speak as if, to the extent that a

country decides to commit to an exchange rate target, there is a unique currency to which it will peg. But, of course, in a world where the major currencies are floating against each other, to peg to one is to float against the others. It may be clear that Estonia should peg to the euro and El Salvador to the dollar. But most countries, such as those in Africa and Asia, have trade that is heavily diversified with respect to trading partners. This is particularly true of most producers of mineral products. This suggests a strategy of pegging to a basket of a few major currencies, such as the dollar, euro, and yen.[16] In theory this should be just as credible as a peg to one. In practice, it may not be. A basket peg is in practice less transparent, less easily verified by the man in the street on a daily basis than is a simple dollar peg.[17]

Analogous considerations apply to the commodity composition of trade. For a country that is specialized in the production of gold or oil, pegging to gold or oil has some extra attractions. The mining companies are saved the trouble of incurring transactions costs and exchange risk in their daily operations. The credibility argument is strengthened, because the commitment to fix to the price of gold is easily verified by the man in the street on a daily basis. But most countries, even among the minority who are specialized in mineral products, are not heavily specialized in a single product such as gold. (The oil producers are the most important exception.) For those who produce a variety of mineral products, like Australia, Bolivia, and some African countries, the logical answer is to peg to a basket of those commodities. But whether the same gains with respect to credibility and transactions costs could be reaped is an unexplored question.

Mechanics of the Proposal

How would the proposal to fix the value of the currency in terms of a commodity anchor work? Call the domestic currency the rand. Let us say that the price in terms of rand of an ounce of gold — or of a given physical quantity of the anchor commodity, whatever it is — threatened to rise above the pre-announced level. For present purposes, the cause of such a fluctuation does not matter, whether it is an overheating of the domestic economy, or a strong market for gold internationally. In this circumstance, the central bank would contract monetary policy, i.e., take rand out of circulation. This would put upward pressure on the value of the rand in terms of gold, i.e., downward pressure on the price of gold in terms of rand, rapidly returning it to its preannounced level. Whenever the price threatened to fall, the central bank would do the opposite: expand monetary policy, that is, increase the volume of rand in the hands of the public. This would put downward pressure on the value of the rand in terms of gold, i.e., upward pressure on the price of gold in terms of rand, again returning it to its preannounced level.

In order to be more precise about the mechanics, we need to distinguish between different versions of the proposal. We explain tight and loose versions, though one could imagine a continuum in between.

- ***Tight version of commodity peg.*** The government could peg the price of gold precisely, by standing ready to exchange rand for gold at a fixed price. (Or it

could do so within narrow margins such as 1%.) There is no assumption here that the country is large enough to affect the world gold market. Quite the contrary: the dollar price of gold is taken as exogenously determined. But the country does have monopoly power in its own currency, and can create or extinguish as much of it as it wants. The direct mechanics of intervening directly in terms of gold only make sense if (i) there is an active domestic gold market, and (ii) the government plans on holding reserves of gold.

- ***The dollar as the vehicle of intervention.*** For many countries, it would make sense to use the dollar as the vehicle currency (or possibly the euro, if its international use rises in the future). As soon as the daily price of gold in terms of dollars is announced in the London fixing, the central bank announces the daily price of dollars in terms of rand (by dividing the pre-announced fixed rand price of gold by the day's dollar price of gold). It then stands ready, for the next 24 hours, to buy or sell dollars in terms of rand at that price, as if under an exchange rate peg. The effect is to keep the rand price of gold constant from day to day. These same operating procedures would also work for copper, oil, wheat, coffee, and other commodities, or baskets of commodities, so long as they are commodities that are traded on standardized markets in London, New York or other financial centres, so that the prices are instantly and unambiguously known.

- ***Loose version of the export peg.*** As an alternative, the country could announce a looser peg, such as a band or target zone of specified width, within which it committed to maintain the rand price of the commodity in question. In the case of commodities that are not traded on standardized markets, the looser version is the only one that could apply. If an East Asian country wanted to peg the price of consumer electronics, or a Caribbean resort island the price of tourist services, or indeed if any country wanted to peg its entire export basket, it would be not be possible to peg it exactly, and it would not be desirable to try. These price statistics are only known with a lag, so that measurement problems alone would make perfect control impossible. Instead of pegging exactly, the central bank would tighten monetary policy, e.g., by raising interest rates, whenever the rand price of exports threatened to break out of the band on the upper side, and to loosen monetary policy, e.g., by lowering interest rates whenever it threatened to drop through the floor. As it built credibility, behaviour of market participants would help the central bank in its job of stabilizing the export price. Thus the mechanics would be analogous to the familiar regimes of targeting the money supply, nominal income, or the 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 whom gold is an important export commodity and also countries for whom oil, wheat, or a few other mineral or agricultural products are important export commodities. Our major criterion for whether gold or other commodities were important to the country in question over the period in question (1970s through 1990s) 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. 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 may 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.

Our list of a dozen gold exporters is as follows:

1. Bolivia
2. Burkina Faso
3. Burundi
4. Fiji
5. Ghana
6. Guyana
7. Mali
8. Mongolia
9. Papua New Guinea
10. Peru
11. Rwanda
12. South Africa

This list is based on past history. The list of most appropriate candidates currently would look different, as Mali, Tanzania, and some others have in recent years achieved large increases in the mining and export of gold. Details regarding the choice of countries and their statistics are given in Table 1 (the electronic version is available at http://ksghome.harvard.edu/~.jfrankel.academic.ksg/counterfactual/rank_price.html.)[18]

How Would the Price of the Export Commodity 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 its exchange rate against the yen and euro, and

what would have been the local currency price of various commodities, if it had pegged to the dollar during the period 1970-2000, instead of following whatever exchange rate policy it actually followed. We can then compute what would have been the movements of the price of its major export in terms of local currency.[19] We can see whether the volatility of this relative price would have been higher or lower over these two decades under the dollar peg. This section discusses the simulated price paths under alternative currency policies; subsequent sections go on to look at implications for export performance. Each country is treated separately, one at a time.[20]

Gold Prices

The two countries that were most specialized in gold exporting averaged over the period 1979-1996, according to our figures, are Burkina Faso (33 % of goods exports) and Ghana (18 %). Mongolia (15%), Papua New Guinea (13%) and Guyana (8%) also rank high; they are the three countries for whom gold exports average more than 5% of total GDP. Rwanda and Burundi also rank high in our figures, though the statistics might be affected by smuggling. Bolivia, Fiji, Mali and Peru are other countries where gold exports are in the range of 3-10% of exports during this period. We have also added South Africa, given its importance, even though gold exports are not as important there as they once were. We have omitted Uruguay, Australia, Dominican Republic, Nicaragua, French Guiana, and Uzbekistan, though they are also candidates by one measure or another.[21]

Figure Set 2 shows the nominal price of gold from the viewpoint of our gold-exporting countries. For each, the line of dark black diamonds shows the actual price of gold on world markets, expressed in terms of local currency, that these countries encountered over the last three decades. The general pattern is as follows: 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 be very important, 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. Compare 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 sharper, as a consequence of devaluation and depreciation of the dollar; the country would have been hit by a 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.

The upper panel of Table 3 reports the corresponding summary statistics for each of eight gold exporting countries. Several measures of volatility are reported: standard

deviation, number of years in which the price would have deviated more than 10 per cent from the mean, percentage of years in which the price would have deviated more than 10 percent from the mean, etc. 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 Figure 1 would have shown a flat line.

Consider next the example of Papua New Guinea, where the currency (the kina) was tied to the dollar until the late 1990s, but is now classified as "independently floating." 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 labour) 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. (South Africa is classified as floating.) 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.

The Figure Set 2 also shows the real price of gold for the same set of countries. Table 3 reports summary statistics on variability of the real price of gold [lower panel]. In all cases, variability is lower than reported for the corresponding measures in the upper 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 looks better now; the real price of gold in the 1990s was at least as stable as 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. If pegged to the dollar, Burundi would have experienced a large upward trend in the 1970s, followed by a slow downward trend in the 1980s and 90s. 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 consider six major oil exporters. In each, oil exports are a high percentage of goods exports: Nigeria 95%, Venezuela 53%, Ecuador 46%, 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 thus 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[22] 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 (when it responded to a financial crisis — itself exacerbated by a weak world oil market — thereby reversing what would otherwise have been a sharp fall in the domestic price of oil), and Russia in the early 1990s (when it was merely offsetting very high domestic inflation) and again in 1999 (when it achieved a major improvement in international competitiveness, again in response to the 1998 financial crisis). On the other hand, the Indonesian rupiah and Ecuadorian sucre, for example, appreciated against the dollar in 1980 (the strong world oil market in these years perhaps contributed to the strength of their currencies); 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 six 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.

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. The decline in the local copper price of 1995-98 could have been largely avoided.

In the 1990s, 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 aluminium market showed peaks in 1980, 1983, 1988 and 1995. Jamaica and Surinam are our two aluminium exporters. Jamaica and Surinam are our two aluminium exporters (40% of total goods exports and 79%, respectively). Both have experienced high inflation. Both follow managed floats. (Jamaica had a monetary target, as of 1999.) 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 aluminium 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, though platinum is also a large share of the merchandise exports of St. Kitts and Nevis (which shares a currency with other members of the East Caribbean Common Market). Both countries succeeded with their actual exchange rate policies in stabilizing the local price of platinum somewhat, relative to what would have happened if they 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. 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% 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 (especially in the 1970s).

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).[23] 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 qualifies. 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. (Other exceptions are El Salvador and Peru.)[24]

Implications of Alternative Currency Pegs for Exports

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 simple 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 behaviour 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 for small countries that produce mineral or agricultural products[25]), and that the local elasticity of supply is one. This assumption is conservative in that it omits any effect whereby local residents respond to an increase in price by consuming less of the tradable good 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 many products). 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.

Our primary interest is not in a comprehensive comparison of the path of exports that the economy would have followed if pegged to the dollar with the actual path of exports. 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 have been on exports (again with crude assumptions about elasticities). We do the same with a peg to the euro, represented during our historical period by the German mark. (Eventually we hope to repeat the experiment with a basket of the three currencies.) Then we see what would have happened to the exports of the gold-producing country if the value of the domestic currency had been fixed in terms of gold, rather than in terms of a major currency. And so on with the other commodities. The results for exports as a share of GDP are shown in Figure Set 4.[26]

Exports of Gold Producers

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 (which in turn could be attributed to an appreciation of the French franc against the dollar after 1985, and to an inability under the CFA constraints to devalue against European currencies in the way that English-speaking African countries had). 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 favourable effect would have been entirely reversed during the period of dollar appreciation, 1995-1999. Thus, overall, the actual path followed by Burkina 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 Burkina 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 ruled out, the same as under any of the major currency pegs. But it could be viewed as an attraction that this devaluation – an abandonment by the CFA countries of a long-standing commitment — might not have been necessary in the first place. 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 end of the sample period, the external accounts would have been more favourable under a gold peg than either under the actual path or under any of the major currency pegs.

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 in the Figure 2 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. 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.

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, although for some countries some of the necessary data are lacking for the first part of the period. 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 (and probably for other continental European currencies) would have been broadly similar to the yen, though less extreme. Of the various regimes, only the gold peg would have saved Bolivia, for example, from a sharp deterioration in its external accounts in the late 1990s.

Exports of Oil Producers

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 levels 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 six oil exporters, Russia is the only serious candidate for pegging to the DM or euro. The simulation shows that a firm peg to any of the three major currencies would have

turned the 1994-1997 decrease in Russia's exports/GDP into a gain, presumably because it would have reduced Russian inflation. 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 Ecuador's and Venezuela's exports 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. 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 Mineral Producers

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, presumably because it would have lost the ability to devalue. 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, indicators of external financial balance would have looked better than they historically did during the two critical periods of the early 1980s and the late 1990s. It would have experienced a particularly 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 aluminium 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 aluminium 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, it 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 two platinum producers are South Africa and St. Kitts and Nevis. 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 Agricultural Producers

We now return to our 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 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.[27] Thus the immediate gain in exports that the simulation 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 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 simulation 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.[28] The simulation suggests that Australia's path over the last three decades would not have been so very 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.

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 have shown up as a fall in exports in some countries (e.g., Colombia and El Salvador).

A currency peg would have prevented Brazil boosting exports via devaluation in 1999 and Colombia in 1999 (or Costa Rica in 1981, Guatemala in 1986, and Madagascar in 1987). 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. If Cameroon had pegged to coffee, for example, it would have experienced severe losses in external balance in 1977 and 1986, but would have done so well in the 1990s as to improve sharply its net international investment position, according to our simulation. Similar patterns hold for the Central American countries. A peg to coffee would have allowed Ethiopia to avoid the sharp 1992 run-up in its debt/export ratio. 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.

Overview of Simulated Effects on Exports in the Late 1990s

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 generalize about 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 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 aluminium, 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. This result is not entirely coincidence, in that weak commodity prices, especially in terms of dollars, were an important component of the wave of crises in emerging markets, as it had been in the international debt crisis of 1982.

Indicators of Financial Health

A higher level or lower variability of exports is not the ultimate objective of economic policy. We need a way of evaluating whether the overall effect of various pegs on a given country would have been favourable or unfavourable. How should we gauge the financial or economic health of a country? According to economic theory, what ultimately matters is the country's standard of living, averaged over time. Technically, what matters is an intertemporal average such as the present discounted value of income or consumption. Swings in countries' export revenues can be smoothed over time — by borrowing when market conditions are bad and paying back when markets are good. In this view, variability in a country's income need not be damaging.[29]

In reality, it is clear that this sort of theoretical approach in any case will not work. Financial markets do not in fact smooth consumption over time in the way the theory says. If they did, international capital flows would not be as procyclical as they are, periodic currency crises would not be as severe as they are, and the entire exercise of trying to reduce volatility by choice of monetary regime would be of less interest. It is more accurate to say that there is a flow of capital to Nigeria, Chile, Argentina, and South Africa when the world markets for – respectively — oil, copper, agriculture, and gold are strong, than when they are weak. It is precisely when poor countries' export markets are weak that the world's investors pull out their money and when financial crisis is most likely. In other words, financial markets do not carry out their assigned smoothing function very well. It does not matter for our purposes what is the market failure, that is, the source of the deviation from textbook theory. The root of the problem could be imperfect domestic institutions (e.g., governments that can't resist launching grandiose spending projects when the export revenue is available, and bailing out banks and other domestic cronies when times are bad) or it could be fickle international investors (who participate in

speculative bubbles and attacks, as in recent theories of multiple equilibria). All that matters is that these boom and bust financial cycles do in fact occur.

The exercise to be undertaken is to consider the case of a country that has already decided to adopt a long-term nominal anchor, and to consider the choice of alternative nominal anchors from the standpoint of reducing the amplitude of the boom-bust cycle that produces periodic crises in emerging markets. The measures of financial health that we wish to emphasize are those that have been used in the burgeoning research on "early warning" indicators, developed in response to recent crises.

What Would Have Happened to Current Accounts and Debt/Export Ratios Under Alternative pegs?

For the time being, we will maintain our assumption that price elasticities are unity (contemporaneously). In the case of the export commodities, we are thinking of these as supply elasticities, since we are thinking of our countries as price-takers on world markets. We are also assuming that the entire production is exported, an assumption that is probably not too far off for gold, oil or coffee, but is admittedly unrealistic for wheat or rice. Under these (extremely restrictive) assumptions, commodity exports would have been one percent higher for every one percent increase in the price of the commodity in terms of local currency.

We have already found that if the Argentine peso had been pegged to the euro in 1999-2001 instead of the dollar, the peso price received for wheat exports would have been higher at precisely the time when it was needed; and that if the peso had been pegged to the price of wheat, the benefits would have been even greater. But we want to see if this logic holds up in the simulation of financial indicators. Theory cannot give us the answer because the outcome depends on the nature of the shocks. If the most important shocks are those that occur in the world market for the export commodity, then a regime that leads to real depreciation at those times when the world market is depressed should indeed be a regime that stabilizes export revenue. But if the most important shocks are idiosyncratic domestic shifts, such as bad harvests or monetary expansions, then there may be no systematic implication of the regime for volatility.

Here we assume that imports and transfers are exogenous.[30] We compute the counterfactual for the trade balance based on our calculations for the impact on exports. We have allowed for the endogeneity of total international interest payments, in proportion to the simulated difference in net international debt. A different trade balance in the first period implies a different change in the net international investment position or net debt position that is carried into the subsequent period. In each subsequent period, the simulated change in the current account balance then translates into net debt.

We have simulated alternative paths for the current account and the debt/export ratio.[31] These simulations assume, not only that exports respond to real exchange rates with an elasticity of one, but also that imports and transfers do not respond at all. Thus the export revenue response is assumed to translate directly into the trade balance. In the first

period the effect on the trade balance is also assumed to translate directly into the current account. The current account each year, in turn, is assumed to be the change in the debt stock. But in the second and subsequent periods, the higher or lower debt stock is assumed to imply proportionately higher or lower interest payments, which are added into the current account, i.e., the change in next period's international investment position. These assumptions could of course be made more elaborate.

Here are some highlights from the results. For Fiji, a peg to either gold or a major currency would have delivered a more favourable trend in the current account or debt/export ratio throughout the period, particularly after 1980. In 1980-82 Fiji's actual situation deteriorated, whereas a peg to gold would have resulted in an automatic currency depreciation and stimulus to trade. The subsequent trend in the current account and debt/export ratio would have been increasingly favourable under any of the pegs, with a yen peg looking the best, but a gold peg coming in second place.

The final gold-producer Figures illustrate the simulations for Fiji and Papua New Guinea. In Papua New Guinea, a gold peg would have hurt the current account and debt/export ratio in the 1980s. But it would have had a favourable effect on these indicators in the 1990s, and by 1997 would have returned the current account to a stronger level than under either the actual path or the major currency pegs.[32]

Oil exporters — such as Ecuador, Mexico, Nigeria and Venezuela — would also have suffered a strong deterioration in the current accounts and debt levels, if their currencies had followed the price of oil upward in the 1970s. In most cases, this process would have reversed in the subsequent decade. Mexico would have experienced sharp improvements in the early 1990s and in 1998 under a gold peg, while a dollar peg would not have looked very different from the actual path. In the case of Venezuela in 2000, an oil peg would have exacerbated the deterioration in these measures of external balance that actually occurred. The story for Indonesia would have been similar in the 1980s, but different in the 1990s. Indonesia achieved a sharp increase in its current account in 1998-99. A trade surplus was achieved through a painful combination of devaluation and domestic contraction that was even larger than for other Asian crisis victims of this period. (The relative severity of Indonesia's crisis presumably stems from political problems associated with the passing of the Suharto regime.) The simulation shows, this improvement would not have been possible under any of the pegs.

Coffee-producers such as Colombia and Kenya suffered deteriorating current account deficits in the 1990s, as the world market in their commodity deteriorated. The simulations show that if they had been pegged to the price of coffee, the coffee producers would instead have experienced dramatic current account surpluses in 1992 and again in 1999-2000. As a result, such debtors as Colombia and Costa Rica would have achieved much lower debt/export ratios, in time for the international contagion of the late 1990s.

Possible Extensions

A future extension could simulate the level of reserves, since this variable appears as an important crisis indicator in the three generations of theoretical models of speculative

attacks as well as in the empirical studies of early warning indicators. In order to pursue the period-by-period simulations, we would treat private capital flows as exogenous, and assume that effects on the trade balance show up in central banks' reserve holdings. Needless to say, capital flows would certainly have been different if radically different policies had been followed. But the spirit of our exercise is that the leading cause of sudden large declines in the net inflow of capital is loss of confidence due to the fears and realities of financial crises.[33] Our argument is that if alternative pegging policies would have moved the crisis indicators in favourable directions at the times when they were historically most in difficulty, then the pattern of capital flows would probably have been better. In that case we can draw our tentative conclusions about whether the overall effect would have been favourable or unfavourable, without having to model capital flows explicitly.

Ultimately, one could hope to compute a weighted average of financial indicator variables, such as debt service ratios and reserve/import ratios. The weights on the various indicators could come from a number of places. The simplest is a uniform weighting scheme. More precisely, each indicator is weighted by the inverse of its sample standard deviation.

The alternative is to use as weights the coefficients that have actually been estimated in the early warning research, generally to predict the probability of currency crisis. One possible source of coefficient estimates comes from Frankel and Rose (1996).[34] More recent studies of early warning indicators include Kaminsky, Lizondo and Reinhart (1999), Berg, Borensztein, Milesi-Ferreti, and Patillo (1999), Edison (2000), Goldstein, Kaminsky and Reinhart (2000), and Wynn, Nowell and Blackman (2000).

For each of our sample developing countries, we could trace the simulated path of the financial health indicator, whether univariate or weighted-average. We could take note of whatever correspondence there is between the high-points of the indicator for each country and its known crises or difficult periods.

We could then ask the counter-factual question: how different might the indicator variables have been if, instead of whatever exchange rate policy the country actually followed, it had pegged to the dollar, the euro, gold, or a number of possible other alternatives. As in what we have done so far, the exercise necessarily involves making some arbitrary assumptions regarding how exports and other variables would have responded if the exchange rates and commodity prices had been different. We hope to be able to consider more elaborate and realistic assumptions in the future.

Conclusion

The currency regime proposed in this study is not for everybody. But for small countries where gold makes up a large share of national production and exports, a novel strategy of pegging the currency to the price of gold might make sense. Of course this commitment would mean giving up the benefits of discretionary monetary policy. But some small developing countries have found those benefits to be elusive at best, and so have either already given up monetary independence anyway or are considering doing so. For such a country, a peg to gold may give the best advantages of both worlds: the enhanced credibility that the gold standard is traditionally supposed to deliver, combined with the automatic adjustment to terms of trade shocks that floating rates are in theory supposed to deliver. Similar arguments can be made for countries that are specialized in the production of other commodities.

Our simulation results illustrate how such a peg, if it had been applied in the past, would at times have been superior to conventional pegs to the dollar or to other major currencies. In particular, many commodity exporters in the late 1990s were hit by three simultaneous shocks: scarce international finance, a strong dollar, and weak commodity prices. If they had been pegged to their principal export commodity at this time, rather than to the dollar, they would have gained export competitiveness at precisely the time when their balance of payments was under maximal strain. Such countries as Bolivia, Burkina Faso, Fiji, Guyana, Papua New Guinea, Peru and South Africa would in the late 1990s have achieved stronger export/GDP ratios if they had been pegged to gold. The commodity peg will not always work in such a beneficial way as this. But this study suggests that the idea is at least deserving of future exploration and consideration.

Notes

1 The late 1990s were in some sense a replay of the early 1980s. A major reason for the international debt crisis that surfaced in 1982 was the combination of an appreciating dollar with weak world market conditions for the commodities exported by developing countries. (E.g., Cline, 1984; Dornbusch, 1985.)
2 To be sure, Chile followed better policies than other countries in many other respects as well. To begin with, its exchange rate regime was not a tight peg to its anchor (the weighted basket), but rather a band that moved on either side of the central parity. Even that regime was abandoned for still more flexibility in September 1999.
3 Some of the classics are Friedman (1950), Johnson (1969), and Mundell (1961). Recent surveys of the arguments appear in Edwards (2002), Eichengreen (1994), and Frankel (1999).
4 The problem may lie with lack of sincere aversion to inflation on the part of central bankers (e.g., Barro and Gordon, 1983; Rogoff, 1985, 1987), or with the scepticism of international investors (e.g., Hausmann, Gavin, Pages-Serra, and Stein, 1999).
5 E.g., Chen and Rogoff (2002).
6 Among many possible references are Svensson (1995) and Bernanke, et al. (1999).
7 The existence of velocity shocks suggests 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.
8 Cooper (1985) or Hall (1982).
9 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).
10 In other words, even though they officially classify themselves as floating, in fact they intervene frequently to stabilize their exchange rates. Calvo and Reinhart (2000).
11 Although Turkey's link to the appreciating dollar in 2000 (ending in the crisis of January 2001) was far weaker than a currency board, some would identify it as another casualty to an unfortunate mismatch between the composition of the currency peg and the composition of trading partners .
12 In the course of the 19th century, first Britain, and then one country after another decided to peg its currency to gold, until the gold standard was virtually global by 1880.
13 Not everyone agrees with this proposition. But it is supported in Frankel and Rose (1998).
14 McKinnon (1963).
15 Ware (2001), p.45-47.
16 Among many possible references on basket pegs are Takagi (1988) and Williamson (2001).
17 Frankel, Schmukler and Servén (2000) argue that some of the credibility gains are lost when the peg is to a basket, as was Chile's in the 1990s. Furthermore, recent empirical evidence suggests that a reduction in exchange rate variability has a far bigger effect on trade when there is a rigid fixing to the currency of an important bilateral trading partner (Rose, 2000; Frankel and Rose, 2002; Saiki, 2002). This suggests that gains in the promotion of bilateral trade and investment may also be lost by a basket peg.
18 Future research could add major emerging market countries that have experienced severe financial pressure in the 1990s. Already among the gold producers, South Africa and Russia qualify. Mexico, Indonesia, Ecuador, Colombia, Brazil, Argentina, Venezuela, and Chile are also among the other important emerging market countries that we have analysed, as exporters of oil, wheat, coffee, or copper. But other crisis victims such as Thailand, Korea and Turkey have not yet been analysed.
19 The local price of the export good is one possible definition of the real exchange rate, if local wages and prices of non-traded goods are fixed in terms of local currency in the short run.
20 The importance of particular export commodities to particular countries is shown in Table Set I; sources are the IMF, ITS database, and World Trade Analyzer. Graphs of the computed commodity prices under alternative scenarios appear as Figure Set II; and statistics on simulated price variability are reported as Table Set III. They are available at:
http://ksghome.harvard.edu/~.jfrankel.academic.ksg/counterfactual/rank_price.html. (Appendices there give further details on how the computations were done.)
21 Rwanda and Burundi do not rank at all in Plowden and Wilde (1999). Statistics in Plowden and Wilde (2001b) suggest that gold exports from Mongolia and Papua New Guinea were higher in 1999 than during the average of our sample period, 1979-1996. Statistics in Plowden and Wilde (2001a) suggest that gold exports by Bolivia, Guyana, Nicaragua and Peru were higher in 1998 than during the average of our sample period. Gold is also now important to Kyrgyz Republic (in 2000) according to Plowden and Wilde (2002).

22 Graphs for the simulations of oil prices and exports of oil producers are available in Frankel (2002). Statistics on the variability of commodity prices under the alternative currency pegs are reported in Frankel and Saiki (2002), for oil and for the seven other commodities as well.
23 Edwards (1984, 1986) explores the macroeconomic implications of the coffee cycle in Colombia. Devarajan and de Melo (1987) includes the case of a boom in coffee and cocoa in Cameroon in 1976-77. Cameroon is a member of the Central African Economic and Monetary Community.
24 Costa Rica and Nicaragua have crawling pegs against the dollar, while Honduras has a crawling band. El Salvador has recently gone beyond a dollar peg, and adopted the dollar as legal tender. Guatemala has technically followed a managed float (but is considering full dollarization), and Peru is formally classified as independently floating (IFS, 1999). Brazil and Colombia float, after having abandoned intermediate regimes in 1999. Ethiopia and Kenya are also classified as managed floaters, Tanzania and Madagascar as independently floating.
25 If a substantial number of gold producers, representing a substantial fraction of global gold supply, were simultaneously to implement the proposal to peg their currencies to gold, then we would have to recognize that the gold price would become endogenous. Fluctuations in the world demand for gold would induce contrary responses in world supply, thereby exacerbating the global price fluctuations: When the world price of gold falls, gold-pegged producers would automatically depreciate, responding by raising production and thereby further dampening the world price. But the United States, Canada, and some other industrialized countries constitute a large share of world gold production, and the gold-pegging proposal is not intended to apply to them. Furthermore, changes in the annual flow of gold supply are relatively small as a fraction of the outstanding stock of gold in the world, and it may be the latter that is the key supply-side variable. In any case, the results reported here (especially for perishable agricultural commodities where flow supply is an important determinant of price) are best understood as applying to regime decisions of an individual country.
26 These and other results are available in greater detail at:
http://ksghome.harvard.edu/~.jfrankel.academic.ksg/counterfactual/rank_price.html.
27 Hong Kong's experience with its currency board indicates that having an open, flexible and debt-free economy is not enough to achieve full convergence of inflation rates, and Ecuador's experience with dollarization indicates that abandoning one's currency altogether is also not enough.
28 David Hale has often pushed this viewpoint. E.g., Hale, "The Fall of a Star Pupil," Financial Times, January 7, 2002; or "Will Argentina's Crisis Destroy the Washington Consensus?" Zurich Financial Services, January 22, 2002.
29 The argument for using income as the measure would be that the consumption data are less reliable. The argument for using consumption is the practical difficulty of knowing how to discount expected future income, and the argument that in theory intertemporally optimising households have already done the discounting when determining their current consumption.
30 One approach would be to apply the unit elasticity assumption also to imports, and assume that imports of a world basket of goods would have been one percent lower for every one percent depreciation of the currency in trade-weighted terms. Another approach would be to focus on the supply of tradable goods, taking the export calculations that we have already performed as a lower bound on the importance of tradable goods in the economy and taking 100% of GDP as an upper bound.
31 More information regarding the simulations for Current accounts and Debt/Export ratios are available at http://ksghome.harvard.edu/~.jfrankel.academic.ksg/counterfactual/rank_price.html Some of our countries lack a continuous time series for actual current account and debt numbers, so that our method of endogen zing interest payments in the debt simulations is not possible. For those countries, one could refer to the simulations that assume interest payments exogenous.
32 Charts for all gold producers are available, but in most cases interest payments must be treated as exogenous, due to lack of data. Interested readers are referred to the website op cit.
33 Calvo and Reinhart (2001) call these episodes "sudden stops."
34 We could consider two sets of weights: from univariate estimation in Frankel-Rose (1995) and multivariate estimation in Frankel-Rose (1996). The latter are theoretically of greater interest, since they were estimated in a statistical exercise to choose the best overall predictor of currency crashes. But we would omit some of the variables that were included in the multivariate estimation, so that those coefficients lose the interpretation as optimal prediction regardless. (We would omit short-term debt, for example. Although this is a good near-range predictor of crisis, it may not be a fundamental source of trouble, so much as an early-warning symptom.). On the one hand, there is a certain attraction to focusing on the univariate estimates, as they can potentially correspond to conventional rules of thumb used by international investors. On the other hand, to focus on the history of a dozen indicators, one by one, for each of several dozen countries, would produce more information than one can cheerfully absorb.

Algebraic Appendix

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:

$Log\ X = \bar{x} + \sigma\ (p_X - w)$,

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 σ 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.

$s^{\$}_{lc}$ 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 σ. (In dollar terms, which may be the most relevant measure if a country has incurred debts in dollars, the loss of export revenue is:

$(1+\sigma)$ 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 log of the domestic cost of variable inputs, w, by the log of the domestic CPI).

To repeat, the key variable in logarithmic terms 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 of price levels under the five possible regimes is calculated as follows:

Under actual history,	$P_X = S^{lc}_{\$} P^{\$}_X$	and	$W = CPI^{lc}$.
Under a hypothetical dollar peg,	$S^{lc}_{\$} = 1$, so $P_X = P^{\$}_X$,	and	$W = CPI^{US}$.
Under a hypothetical yen peg,	$S^{lc}_{\$} = S^{Y}_{\$}$, so $P_X = S^{Y}_{\$} P^{\$}_X$,	and	$W = CPI^{J}$.
Under a hypothetical DM or euro peg,[1]	$S^{lc}_{\$} = S^{DM}_{\$}$, so $P_X = S^{DM}_{\$} P^{\$}_X$,	and	$W = CPI^{G}$.
Under a hypothetical commodity peg,	$S^{lc}_{\$} = 1/P^{\$}_X$, so $P_X = 1$,	and	$W = 1$.

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 (in log terms) would have been under the alternative regime and what it was historically.

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.[2]

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. (This is the assumption that the supply elasticity is unity.) The percentage deviation relative to actual history is given as follows:

Under a hypothetical dollar peg,

$$d_{\$} = \log P^{\$}_{x} / CPI^{US}) / (S^{lc}_{\$} P^{\$}_{x} / CPI^{lc}) + k_{\$}$$

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

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,

$$d_{x} = \log 1/(S^{lc}_{\$} P^{\$}_{x} /CPI^{lc}) + k_{x} .$$

Notes

1 The exchange rate of the German Mark after 1999 is calculated as follows:
S(DM/$) in 1999 = S(Euro/$) in 1999 ¥ S(DM/Euro) in 1999;
S(DM/$) in 2000 = S(DM/$) in 1999 ¥ (1 + % change of the euro exchange rate)
2 When calculating the real exchange rate for the euro, we continue to use the German CPI.

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Figures and Tables

The first set of figures and tables relate specifically to gold. Figures and tables for copper, wheat and coffee can be found on page 63. A full set of tables and figures for a range of commodities can be found on Prof Frankel's website, including technical appendices.
http://ksghome.harvard.edu/~.jfrankel.academic.ksg/counterfactual/rank_price.html

As of 2002, the files were also available at:
http://people.brandeis.edu/~smap/counter,
http://www.brandeis.edu/~smap/files, and
http://people.brandeis.edu/~smap/rank_price.html and
http://people.brandeis.edu/~smap/counter/counter2.html.

Table I:
Rankings of Countries by Concentration in Commodity Exports

Gold Export Concentration Rankings

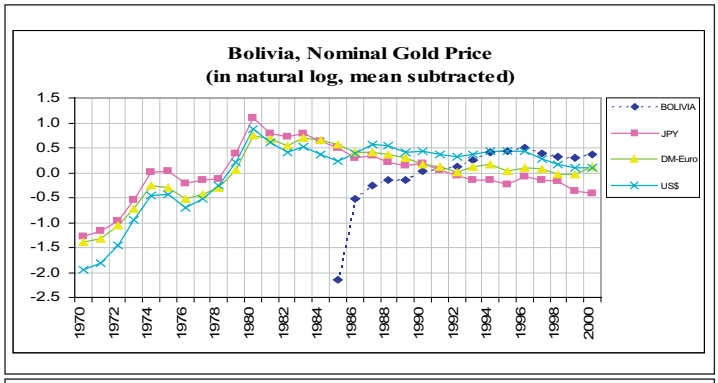
	Average (1000 US$)		% of GDP		% of XGS*		% of XG**	
1	UNITED STATES	3.87E+06	MONGOLIA	6.46%	BURKINA FASO	32.34%	BURKINA FASO	33.05%
2	CANADA	1.90E+06	GUYANA	6.13%	GHANA	15.96%	GHANA	17.65%
3	FORMER USSR	1.77E+06	PAPUA NEW GUINEA	5.45%	URUGUAY	12.18%	URUGUAY	16.27%
4	AUSTRALIA	1.65E+06	BURKINA FASO	3.62%	PAPUA NEW GUINEA	11.97%	MONGOLIA	15.13%
5	SOUTH AFRICAN CUST.	7.41E+05	URUGUAY	2.97%	MONGOLIA	11.65%	RWANDA	13.36%
6	GERMANY	6.44E+05	GHANA	2.69%	BURUNDI	10.31%	PAPUA NEW GUINEA	12.86%
7	KOREA, REPUBLIC OF	5.24E+05	FIJI	2.39%	RWANDA	9.40%	FIJI	8.93%
8	UNITED KINGDOM	4.17E+05	UZBEKISTAN	1.49%	GUYANA	7.43%	GUYANA	7.77%
9	BELGIUM-LUXEMBOURG	3.68E+05	BOLIVIA	1.06%	MALI	6.07%	MALI	7.68%
10	FRANCE	3.59E+05	BURUNDI	1.00%	BOLIVIA	5.10%	BOLIVIA	6.90%
11	UZBEKISTAN	3.31E+05	MALI	0.98%	FIJI	4.62%	DOMINICAN REPUBLIC	6.02%
12	PAPUA NEW GUINEA	2.16E+05	SINGAPORE	0.84%	DOMINICAN REPUBLIC	3.28%	AUSTRALIA	4.02%
13	CHILE	1.84E+05	PANAMA	0.78%	NICARAGUA	3.21%	NICARAGUA	3.94%
14	JAPAN	1.80E+05	SOUTH AFRICAN CUST.	0.78%	UZBEKISTAN	3.16%	ETHIOPIA	3.30%
15	URUGUAY	1.71E+05	DOMINICAN REPUBLIC	0.78%	AUSTRALIA	3.06%	PERU	3.11%
16	SWITZERLAND	1.67E+05	NICARAGUA	0.69%	SOUTH AFRICAN CUST.	2.66%	SOUTH AFRICAN CUST.	3.07%
17	SINGAPORE	1.66E+05	BAHRAIN	0.63%	PERU	2.62%	CHILE	2.34%
18	GHANA	1.60E+05	RWANDA	0.56%	ETHIOPIA	2.06%	JORDAN	1.97%
19	NETHERLANDS	1.49E+05	AUSTRALIA	0.55%	CHILE	1.87%	CANADA	1.77%
20	PERU	1.34E+05	CHILE	0.54%	CANADA	1.57%	ECUADOR	1.75%
21	SWITZ.LIECHT	1.26E+05	CANADA	0.45%	ECUADOR	1.46%	PARAGUAY	1.61%
22	INDONESIA	1.19E+05	ECUADOR	0.42%	PANAMA	0.98%	PANAMA	1.51%
23	SWEDEN	1.00E+05	JORDAN	0.37%	PARAGUAY	0.93%	ZIMBABWE	0.98%
24	BRAZIL	9.25E+04	PERU	0.34%	UNITED STATES	0.89%	COSTA RICA	0.96%
25	VENEZUELA	8.49E+04	COSTA RICA	0.27%	ZIMBABWE	0.86%	COLOMBIA	0.79%
26	COLOMBIA	8.38E+04	BELGIUM-LUXEMBOURG	0.27%	JORDAN	0.83%	COTE D'IVOIRE	0.67%
27	UNITED ARAB EMIRATES	7.62E+04	UNITED ARAB EMIRATES	0.22%	CONGO, DEM. REP.	0.75%	PHILIPPINES	0.64%
28	BURKINA FASO	7.40E+04	COTE D'IVOIRE	0.21%	COSTA RICA	0.74%	NEW ZEALAND	0.63%
29	ECUADOR	7.18E+04	ZIMBABWE	0.20%	COLOMBIA	0.65%	VENEZUELA	0.61%
30	NEW ZEALAND	7.09E+04	ETHIOPIA	0.15%	COTE D'IVOIRE	0.59%	SINGAPORE	0.55%

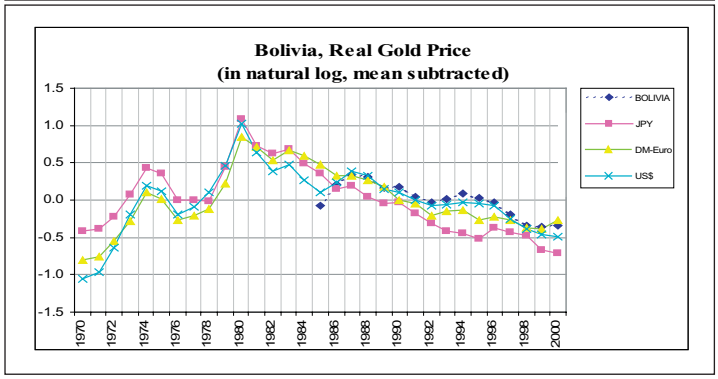
* XGS: Exports of goods & sevices

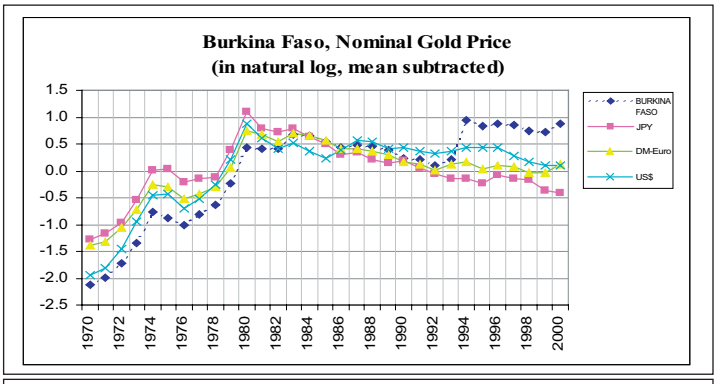
** XG: Exports of goods

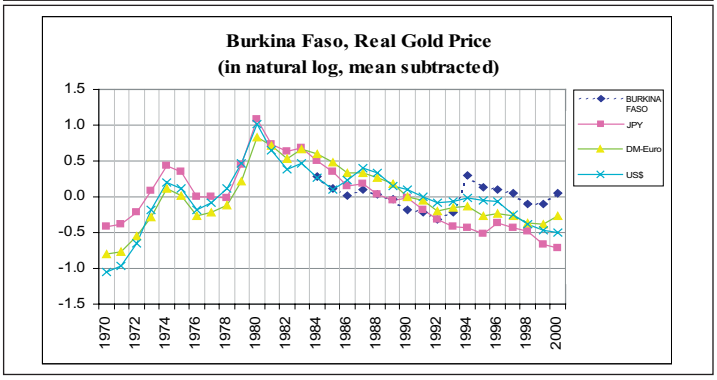
Figure Set 2:
Nominal and Real Log Export Prices, Simulated under Alternative Exchange Rate Regimes

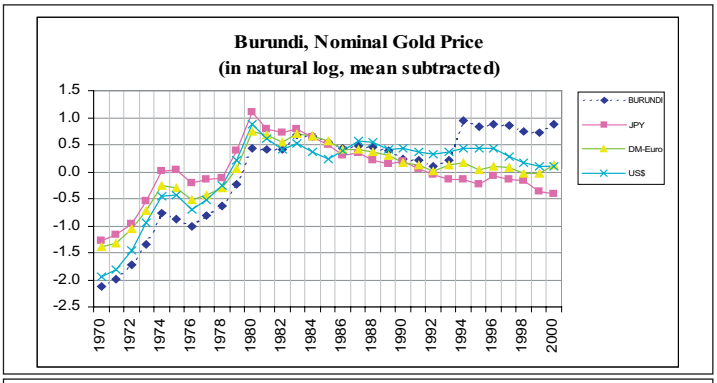
Gold Producers - Export Prices

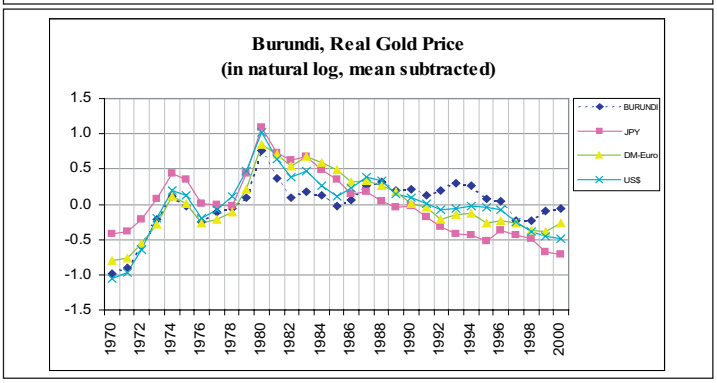


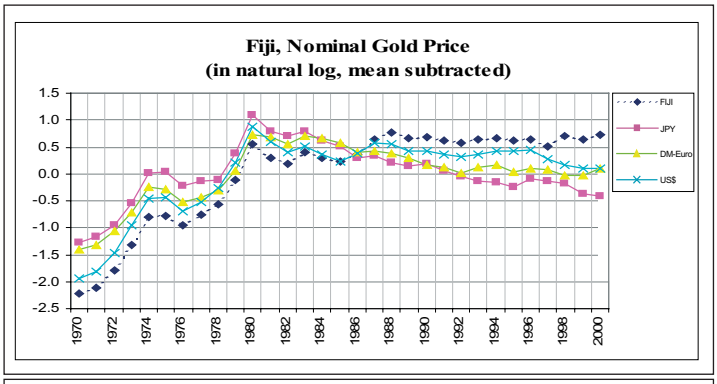


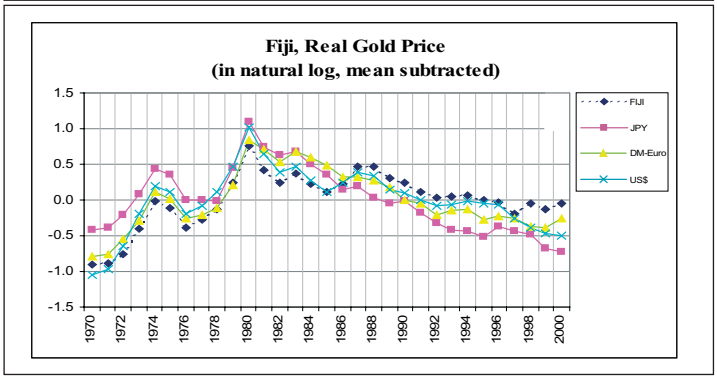


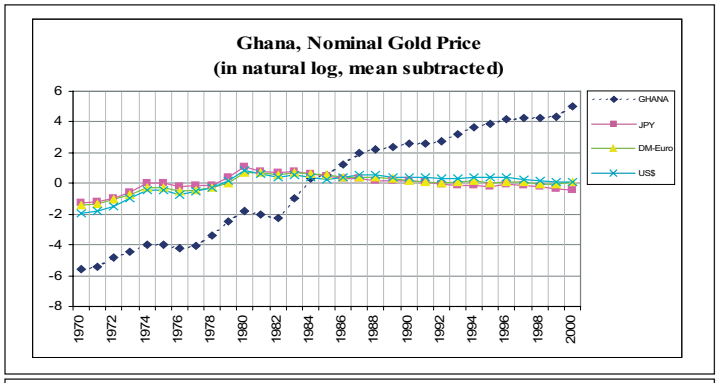


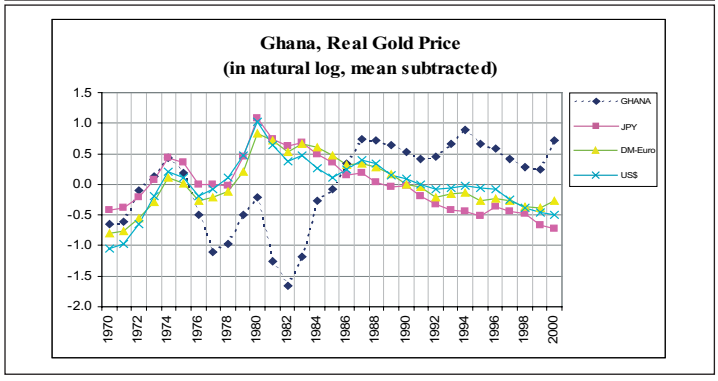

Burundi, Nominal Gold Price
(in natural log, mean subtracted)
BURUNDI
JPY
DM-Euro
US$

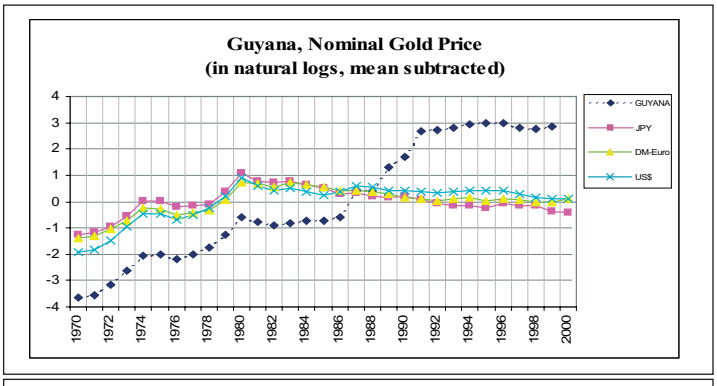

Burundi, Real Gold Price
(in natural log, mean subtracted)
BURUNDI
JPY
DM-Euro
US$

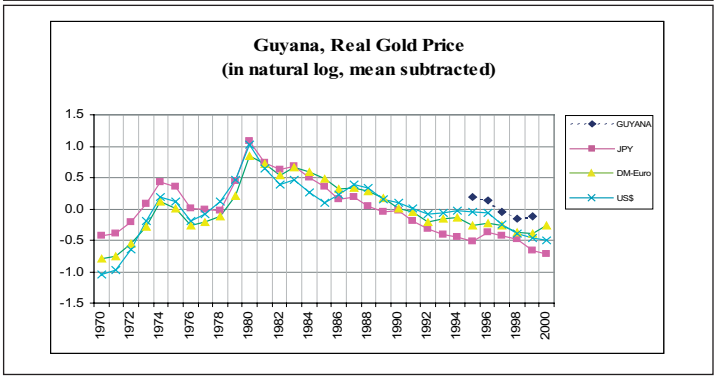

Fiji, Nominal Gold Price
(in natural log, mean subtracted)
FIJI
JPY
DM-Euro
US$

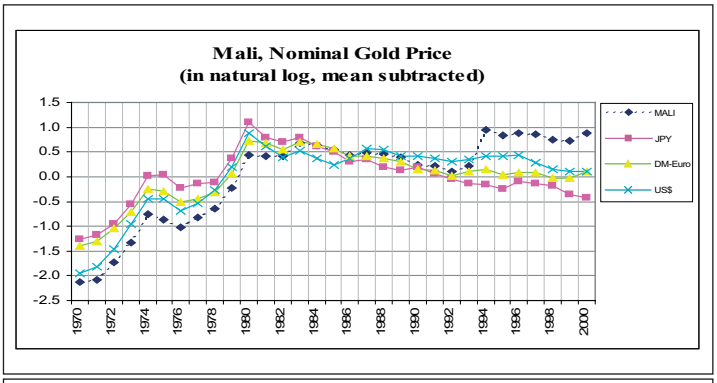

Fiji, Real Gold Price
(in natural log, mean subtracted)
FIJI
JPY
DM-Euro
US$

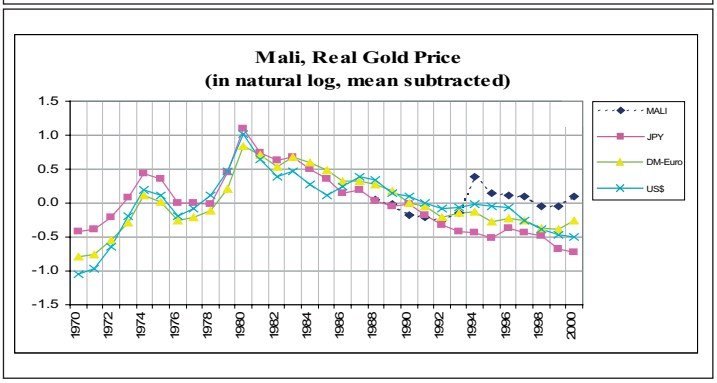

Ghana, Nominal Gold Price
(in natural log, mean subtracted)
GHANA
JPY
DM-Euro
US$

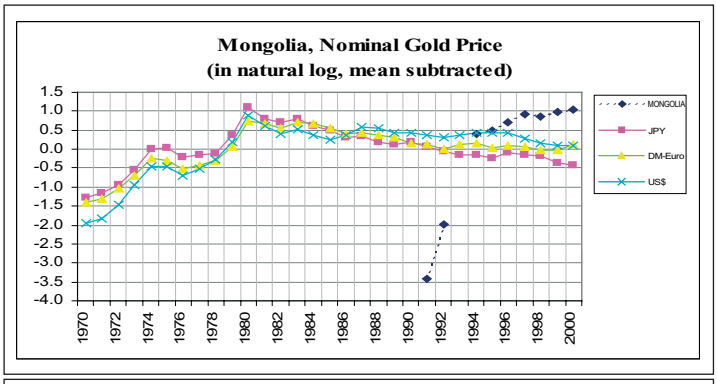

Ghana, Real Gold Price
(in natural log, mean subtracted)
GHANA
JPY
DM-Euro
US$

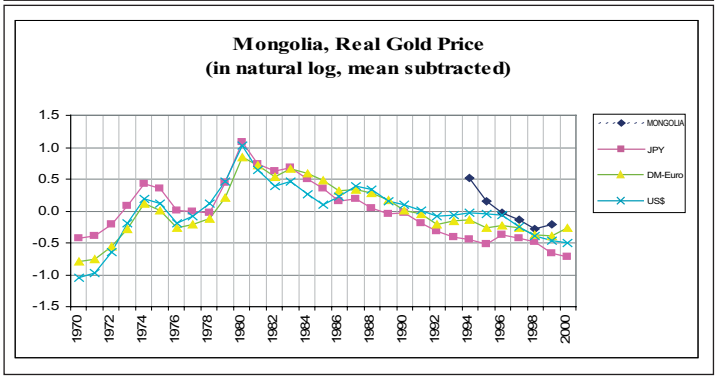

Guyana, Nominal Gold Price
(in natural logs, mean subtracted)
GUYANA
JPY
DM-Euro
US$

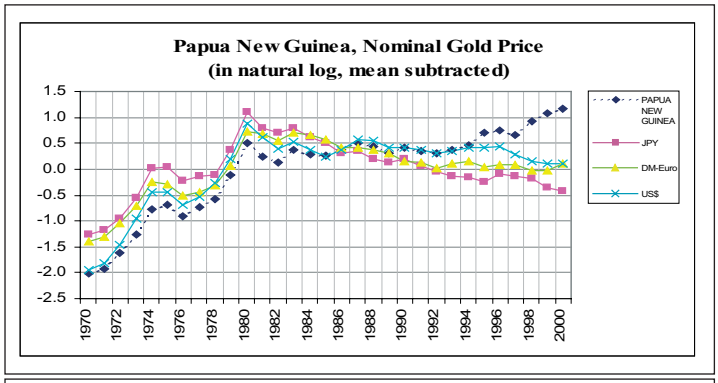

Guyana, Real Gold Price
(in natural log, mean subtracted)
GUYANA
JPY
DM-Euro
US$

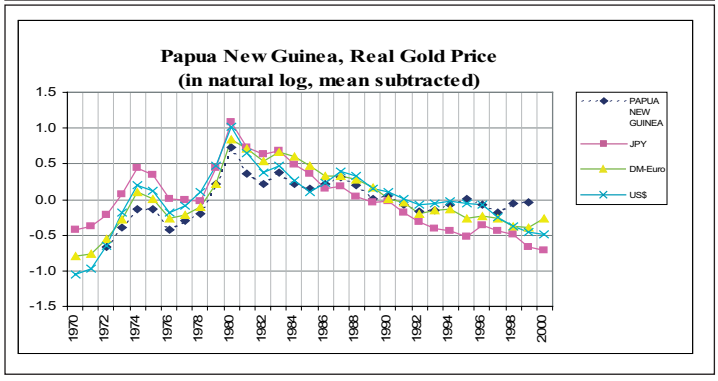

Mali, Nominal Gold Price
(in natural log, mean subtracted)
MALI
JPY
DM-Euro
US$

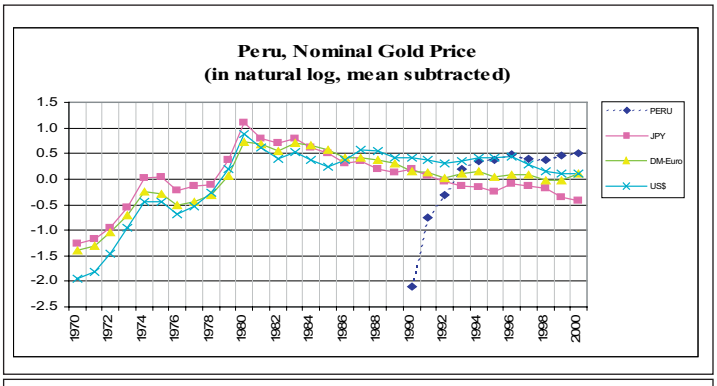

Mali, Real Gold Price
(in natural log, mean subtracted)
MALI
JPY
DM-Euro
US$

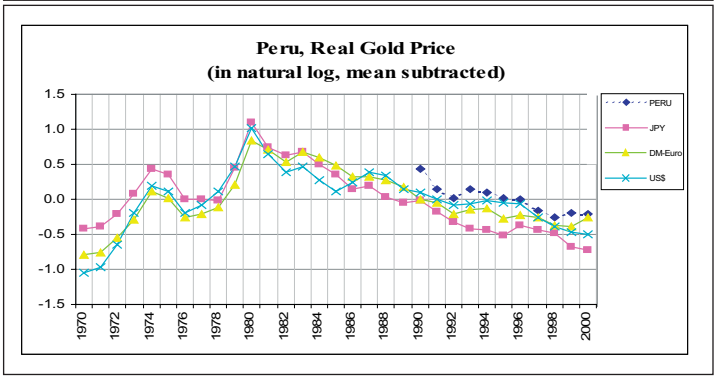

Mongolia, Nominal Gold Price
(in natural log, mean subtracted)
MONGOLIA
JPY
DM-Euro
US$

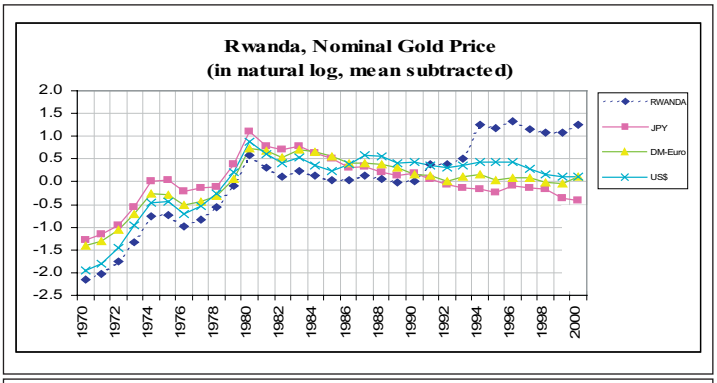

Mongolia, Real Gold Price
(in natural log, mean subtracted)
MONGOLIA
JPY
DM-Euro
US$

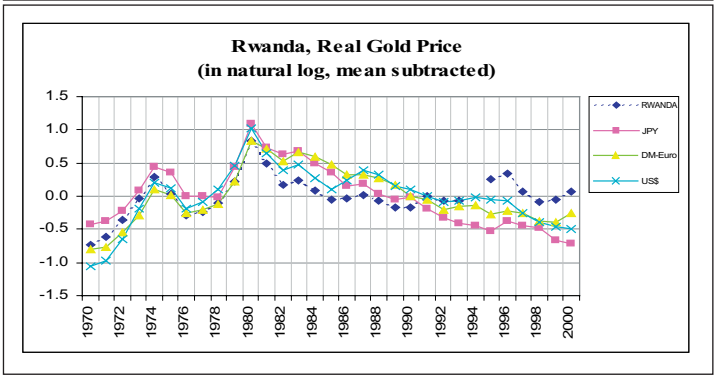

Papua New Guinea, Nominal Gold Price
(in natural log, mean subtracted)
PAPUA NEW GUINEA
JPY
DM-Euro
US$

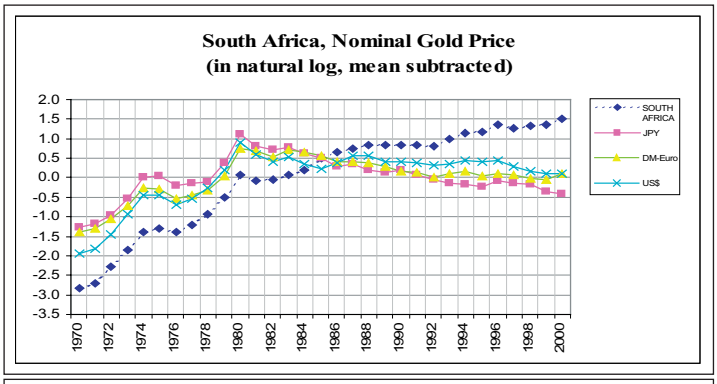

Papua New Guinea, Real Gold Price
(in natural log, mean subtracted)
PAPUA NEW GUINEA
JPY
DM-Euro
US$


Peru, Nominal Gold Price
(in natural log, mean subtracted)
PERU
JPY
DM-Euro
US$


Peru, Real Gold Price
(in natural log, mean subtracted)
PERU
JPY
DM-Euro
US$


Rwanda, Nominal Gold Price
(in natural log, mean subtracted)
RWANDA
JPY
DM-Euro
US$


Rwanda, Real Gold Price
(in natural log, mean subtracted)
RWANDA
JPY
DM-Euro
US$


South Africa, Nominal Gold Price
(in natural log, mean subtracted)
SOUTH AFRICA
JPY
DM-Euro
US$

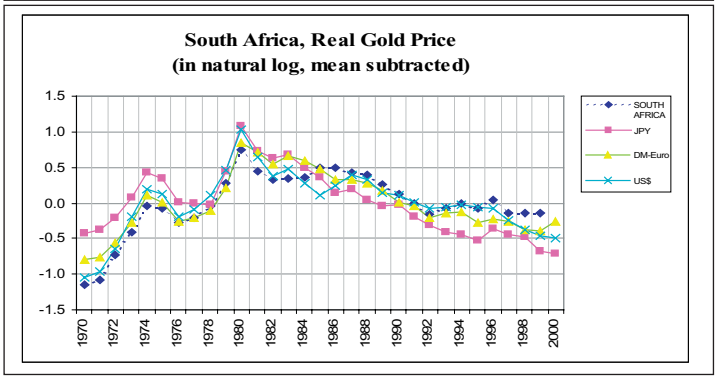

South Africa, Real Gold Price
(in natural log, mean subtracted)
SOUTH AFRICA
JPY
DM-Euro
US$

Table Set 3:
Summary Statistics on Variability of Simulated Export Prices, Nominal and Real, under Alternative Exchange Rate Regimes

Nominal Gold Price

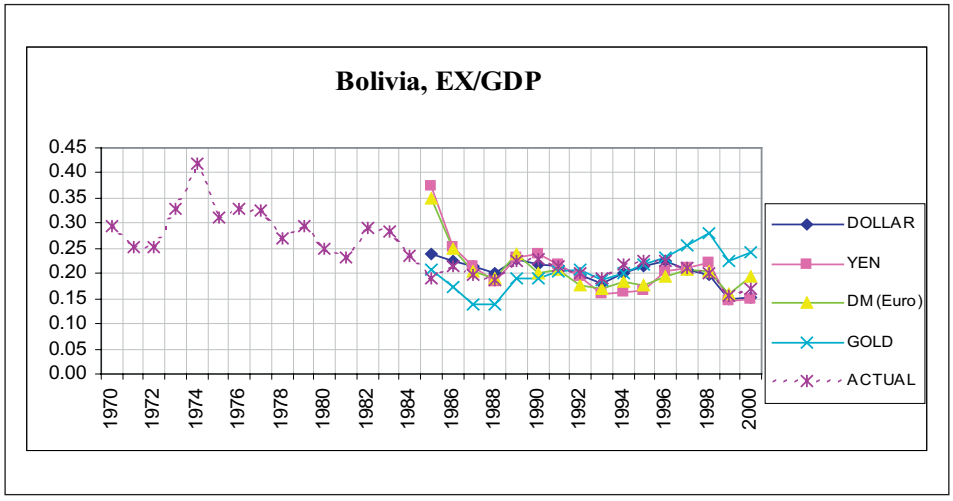
	Mean	Stdev	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean	Out of	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean
USD	5.52	0.72	31	28	26	11	31	100%	90%	84%	35%
Yen	10.73	0.54	26	18	15	10	31	84%	58%	48%	32%
DM-Euro	6.27	0.55	24	19	19	11	31	77%	61%	61%	35%
Bolivia	7.08	0.64	14	11	11	3	16	88%	69%	69%	19%
Burkina Faso	11.32	0.90	30	30	26	19	31	97%	97%	84%	61%
Burundi	10.51	1.11	28	25	25	22	31	90%	81%	81%	71%
Fiji	5.67	0.90	31	29	28	24	31	100%	94%	90%	77%
Ghana	9.18	3.52	31	31	31	30	31	100%	100%	100%	97%
Guyana	7.94	2.24	30	30	30	28	30	100%	100%	100%	93%
Mali	11.32	0.91	30	30	26	19	31	97%	97%	84%	61%
Mongolia	11.57	1.59	9	9	9	7	9	100%	100%	100%	78%
Papua New Guinea	5.50	0.85	31	29	28	17	31	100%	94%	90%	55%
Peru	6.38	0.80	11	10	10	3	11	100%	91%	91%	27%
Rwanda	10.35	0.96	25	22	21	18	31	81%	71%	68%	58%
South Africa	6.07	1.29	27	27	26	25	31	87%	87%	84%	81%

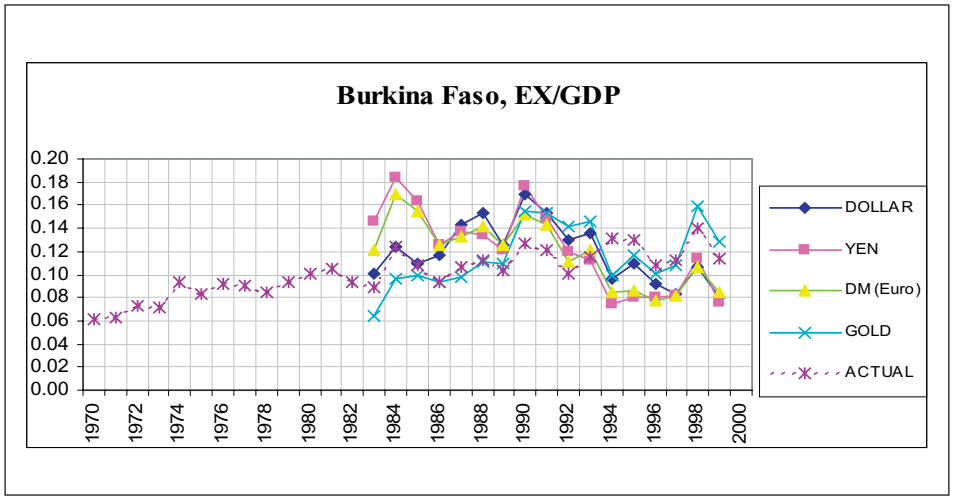
Real Gold Price

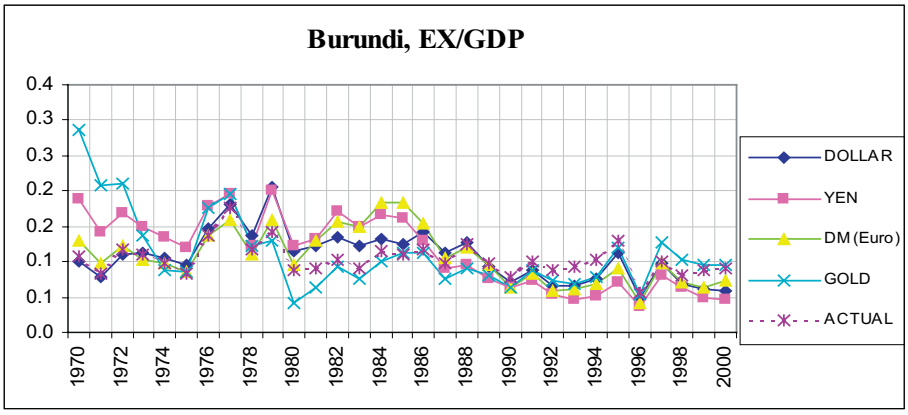
	Mean	Stdev	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean	Out of	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean
USD	4.58	0.44	24	16	15	5	31	77%	52%	48%	16%
Yen	9.81	0.45	24	21	20	7	31	77%	68%	65%	23%
DM-Euro	5.64	0.42	28	23	19	8	31	90%	74%	61%	26%
Bolivia	-1.72	0.22	9	6	5	0	16	56%	38%	31%	0%
Burkina Faso	11.64	0.17	12	5	3	0	17	71%	29%	18%	0%
Burundi	9.05	0.35	22	14	10	4	31	71%	45%	32%	13%
Fiji	4.31	0.38	23	17	12	4	31	74%	55%	39%	13%
Ghana	4.22	0.70	29	27	25	17	31	94%	87%	81%	55%
Guyana	10.59	0.16	4	0	0	0	5	80%	0%	0%	0%
Mali	11.72	0.18	8	3	2	0	13	62%	23%	15%	0%
Mongolia	9.52	0.30	5	3	2	1	6	83%	50%	33%	17%
Papua New Guinea	4.50	0.29	20	12	8	2	28	71%	43%	29%	7%
Peru	-0.51	0.20	7	4	2	0	11	64%	36%	18%	0%
Rwanda	8.91	0.30	16	12	9	3	30	53%	40%	30%	10%
South Africa	4.36	0.44	22	17	16	4	30	73%	57%	53%	13%

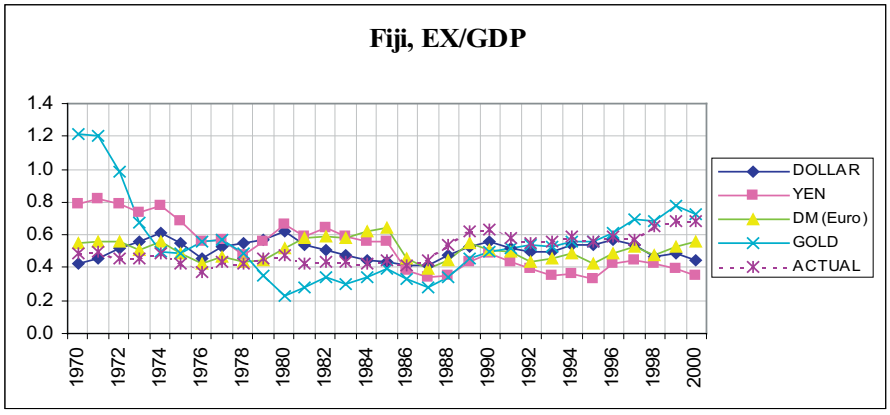
Figure Set 4:
Simulated path of Export/GDP under Alternative Peg Assumptions

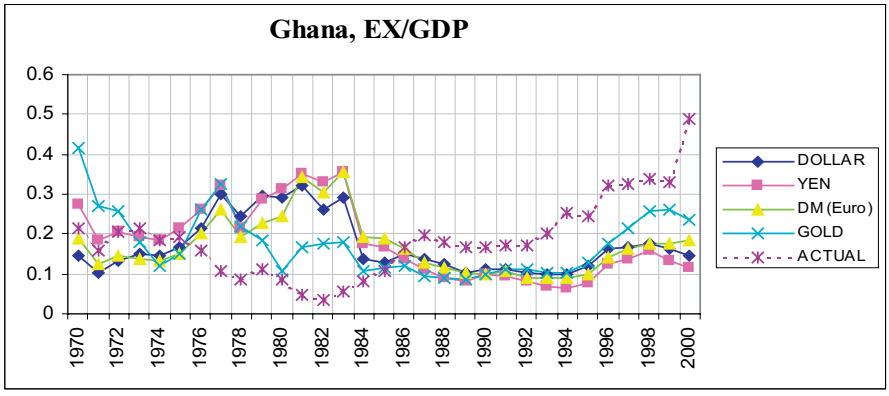
Gold Producers - Simulated Exports/GDP

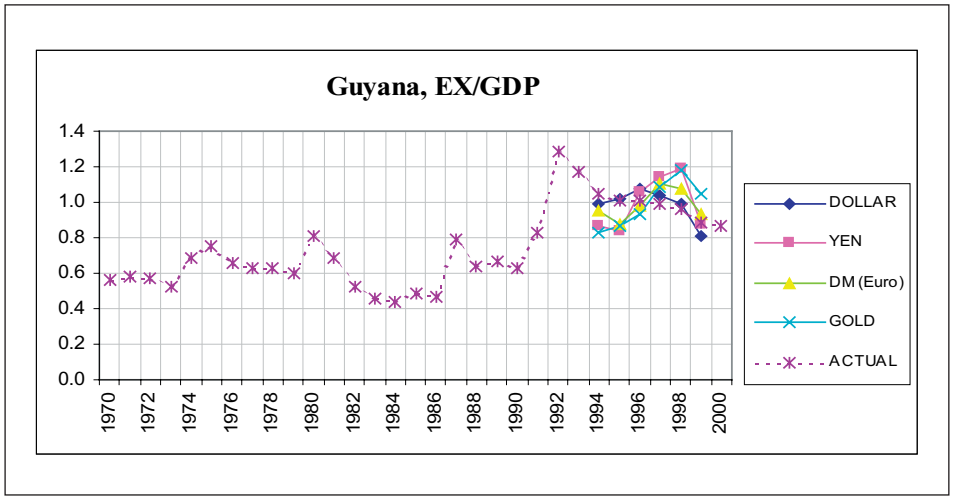


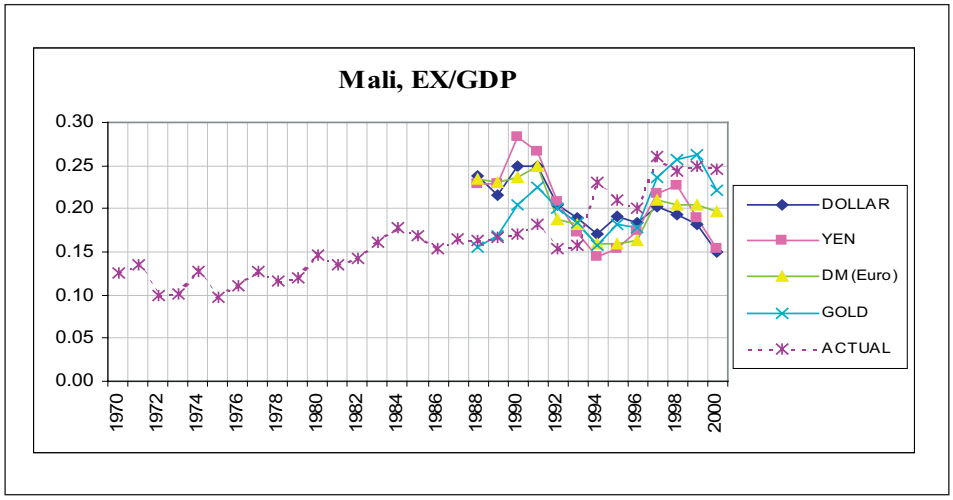


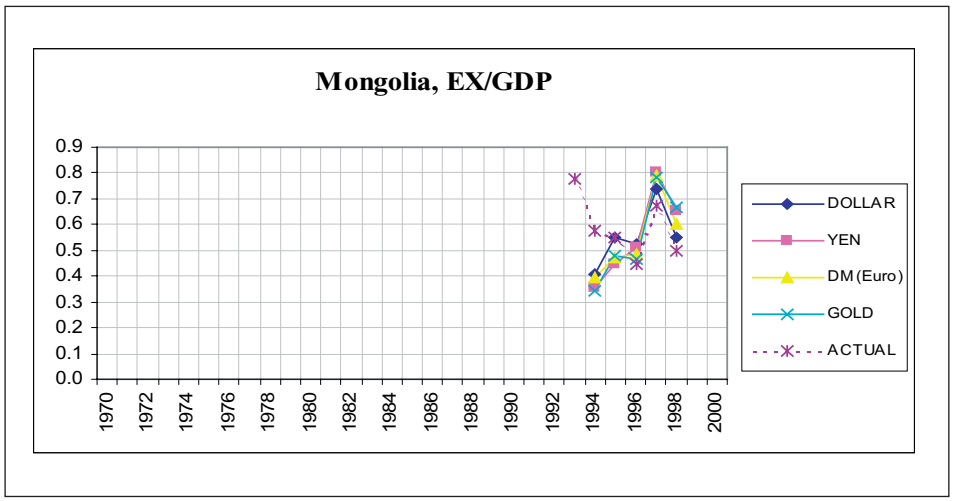

Burundi, EX/GDP
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL

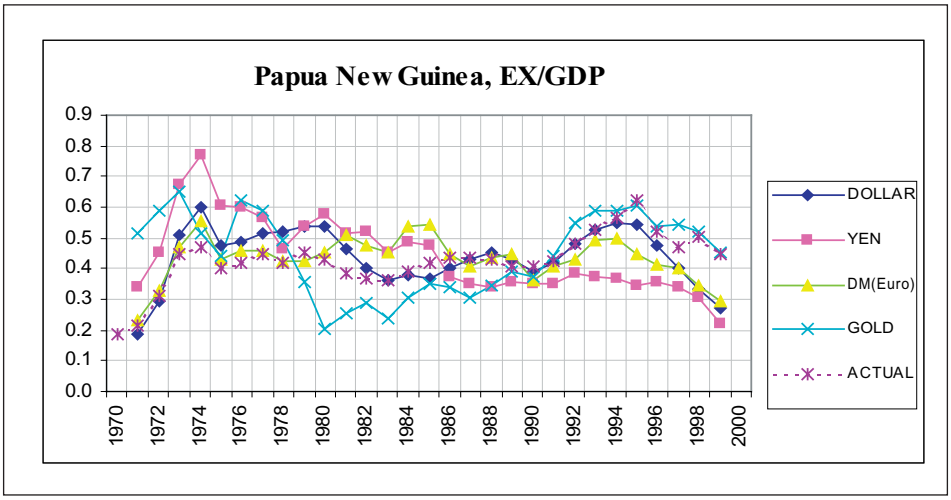

Fiji, EX/GDP
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL

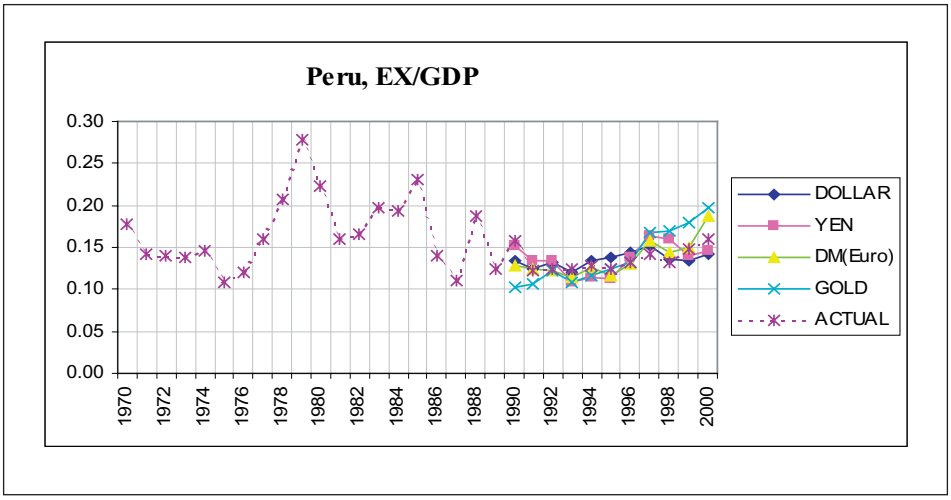

Ghana, EX/GDP
0.6
0.5
0.4
0.3
0.2
0.1
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL

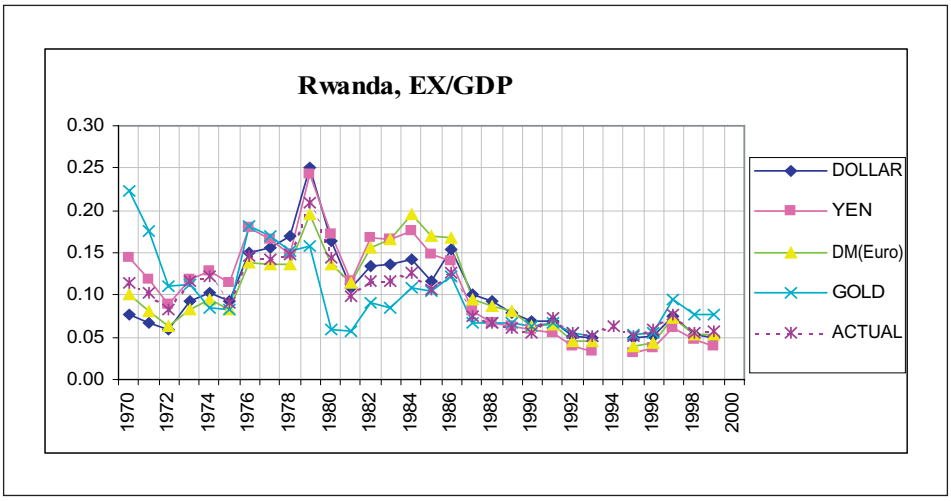

Guyana, EX/GDP
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL


Mali, EX/GDP
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL


Mongolia, EX/GDP
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL


Papua New Guinea, EX/GDP
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM(Euro)
GOLD
ACTUAL


Peru, EX/GDP
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM(Euro)
GOLD
ACTUAL


Rwanda, EX/GDP
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM(Euro)
GOLD
ACTUAL

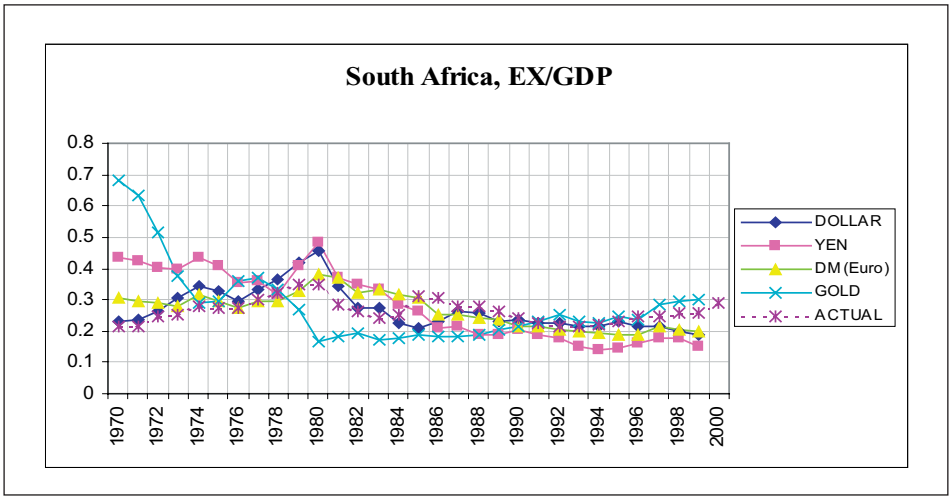
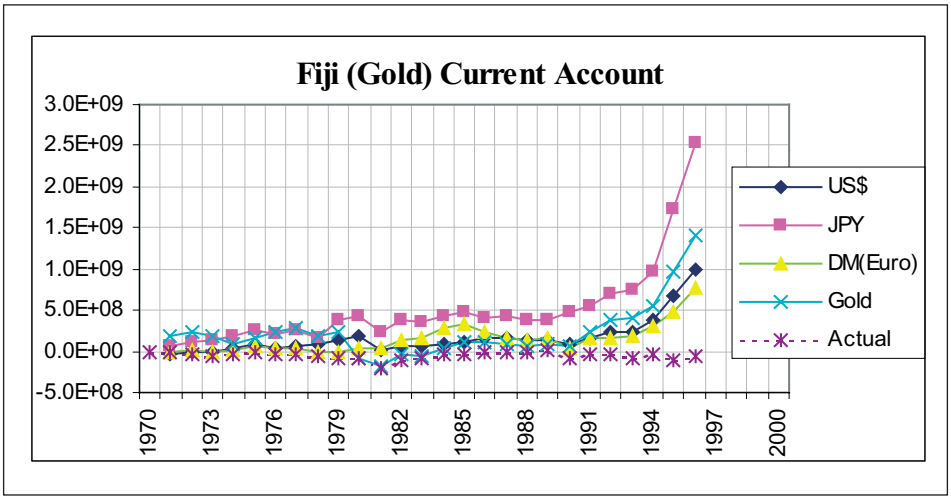
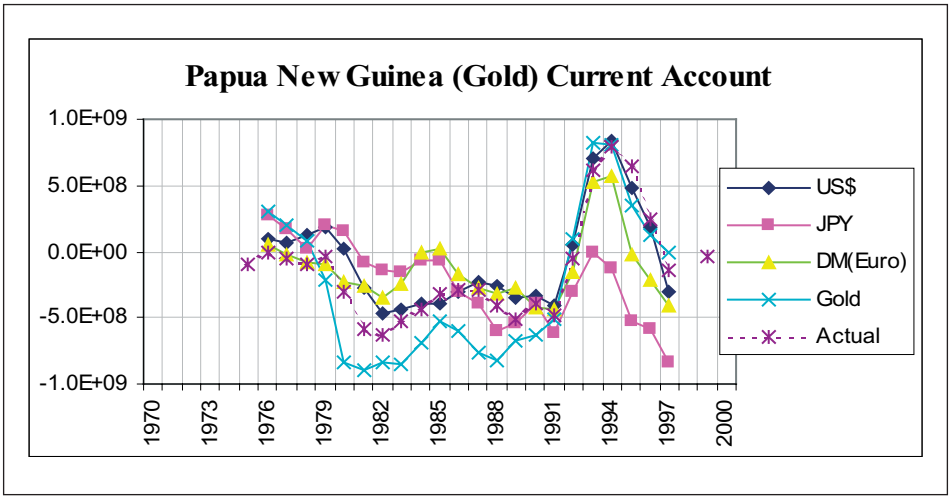

South Africa, EX/GDP
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
DOLLAR
YEN
DM (Euro)
GOLD
ACTUAL

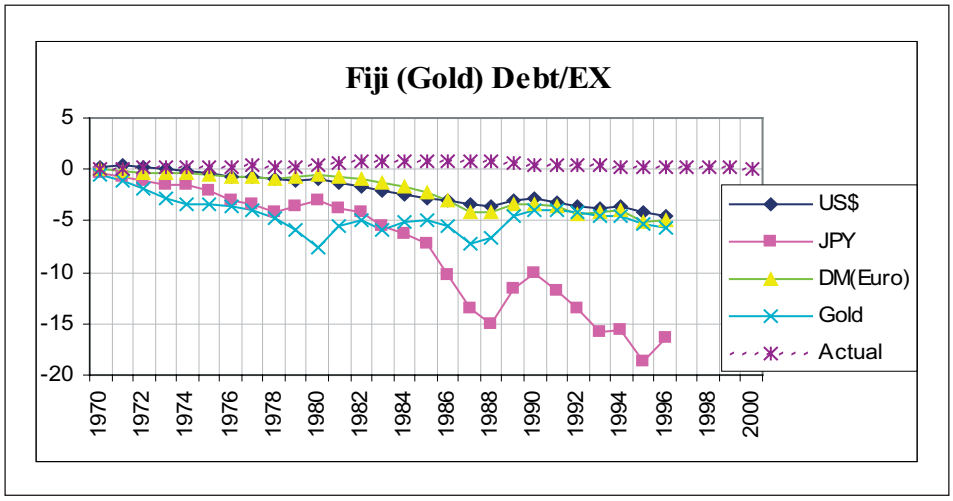
Figure Set 5:
Simulated of path Current Account and Debt/Exports under Alternative Peg Assumptions (with Endogenous Interest Payments Account)

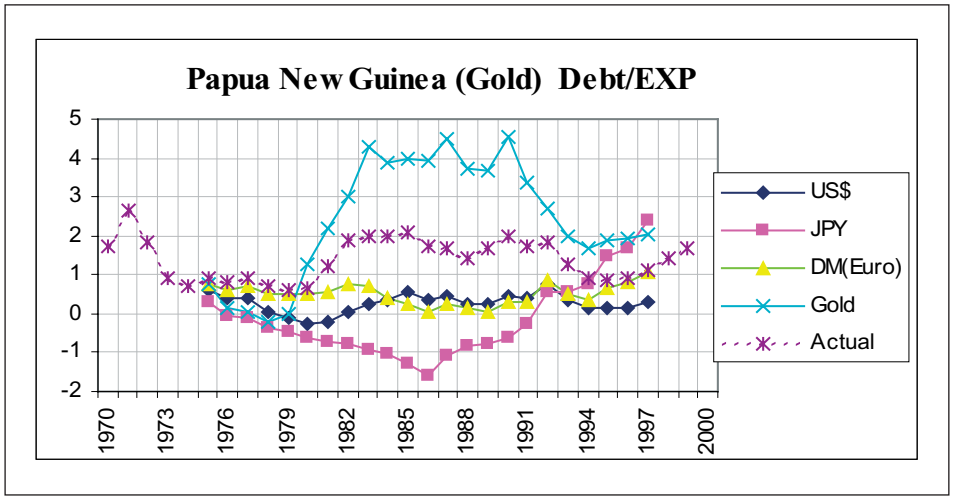
Gold Producers - Simulated Current Account





Gold Producers - Simulated Debt/Export





Figures and Tables appendix

Table Set 6:
Rankings of Countries by Concentration in Commodity Exports

Copper Export Concentration Rankings

	Average (1000 US$)		% of GDP		% of XGS*		% of XG**	
1	CHILE	1806803.50	MONGOLIA	19.18%	MONGOLIA	42.82%	MONGOLIA	45.49%
2	INDONESIA	1522495.00	CHILE	2.58%	CHILE	8.98%	CHILE	11.27%
3	AUSTRALIA	484501.50	INDONESIA	0.89%	INDONESIA	2.74%	INDONESIA	3.21%
4	AUSTRALIA	404172.20	BURKINA FASO	0.40%	PAPUA NEW GUINEA	1.96%	MONGOLIA	2.40%
5	USA, PR, USVI	287218.50	BULGARIA	0.33%	PERU	1.75%	PERU	2.33%
6	ARGENTINA	246516.50	MACEDONIA, FYR	0.25%	ARGENTINA	0.79%	ARGENTINA	1.16%
7	MONGOLIA	205166.00	PERU	0.24%	MACEDONIA, FYR	0.75%	AUSTRALIA	0.91%
8	PORTUGAL	166846.25	ZAMBIA	0.17%	AUSTRALIA	0.63%	PORTUGAL	0.69%
9	PERU	130370.80	PORTUGAL	0.15%	BULGARIA	0.53%	BULGARIA	0.62%
10	PHILIPPINES	63972.75	AUSTRALIA	0.12%	PORTUGAL	0.51%	ALBANIA	0.61%
11	SOUTH AFRICAN CUST.	57669.75	PHILIPPINES	0.08%	ZAMBIA	0.46%	MOROCCO	0.37%
12	TURKEY	39691.50	ARGENTINA	0.08%	ALBANIA	0.36%	PHILIPPINES	0.37%
13	MALAYSIA	33533.00	MOROCCO	0.07%	MOROCCO	0.27%	CANADA	0.21%
14	BULGARIA	32913.00	CANADA	0.07%	PHILIPPINES	0.21%	TURKEY	0.18%
15	MEXICO	28765.75	ALBANIA	0.05%	CANADA	0.17%	UNITED STATES	0.05%
16	SWEDEN	27486.75	SOUTH AFRICAN CUST.	0.04%	SOUTH AFRICAN CUST.	0.14%	MALAYSIA	0.05%
17	MOROCCO	25436.00	MALAYSIA	0.04%	TURKEY	0.10%	MEXICO	0.04%
18	SPAIN	16086.75	TURKEY	0.02%	MALAYSIA	0.04%	PAKISTAN	0.04%
19	RUSSIAN FEDERATION	10857.00	SWEDEN	0.01%	PAKISTAN	0.03%	SWEDEN	0.03%
20	GERMANY	10196.60	MEXICO	0.01%	UNITED STATES	0.03%	COLOMBIA	0.03%
21	NORWAY	9710.75	SLOVAK REPUBLIC	0.01%	SWEDEN	0.03%	ROMANIA	0.03%
22	MACEDONIA, FYR	7009.50	NORWAY	0.01%	MEXICO	0.03%	NORWAY	0.02%
23	ARMENIA	6502.00	ROMANIA	0.01%	ROMANIA	0.02%	BOLIVIA	0.02%
24	ZAMBIA	5758.00	PAKISTAN	0.01%	COLOMBIA	0.02%	ECUADOR	0.02%
25	UNITED KINGDOM	4653.75	ECUADOR	0.00%	NORWAY	0.02%	POLAND	0.02%
26	POLAND	4391.00	UNITED STATES	0.00%	ECUADOR	0.02%	SPAIN	0.02%
27	COLOMBIA	3464.60	COLOMBIA	0.00%	BOLIVIA	0.01%	SLOVAK REPUBLIC	0.02%
28	PAKISTAN	2927.00	POLAND	0.00%	SLOVAK REPUBLIC	0.01%	RUSSIAN FEDERATION	0.01%
29	ROMANIA	2400.00	BOLIVIA	0.00%	SPAIN	0.01%	OMAN	0.01%
30	BELGIUM-LUXEMBOURG	1057.75	RUSSIAN FEDERATION	0.00%	RUSSIAN FEDERATION	0.01%	INDIA	0.00%

* XGS: Exports of goods & sevices

** XG: Exports of goods

Wheat Export Concentration Rankings

	Average (1000 US$)		% of GDP		% of XGS*		% of XG**	
1	CANADA	3,228,547.8	CANADA	0.78%	ARGENTINA	8.42%	ARGENTINA	8.13%
2	FRANCE	2,603,841.2	ARGENTINA	0.69%	AUSTRALIA	4.11%	AUSTRALIA	5.20%
3	AUSTRALIA	1,471,231.1	AUSTRALIA	0.67%	CANADA	2.79%	CANADA	3.14%
4	ARGENTINA	823,071.1	BERMUDA	0.44%	MOZAMBIQUE	1.48%	GREECE	2.67%
5	UNITED KINGDOM	514,026.2	EQUATORIAL GUINEA	0.41%	FRANCE	1.32%	MOZAMBIQUE	2.36%
6	GERMANY	472,506.2	FRANCE	0.30%	GREECE	1.30%	EQUATORIAL GUINEA	1.44%
7	GREECE	146,516.5	GREECE	0.22%	EQUATORIAL GUINEA	1.26%	URUGUAY	1.18%
8	DENMARK	122,973.6	URUGUAY	0.20%	URUGUAY	0.93%	DJIBOUTI	1.14%
9	SAUDI ARABIA	111,921.4	ROMANIA	0.19%	ROMANIA	0.69%	ZIMBABWE	0.87%
10	BELGIUM-LUXEMBOURG	106,771.6	MOZAMBIQUE	0.17%	PRAGUAY	0.69%	TURKEY	0.84%
11	PRAGUAY	82,894.2	PRAGUAY	0.16%	PRAGUAY	0.61%	ROMANIA	0.46%
12	NETHERLANDS	71,968.0	ZIMBABWE	0.15%	ZIMBABWE	0.59%	GUINEA-BISSAU	0.42%
13	SPAIN	59,399.4	BULGARIA	0.12%	GUINEA-BISSAU	0.36%	ALBANIA	0.40%
14	AUSTRIA	57,204.8	ST. KITTS AND NEVIS	0.12%	ALBANIA	0.35%	PRAGUAY	0.38%
15	ITALY	56,366.3	SAUDI ARABIA	0.11%	BULGARIA	0.30%	DENMARK	0.37%
16	SWEDEN	48,140.4	DENMARK	0.10%	PAKISTAN	0.28%	PAKISTAN	0.37%
17	ROMANIA	38,038.2	HUNGARY	0.10%	SAUDI ARABIA	0.28%	SAUDI ARABIA	0.32%
18	RUSSIAN FEDERATION	36,809.3	DJIBOUTI	0.09%	DENMARK	0.27%	HUNGARY	0.29%
19	YUGOSLAVIA, FR[1]	31,789.3	TURKEY	0.08%	UNITED KINGDOM	0.26%	BULGARIA	0.29%
20	INDIA	29,784.7	UNITED KINGDOM	0.07%	HUNGARY	0.25%	ST. KITTS AND NEVIS	0.26%
21	HUNGARY	28,130.5	LIBERIA	0.06%	ST. KITTS AND NEVIS	0.20%	SYRIAN ARAB REBUBLIC	0.24%
22	CZECH REPUBLIC	24,715.4	GUINEA-BISSAU	0.06%	SYRIAN ARAB REBUBLIC	0.20%	AUSTRIA	0.24%
23	BULGARIA	20,108.5	TOGO	0.06%	LAO PDR	0.19%	JORDAN	0.22%
24	URUGUAY	16,806.6	AUSTRIA	0.06%	DJIBOUTI	0.18%	LAO PDR	0.22%
25	POLAND	13,648.1	MONGOLIA	0.06%	GERMANY	0.16%	TOGO	0.18%
26	IRELAND	12,308.8	CZECH REPUBLIC	0.06%	TOGO	0.15%	LIBERIA	0.17%
27	ZIMBABWE	12,075.2	SYRIAN ARAB REBUBLIC	0.05%	LIBERIA	0.15%	INDIA	0.16%
28	PARAGUAY	11,911.4	ALBANIA	0.05%	AUSTRIA	0.15%	MYANMAR	0.16%
29	SOUTH AFRICA	11,607.5	GAMBIA, THE	0.04%	NICARAGUA	0.14%	GAMBIA, THE	0.16%
30	MEXICO	10,694.7	LAO PDR	0.04%	CZECH REPUBLIC	0.14%	NICARAGUA	0.15%

[1] SERBIA/MONTENEGRO

* XGS: Exports of goods & sevices

** XG: Exports of goods

Coffee Export Concentration Rankings

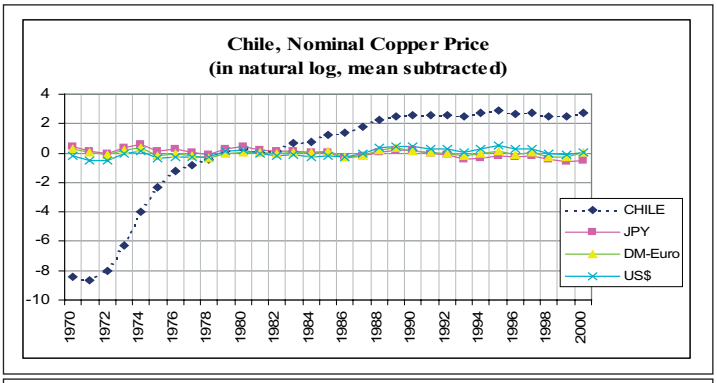
	Average (1000 US$)		% of GDP		% of XGS*		% of XG**	
1	BRAZIL	2583812.50	HONDURAS	7.33%	ETHIOPIA	35.07%	ETHIOPIA	65.16%
2	COLOMBIA	1910398.20	NICARAGUA	6.71%	GUATEMALA	17.86%	NICARAGUA	25.44%
3	GERMANY	972011.60	ETHIOPIA	4.77%	NICARAGUA	17.84%	GUATEMALA	22.36%
4	MEXICO	835311.75	EL SALVADOR	3.64%	EL SALVADOR	16.27%	HONDURAS	19.40%
5	INDONESIA	591344.25	COSTA RICA	3.29%	C	16.00%	EL SALVADOR	19.03%
6	GUATEMALA	547289.00	GUATEMALA	3.26%	COLOMBIA	12.84%	COLOMBIA	16.75%
7	INDIA EX SIK	435148.67	KENYA	2.74%	KENYA	9.17%	TANZANIA	14.39%
8	BELGIUM-LUXEMBOURG	416587.50	COLOMBIA	2.05%	TANZANIA	8.50%	KENYA	13.41%
9	COSTA RICA	408900.50	MADAGASCAR	1.66%	COSTA RICA	8.00%	MADAGASCAR	11.31%
10	EL SALVADOR	388730.50	CAMEROON	1.59%	MADAGASCAR	7.36%	COSTA RICA	9.90%
11	COSTA RICA	331680.75	TANZANIA	1.34%	CAMEROON	6.58%	CAMEROON	8.21%
12	FRANCE	311233.00	MALAWI	1.08%	BRAZIL	4.52%	HAITI	6.69%
13	PERU	292770.80	ECUADOR	0.83%	PERU	3.88%	BRAZIL	5.19%
14	ETHIOPIA	275642.00	JAMAICA	0.62%	MALAWI	3.65%	PERU	4.83%
15	KENYA	270683.75	PERU	0.53%	ECUADOR	2.84%	ECUADOR	3.37%
16	ITALY	262368.75	DOMINICAN REPUBLIC	0.46%	HAITI	2.70%	JAMAICA	1.83%
17	USA, PR, USVI	213881.50	ZIMBABWE	0.36%	DOMINICAN REPUBLIC	1.49%	BOLIVIA	1.66%
18	NETHERLANDS	166651.75	INDONESIA	0.36%	JAMAICA	0.04%	DOMINICAN REPUBLIC	1.51%
19	UNITED KINGDOM	156856.50	BRAZIL	0.34%	BOLIVIA	1.14%	INDIA	1.30%
20	ECUADOR	155505.50	PANAMA	0.29%	INDONESIA	1.07%	INDONESIA	1.17%
21	SINGAPORE	152961.60	BOLIVIA	0.25%	INDIA	1.04%	MEXICO	0.85%
22	CANADA	137400.00	HAITI	0.24%	ZIMBABWE	0.98%	LITHUANIA	0.72%
23	NICARAGUA	136151.80	MEXICO	0.24%	CENTRAL AFRICAN REPUBLIC	0.91%	ESTONIA	0.40%
24	CAMEROON	134765.00	LITHUANIA	0.22%	PANAMA	0.80%	PANAMA	0.40%
25	SPAIN	129338.50	SINGAPORE	0.19%	MEXICO	0.77%	LATVIA	0.30%
26	UNITED REPUBLIC TANZANIA	102948.00	CENTRAL AFRICAN REPUBLIC	0.18%	LITHUANIA	0.56%	GREECE	0.28%
27	THAILAND	98523.60	ESTONIA	0.17%	ESTONIA	0.23%	BELGIUM-LUXEMBOURG	0.27%
28	SWITZ.LIECHT	96151.80	INDIA	0.11%	LATVIA	0.19%	MOROCCO	0.24%
29	SWEDEN	70445.25	LATVIA	0.09%	POLAND	0.19%	POLAND	0.23%
30	POLAND	68983.00	THAILAND	0.07%	MOROCCO	0.17%	GERMANY	0.18%

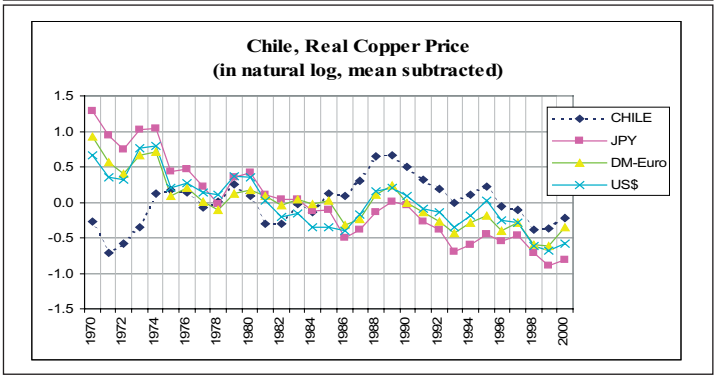
* XGS: Exports of goods & sevices

** XG: Exports of goods

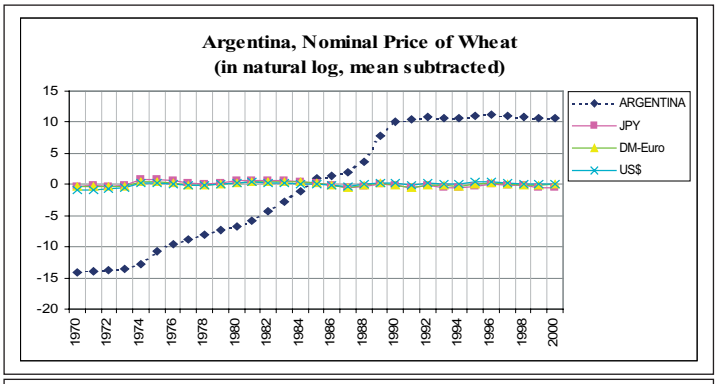
Figure Set 7: Nominal and Real Log Export Prices, Simulated under Alternative Exchange Rate Regimes

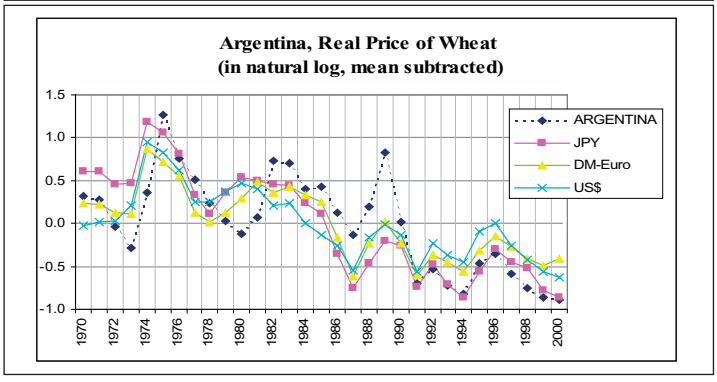
Copper Producers - Export Prices

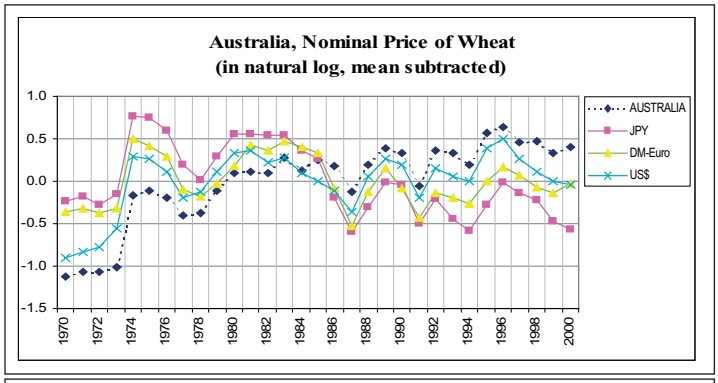


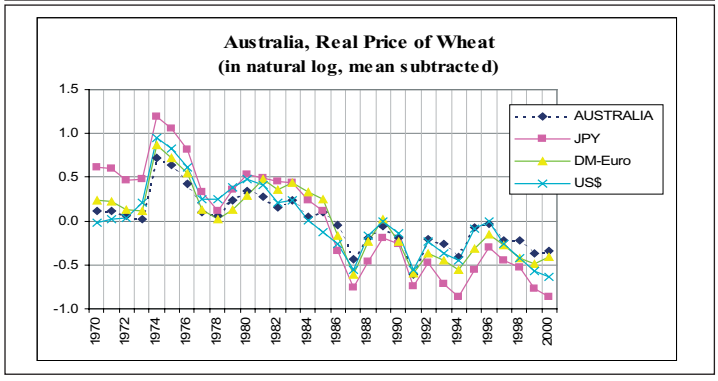


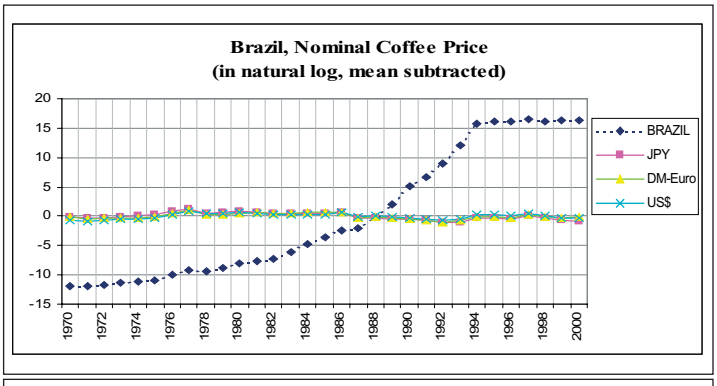
Wheat Producers - Export Prices

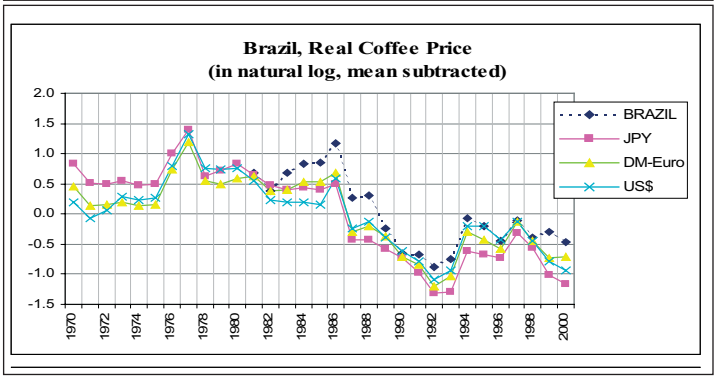




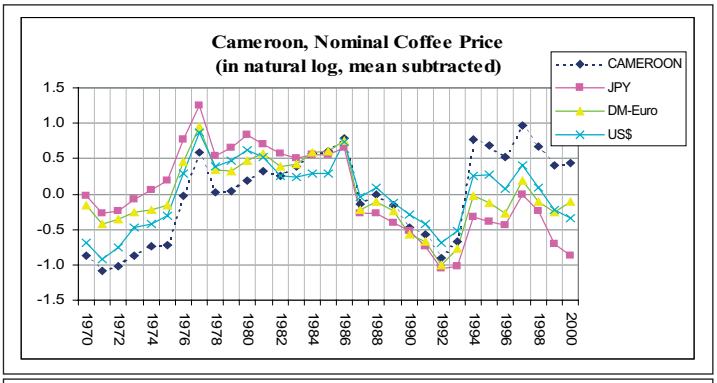


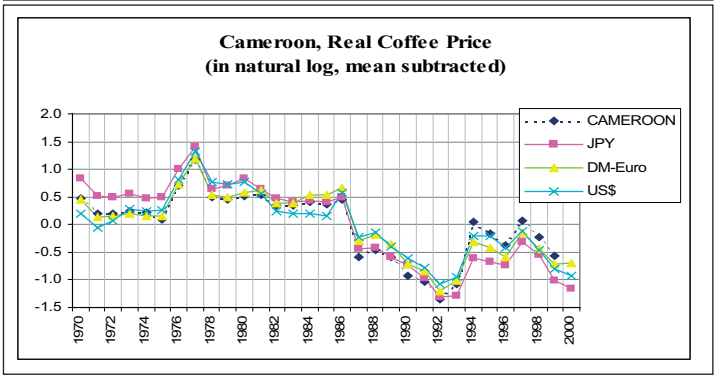


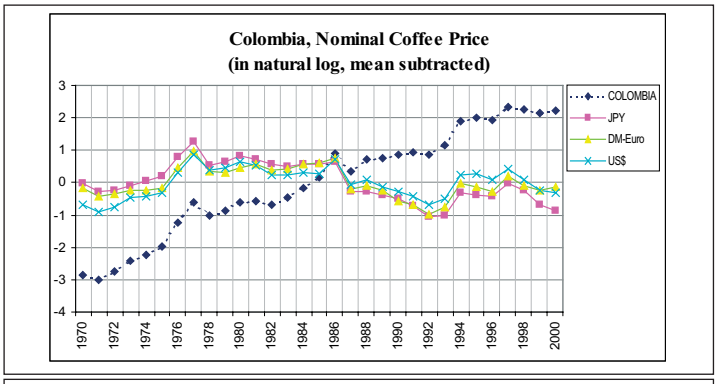


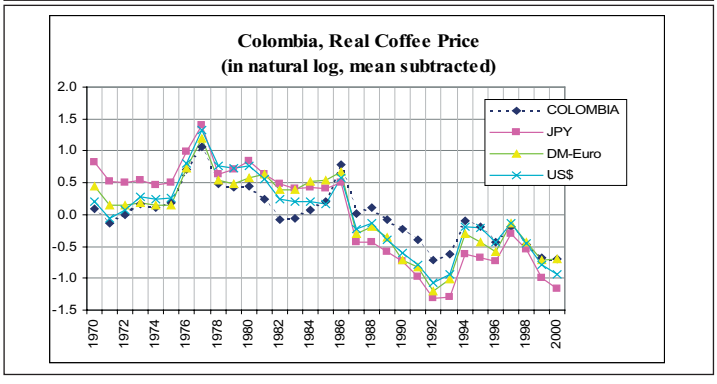


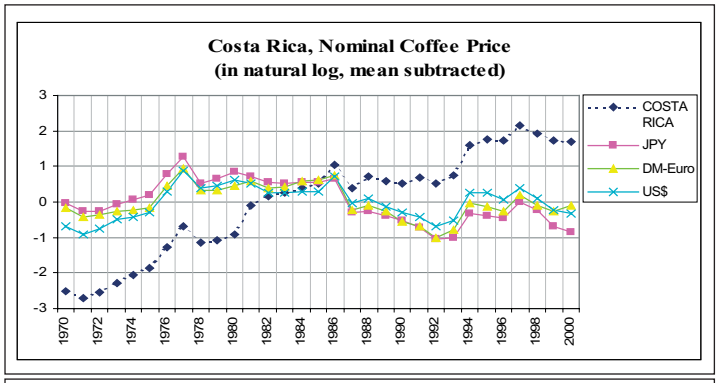
Coffee Producers - Export Prices

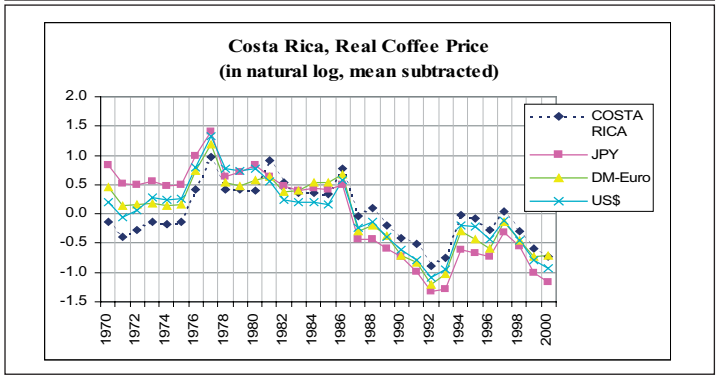

Cameroon, Nominal Coffee Price
(in natural log, mean subtracted)
CAMEROON
JPY
DM-Euro
US$
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000

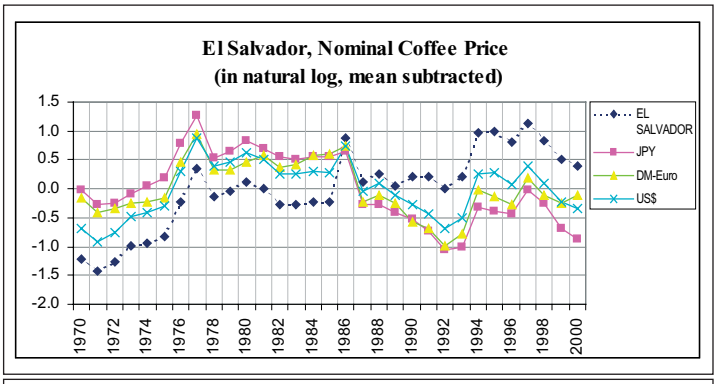

Cameroon, Real Coffee Price
(in natural log, mean subtracted)
CAMEROON
JPY
DM-Euro
US$
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000

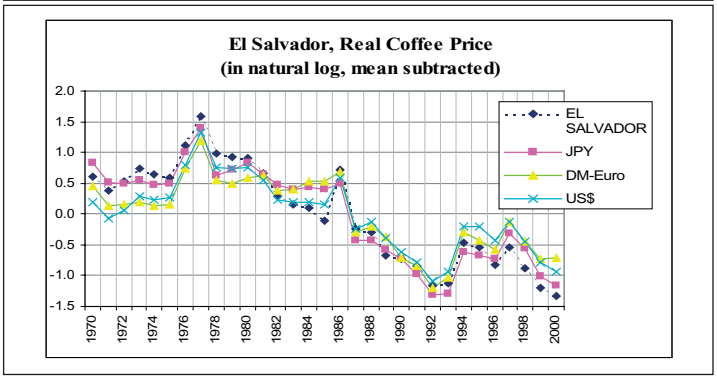

Colombia, Nominal Coffee Price
(in natural log, mean subtracted)
COLOMBIA
JPY
DM-Euro
US$
3
2
1
0
-1
-2
-3
-4
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000

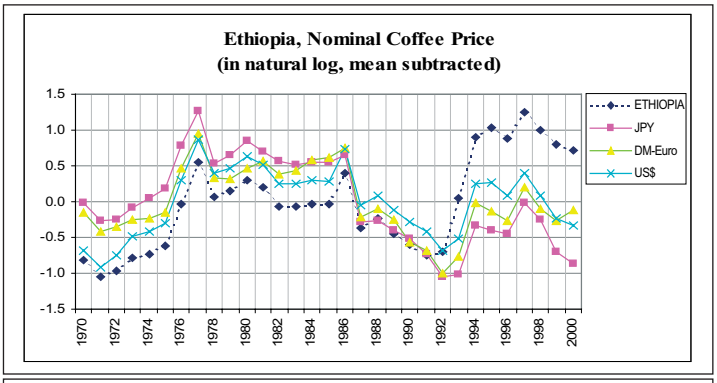

Colombia, Real Coffee Price
(in natural log, mean subtracted)
COLOMBIA
JPY
DM-Euro
US$
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000

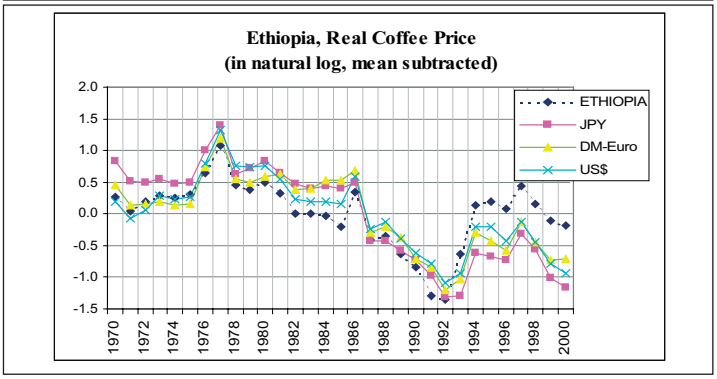

Costa Rica, Nominal Coffee Price
(in natural log, mean subtracted)
COSTA RICA
JPY
DM-Euro
US$

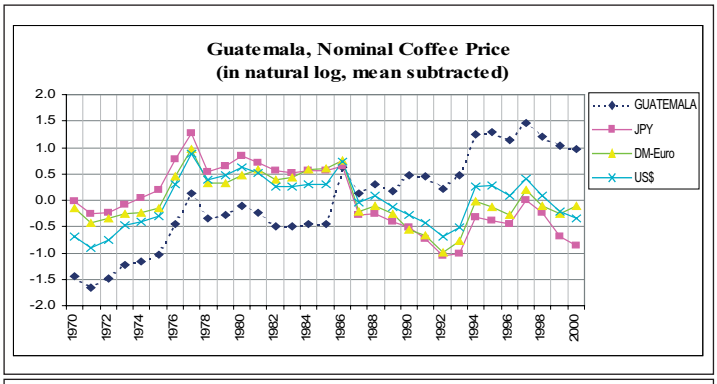

Costa Rica, Real Coffee Price
(in natural log, mean subtracted)
COSTA RICA
JPY
DM-Euro
US$

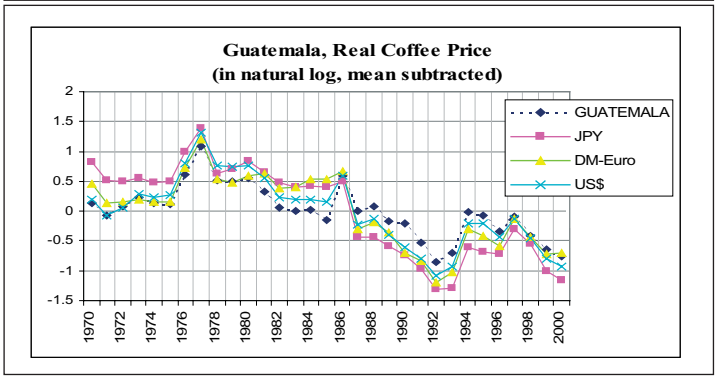

El Salvador, Nominal Coffee Price
(in natural log, mean subtracted)
EL SALVADOR
JPY
DM-Euro
US$

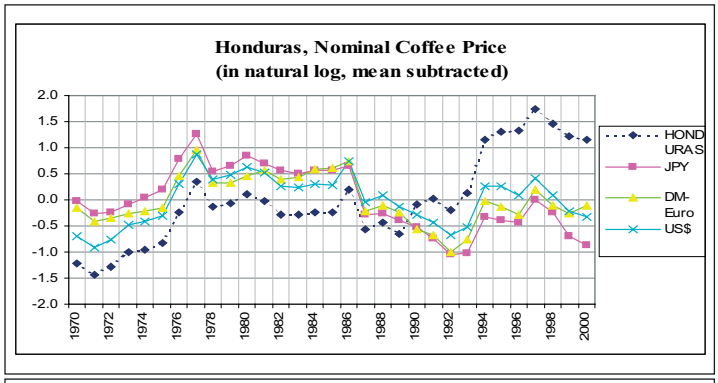

El Salvador, Real Coffee Price
(in natural log, mean subtracted)
EL SALVADOR
JPY
DM-Euro
US$

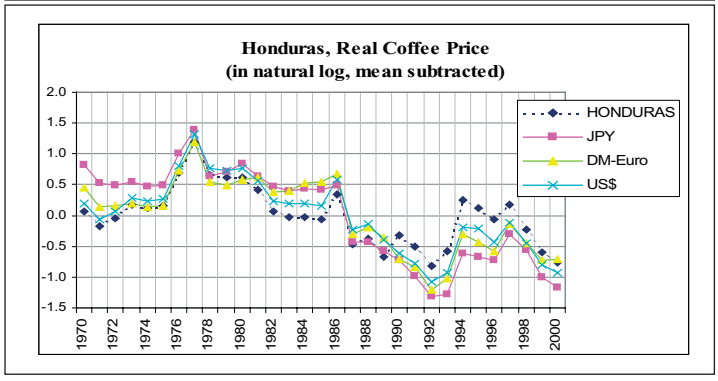

Ethiopia, Nominal Coffee Price
(in natural log, mean subtracted)
ETHIOPIA
JPY
DM-Euro
US$

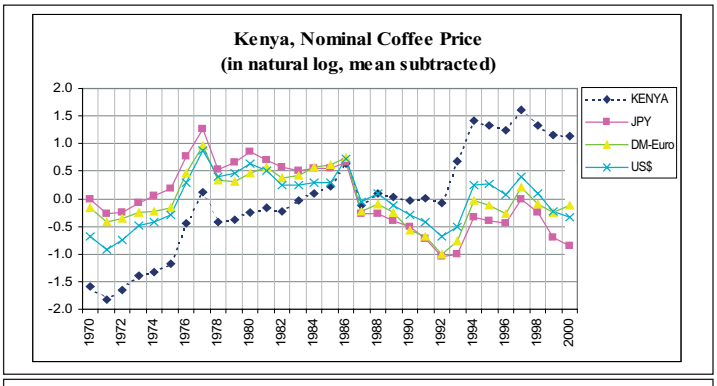

Ethiopia, Real Coffee Price
(in natural log, mean subtracted)
ETHIOPIA
JPY
DM-Euro
US$

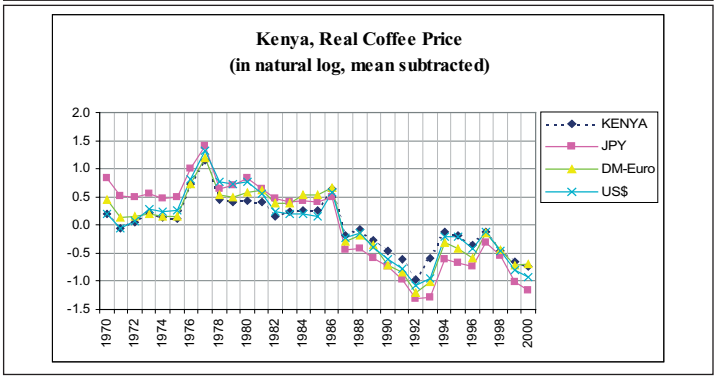

Guatemala, Nominal Coffee Price
(in natural log, mean subtracted)
GUATEMALA
JPY
DM-Euro
US$

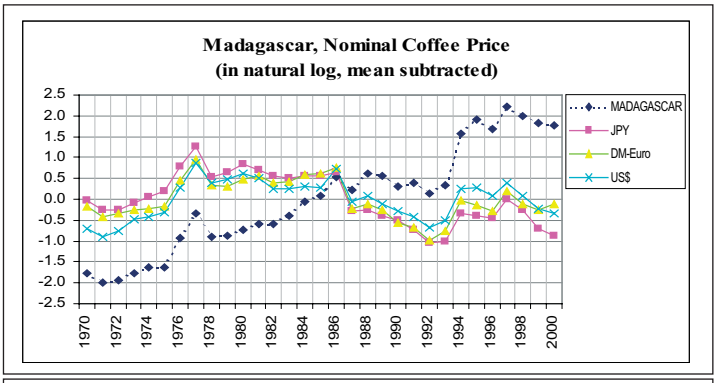

Guatemala, Real Coffee Price
(in natural log, mean subtracted)
GUATEMALA
JPY
DM-Euro
US$

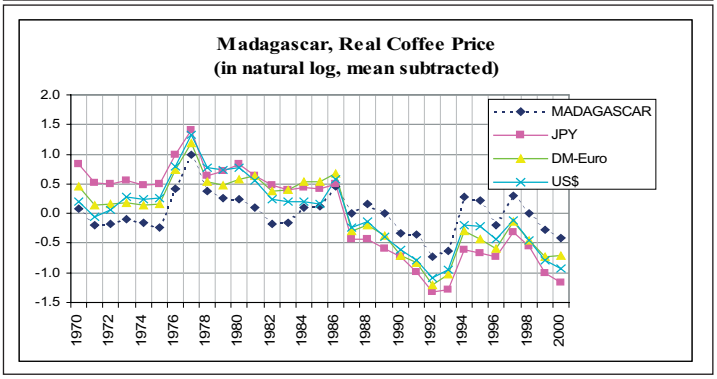

Honduras, Nominal Coffee Price
(in natural log, mean subtracted)
HONDURAS
JPY
DM-Euro
US$

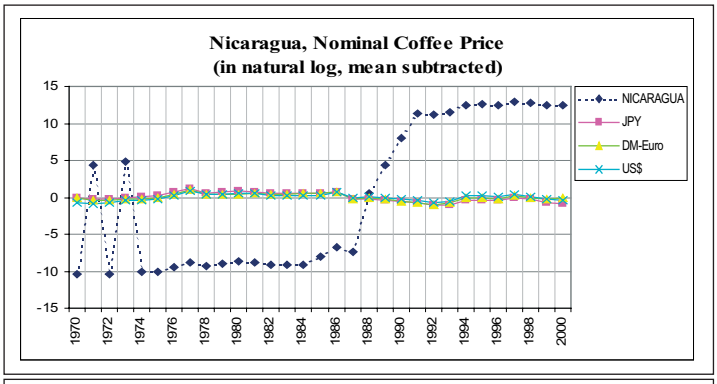

Honduras, Real Coffee Price
(in natural log, mean subtracted)
HONDURAS
JPY
DM-Euro
US$

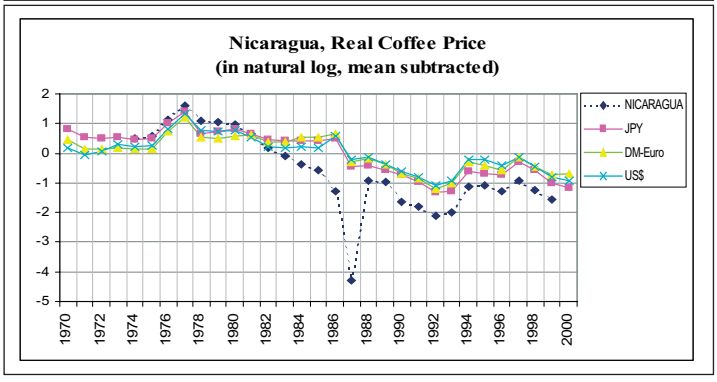

Kenya, Nominal Coffee Price
(in natural log, mean subtracted)
KENYA
JPY
DM-Euro
US$

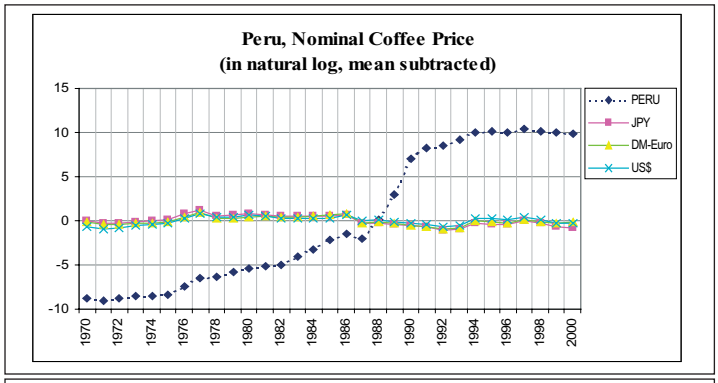

Kenya, Real Coffee Price
(in natural log, mean subtracted)
KENYA
JPY
DM-Euro
US$

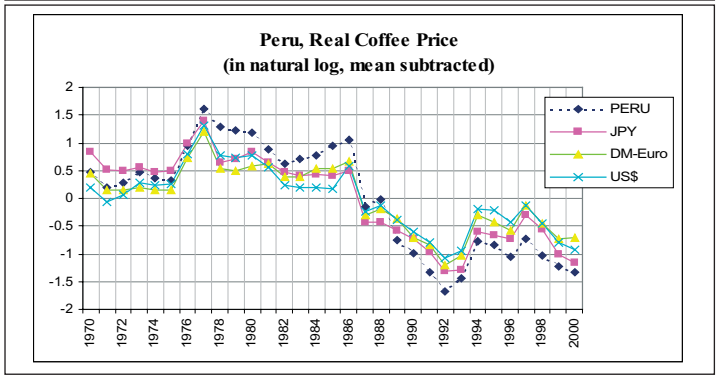

Madagascar, Nominal Coffee Price
(in natural log, mean subtracted)
MADAGASCAR
JPY
DM-Euro
US$

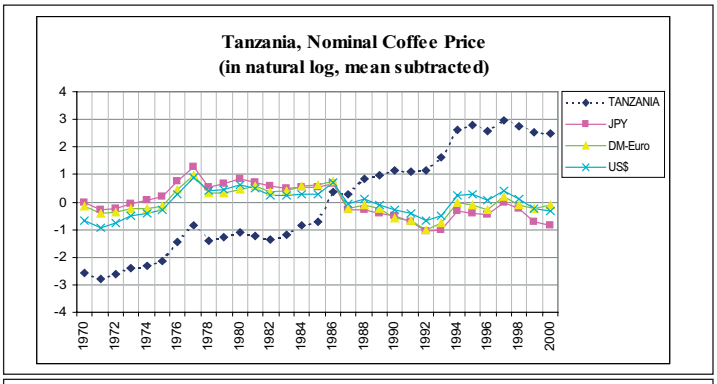

Madagascar, Real Coffee Price
(in natural log, mean subtracted)
MADAGASCAR
JPY
DM-Euro
US$


Nicaragua, Nominal Coffee Price
(in natural log, mean subtracted)
NICARAGUA
JPY
DM-Euro
US$


Nicaragua, Real Coffee Price
(in natural log, mean subtracted)
NICARAGUA
JPY
DM-Euro
US$


Peru, Nominal Coffee Price
(in natural log, mean subtracted)
PERU
JPY
DM-Euro
US$


Peru, Real Coffee Price
(in natural log, mean subtracted)
PERU
JPY
DM-Euro
US$


Tanzania, Nominal Coffee Price
(in natural log, mean subtracted)
TANZANIA
JPY
DM-Euro
US$

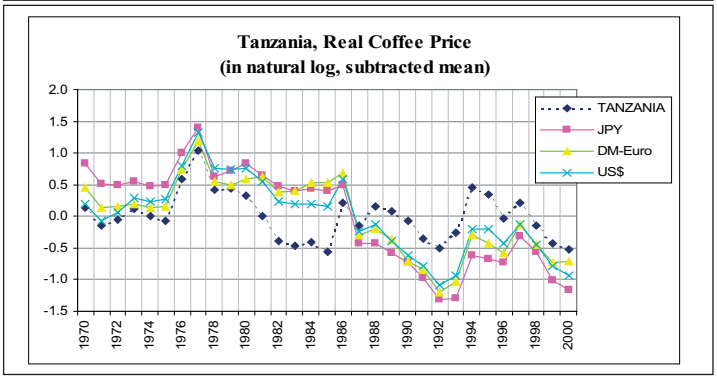

Tanzania, Real Coffee Price
(in natural log, subtracted mean)
TANZANIA
JPY
DM-Euro
US$

Table Set 8:
Summary Statistics on Variability of Simulated Export Prices, Nominal and Real, under Alternative Exchange Rate Regimes

Nominal Copper Price

	Mean	Stdev	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean	Out of	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean
USD	-0.22	0.28	25	20	15	2	31	81%	65%	48%	6%
Yen	4.99	0.30	25	14	12	3	31	81%	45%	39%	10%
DM-Euro	0.53	0.18	16	10	6	0	31	52%	32%	19%	0%
Chile	3.37	3.50	30	28	28	26	31	97%	90%	90%	84%
Mongolia	5.71	1.57	9	9	9	8	9	100%	100%	100%	89%

Real Copper Price

	Mean	Stdev	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean	Out of	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean
USD	-1.17	0.38	27	20	16	6	31	87%	65%	52%	19%
Yen	4.07	0.58	26	22	21	11	31	84%	71%	68%	35%
DM-Euro	-0.10	0.37	23	17	14	6	31	74%	55%	45%	19%
Chile	-5.07	0.33	24	16	14	5	31	77%	52%	45%	16%
Mongolia	3.65	0.35	4	4	4	0	6	67%	67%	67%	0%

Nominal Wheat Price

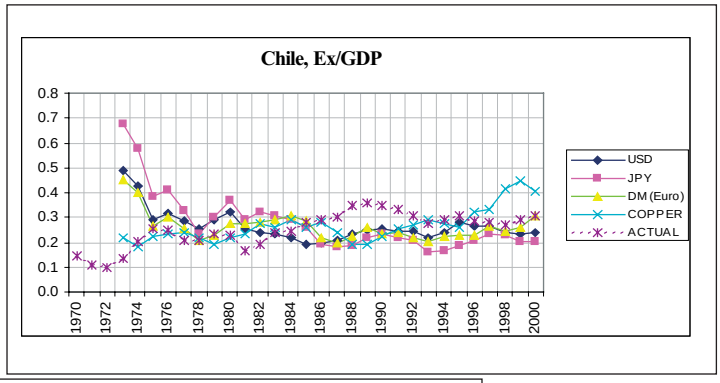
	Mean	Stdev	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean	Out of	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean
USD	1.26	0.36	25	15	14	5	31	81%	48%	45%	16%
Yen	6.47	0.42	27	22	19	10	31	87%	71%	61%	32%
DM-Euro	2.00	0.29	23	15	15	2	31	74%	48%	48%	6%
Argentina	-9.43	9.66	31	31	31	31	31	100%	100%	100%	100%
Australia	1.37	0.49	29	19	17	6	31	94%	61%	55%	19%
Mozambique	6.85	2.65	31	31	31	30	31	100%	100%	100%	97%

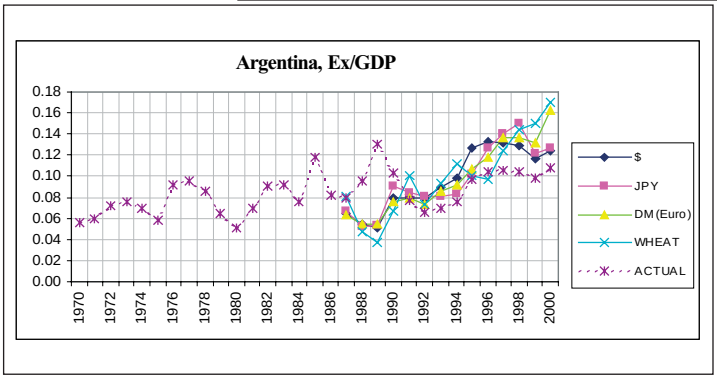
Real Wheat Price

	Mean	Stdev	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean	Out of	% of Year out of +- 0.1+Mean	% of Year out of +- 0.2+Mean	% of Year out of +- 0.25+Mean	% of Year out of +- 0.5+Mean
USD	0.31	0.40	24	21	16	7	31	77%	68%	52%	23%
Yen	5.54	0.60	31	28	27	14	31	100%	90%	87%	45%
DM-Euro	1.37	0.40	29	23	18	6	31	94%	74%	58%	19%
Argentina	-24.43	0.57	27	23	22	14	31	87%	74%	71%	45%
Australia	0.09	0.31	23	16	11	6	31	74%	52%	35%	10%
Mozambique	6.64	0.30	9	4	4	1	13	69%	31%	31%	8%

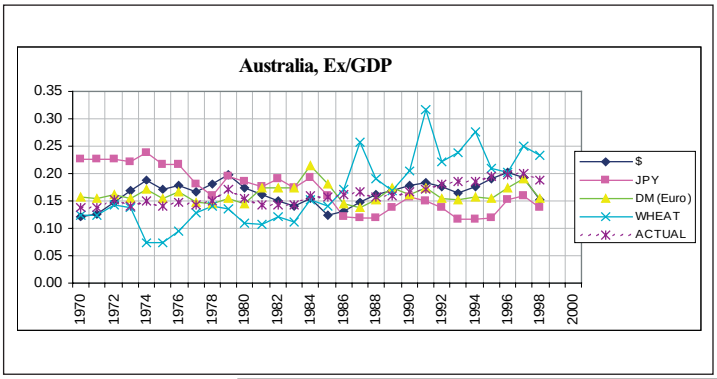
Figure Set 9:
Simulated path of Export/GDP under Alternative Peg Assumptions

Copper Producers - Simulated Exports/GDP

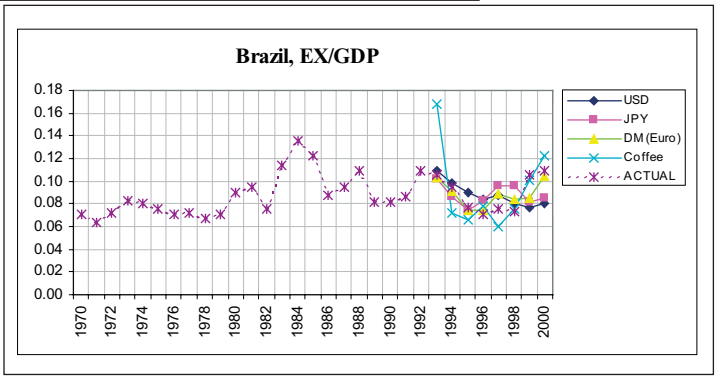


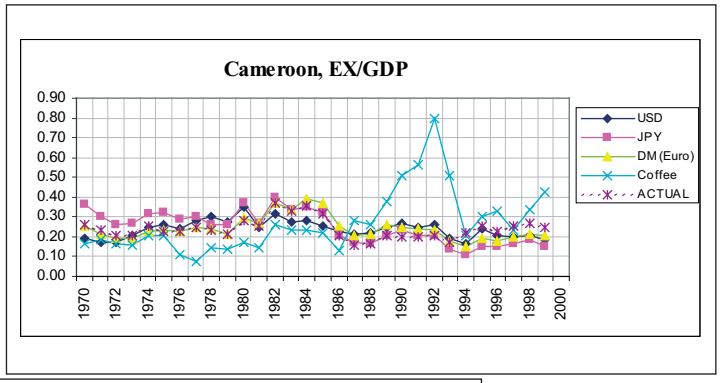


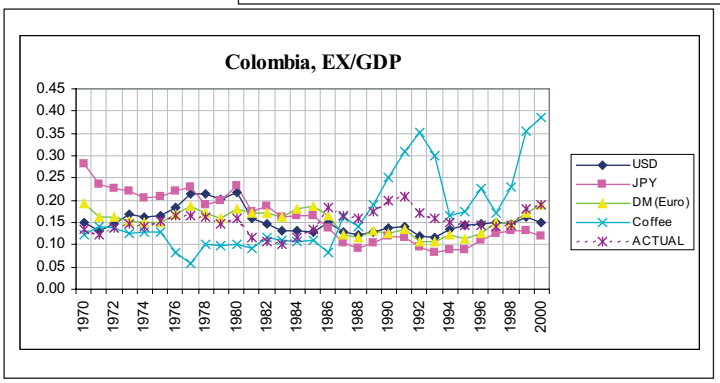
Wheat Producers - Simulated Exports/GDP

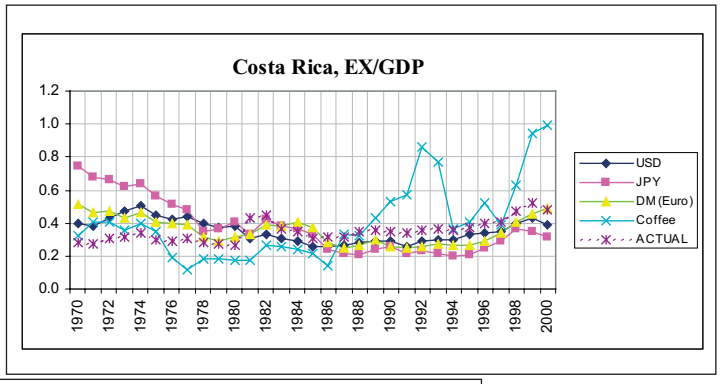


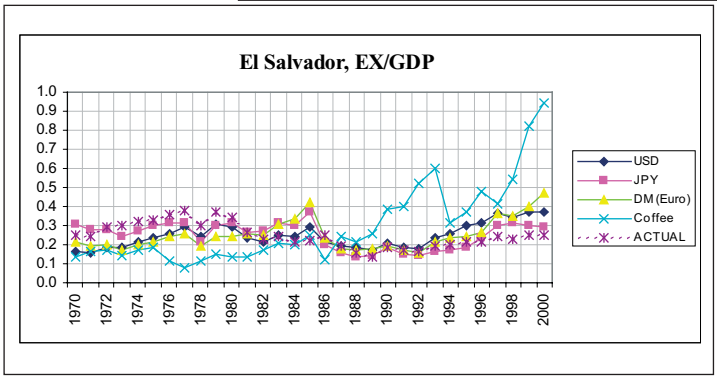
Coffee Producers - Simulated Exports/GDP

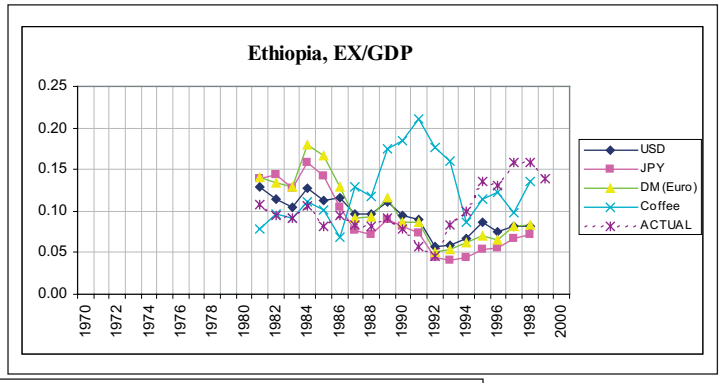


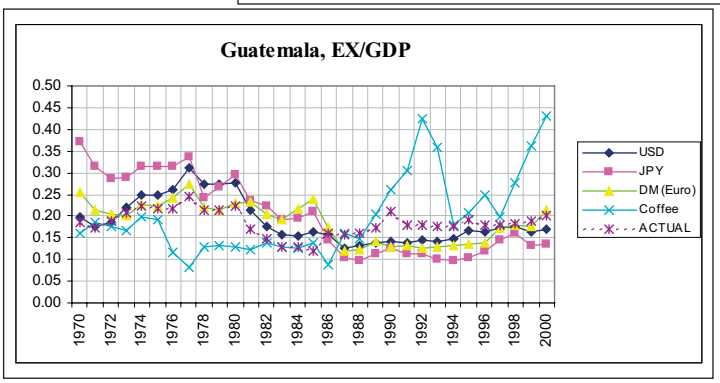

Cameroon, EX/GDP
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL

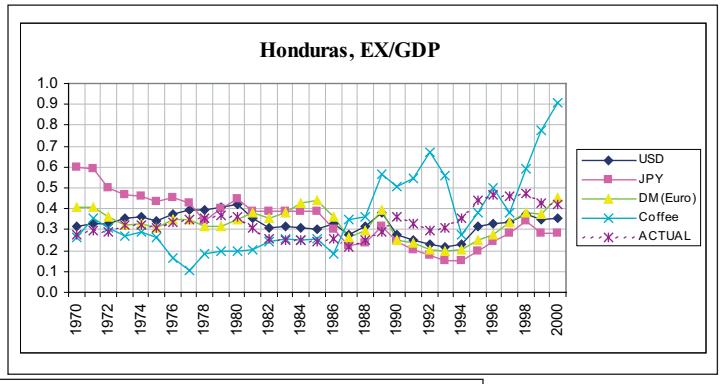

Colombia, EX/GDP
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL

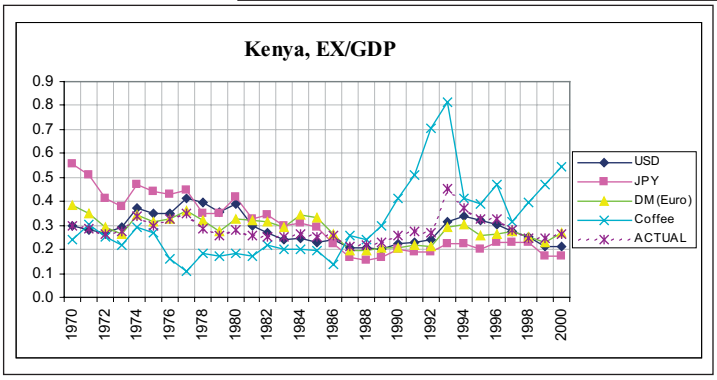

Costa Rica, EX/GDP
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL

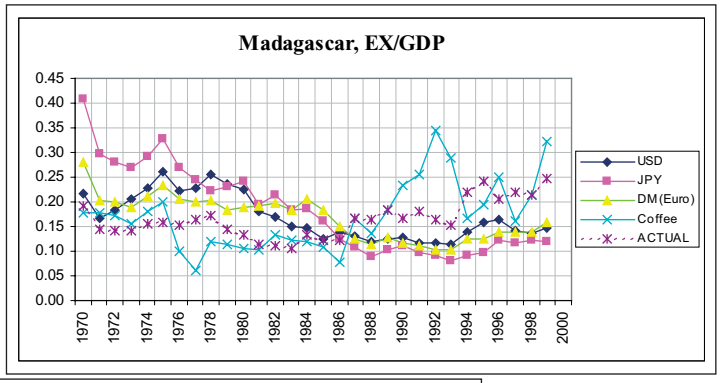

El Salvador, EX/GDP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL

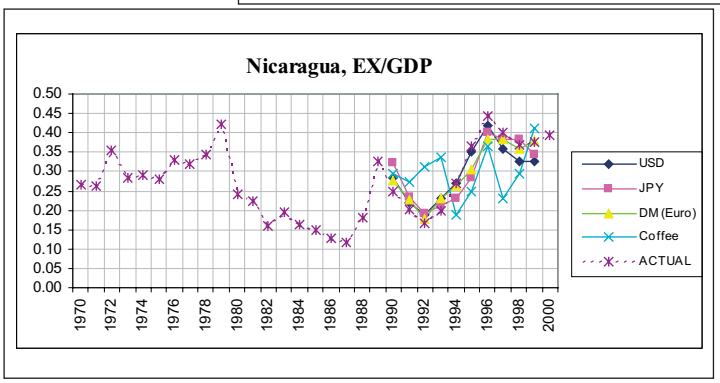

Ethiopia, EX/GDP
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL

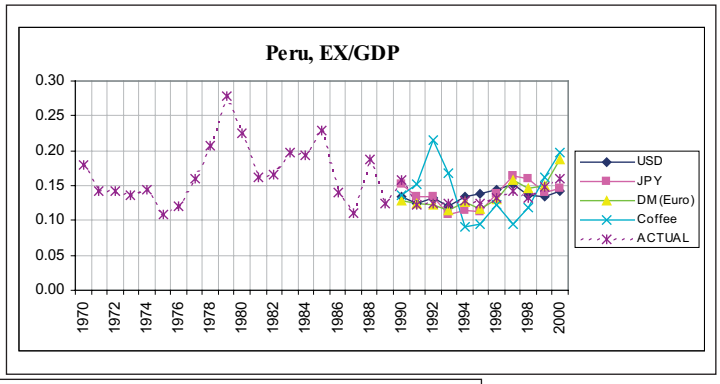

Guatemala, EX/GDP
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL


Honduras, EX/GDP
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL


Kenya, EX/GDP
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL


Madagascar, EX/GDP
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL


Nicaragua, EX/GDP
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL


Peru, EX/GDP
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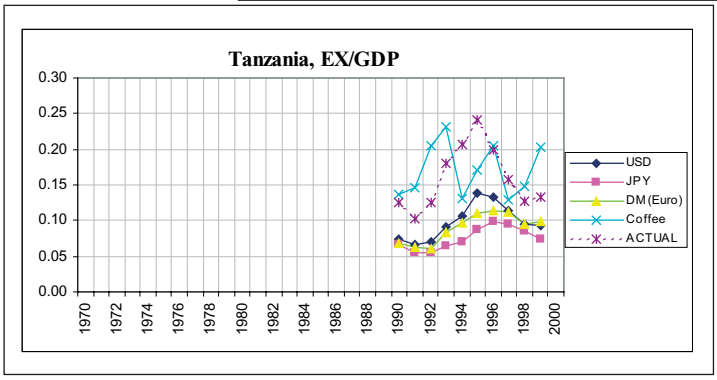
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL


Tanzania, EX/GDP
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
USD
JPY
DM (Euro)
Coffee
ACTUAL

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