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Faculty Research Working Paper Series

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July 2011
RWP11-027

revised April 29++June 28, 2011+

A Comparison of Product Price Targeting and Other Monetary Anchor Options, for Commodity Exporters in Latin America

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Forthcoming, *Economia*, 2011

This paper was presented at a meeting of the 23rd *Economia* panel of LACEA, May 7, 2011. It is a revised version of NBER Working Paper 16362, which in turn draws on an earlier study presented at a workshop on *Myths and Realities of Commodity Dependence: Policy Challenges and Opportunities for Latin America and the Caribbean*, World Bank, September 2009. The author thanks Cynthia Balloch and Daniella Llanos for excellent research assistance and participants at the LACEA meeting for comments.

Abstract

Seven possible nominal variables are considered as candidates to be the anchor or target for monetary policy. The context is countries in Latin America and the Caribbean (LAC), which tend to be price takers on world markets, to produce commodity exports subject to volatile terms of trade, and to experience procyclical international finance. Three anchor candidates are exchange rate pegs: to the dollar, euro and SDR. One candidate is orthodox Inflation Targeting. Three candidates represent proposals for a new sort of inflation targeting that differs from the usual focus on the CPI, in that prices of export commodities are given substantial weight and prices of imports are not: PEP (Peg the Export Price), PEPI (Peg an Export Price Index), and PPT (Product Price Targeting). The selling point of these production-based price indices is that each could serve as a nominal anchor while yet accommodating terms of trade shocks, in comparison to a CPI target. CPI-targeters such as Brazil, Chile, and Peru are observed to respond to increases in world prices of imported oil with monetary policy that is sufficiently tight to appreciate their currencies, an undesirable property, which is the opposite of accommodating the terms of trade. As hypothesized, a product price target generally does a better job of stabilizing the real domestic prices of tradable goods than does a CPI target. Bottom line: A Product Price Targeter would appreciate in response to an increase in world prices of its commodity exports, not in response to an increase in world prices of its imports. CPI targeting gets this backwards.

JEL classifications: E5, F4.

Key words: money, nominal anchor, peg, terms of trade, agricultural commodities, Inflation Targeting, Peg the Export Price, Product Price Targeting, CPI target, mineral commodities, gold, Latin America.

A Comparison of Monetary Anchor Options, Including Product Price Targeting, for Commodity-Exporters in Latin America

1. Introduction: The Evolution of Nominal Targets for Monetary Policy in Latin America and the Caribbean

In perhaps no other region have attitudes with respect to nominal anchors for monetary policy evolved more than in the developing countries of the Western Hemisphere.

Inflation rates went very high in the early 1980s, to hyperinflation in some cases (including Argentina, Bolivia, Brazil, and Nicaragua). As a result, the need for a nominal anchor was plain to see. In a non-stochastic model, any nominal variable is as good a choice for monetary anchor as any other nominal variable. But in a stochastic model, not to mention the real world, it makes quite a difference what is the nominal variable toward which the monetary authorities publicly commit in advance.[1] Should it be the money supply? Exchange rate? CPI? Other alternatives? That question is the subject of this paper.

When stabilization was finally achieved in the countries of Latin America and the Caribbean (LAC), in the 1980s and early 1990s, the exchange rate was virtually always the nominal anchor around which the successful stabilization programs were built, whether it was Chile's tablita, Bolivia's exchange rate target, Argentina's convertibility plan, or Brazil's real plan. But matters have continued to evolve.

1.1 The trend from exchange rate targeting to inflation targeting

The series of emerging market currency crises that began in Mexico in December 1994 and ended in Argentina in January 2002 all involved the abandonment of exchange rate targets, in favor of more flexible currency regimes, if not outright floating. In many countries, the abandonment of a cherished exchange rate anchor for monetary policy took place under the urgent circumstances of a speculative attack (including Mexico and Argentina). A few countries made the jump to floating preemptively, before a currency crisis could hit (Chile and Colombia). Only a very few smaller countries responded to the ever rougher seas of international financial markets by moving the opposite direction, to full dollarization (Ecuador, under pressure of crisis; and El Salvador, out of longer-run motivations). On a 30-year time span, the general trend has been toward increased flexibility.[2]

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[1] The best reference for this familiar point is Rogoff (1985). Two appendices there demonstrate that the choice of nominal target makes a big difference in the presence of shocks.

[2] Collins (1996). The co-existence of floating, on the one hand, and currency boards and dollarization, on the other, gave rise in the late 1990s to the hypothesis that emerging market countries could go to either the floating corner or the institutionally fixed corner, but that intermediate exchange rate regimes such as basket pegs or target zones were no longer viable. This "corners hypothesis" subsequently fell largely out of fashion, as one could have predicted. Frankel (2004).

With exchange rate targets somewhat out of favor by the end of the 1990s, and the gold standard and monetarism[3] having been already relegated to the scrap heap of history, there was a clear vacancy for the position of preferred nominal anchor, or intermediate target for monetary policy. [The table in Appendix I summarizes, with historical examples, the Achilles heel or vulnerability of monetarism, the gold standard, and each of the other variables that have been proposed as candidates for nominal target.]

The regime of Inflation Targeting (IT) was a fresh young face, coming with an already-impressive resume of recent successes in wealthier countries (New Zealand, Canada, United Kingdom, and Sweden). In many emerging market countries around the world, IT got the job of preferred nominal anchor. Three South American countries officially adopted Inflation Targeting in 1999, in place of exchange rate targets: Brazil, Chile, and Colombia.[4] Mexico had done so earlier, after the peso crisis of 1994-95. Peru followed suit in 2002, switching from an official regime of money targeting. Guatemala has officially entered a period of transition to inflation targeting, under a law passed in 2002.

In many ways, Inflation Targeting has functioned well. It apparently anchored expectations and avoided a return to inflation in Brazil, for example, despite two severe challenges: the 50% depreciation of early 1999, as the country exited from the real plan, and the similarly large depreciation of 2002, when a presidential candidate who at the time was considered anti-market and inflationary pulled ahead in the polls.[5]

One could argue, however, that events of recent years, particularly the global financial crisis of 2008-2009, have put strains on the Inflation Targeting regime much as the events of 1994-2001 had earlier put strains on the regime of exchange rate targeting. Three other kinds of nominal variables have forced their way into the attentions of central bankers, beyond the CPI. One nominal variable, the exchange rate, never really left – certainly not for the smaller countries. A second category of nominal variable, asset prices, has been the most relevant in the last few years *in industrialized countries*. The international financial upheaval that began in mid-2007 with the US sub-prime mortgage crisis has forced central bankers to re-think their intent focus on inflation, to the exclusion of equity and real estate prices. But a third category, prices of agricultural and mineral products, is particularly relevant for countries in Latin America and the Caribbean. The greatly heightened volatility of commodity prices has resurrected arguments about the desirability of a currency regime that accommodates terms of trade shocks. This third challenge to CPI-targeting is the main focus of this study.

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[3] Enthusiasm for monetarism had largely died out by the mid-1980s, perhaps because M1 targets had recently proven unrealistically restrictive in the largest industrialized countries. A surprising number of LAC countries continue officially to list money supply as their anchoring variable (Argentina, Guyana, Jamaica, and Uruguay). But one may doubt in practice how strictly they try to keep any monetary aggregate within declared ranges.

[4] Chile had begun to set inflation targets in 1991, but had also followed a basket peg exchange rate target throughout the 1990s. Mishkin (2008) discusses the examples of Chile and Brazil.

[5] Giavazzi, Goldfajn, and Herrera (2005).

1.2 Roadmap for the paper

This paper weighs the advantages of major competing monetary regimes. The context is countries, such as those in Latin America and the Caribbean, that tend to be price takers on world markets, to produce commodity exports subject to volatile terms of trade, and to lack countercyclical international finance. Section 2 elaborates on the Inflation Targeting regime, some drawbacks that it has encountered as a result of focusing on the CPI, and some proposed alternative versions that focus on production-oriented price indices instead. The selling point of a production-based price index is it could serve as a nominal anchor while yet accommodating terms of trade shocks, in comparison to a CPI target. Section 3 is a simple theoretical model, in the mode of Rogoff (1985), to illustrate the comparison among exchange rate targeting, CPI targeting, and the alternative of a product-price target.

Section 4, the heart of the paper, is a counterfactual statistical analysis. Seven possible nominal variables are considered as candidates to be the anchor or target for monetary policy. Three anchor candidates are exchange rate pegs: to the dollar, euro and SDR. One candidate is orthodox Inflation Targeting. Three candidates represent the proposals for a new sort of inflation targeting that differs from the usual focus on the CPI, in that prices of export commodities are given substantial weight and prices of imports are not: PEP (Peg the Export Price), PEPI (Peg an Export Price Index), and PPT (Product Price Targeting). Unsurprisingly all seven nominal anchors deliver greater overall nominal price stability in our simulations than the inflationary historical monetary regimes actually followed by LAC countries (with the exception of Panama). A dollar peg does not particularly stabilize domestic commodity prices. The key finding is that, as hypothesized, a product price target generally does a better job of stabilizing the real domestic prices of tradable goods than does a CPI target. Bottom line: A Product Price Targeter would appreciate in response to an increase in world prices of its commodity exports, not in response to an increase in world prices of its imports. CPI targeting gets this backwards.

2. Problems with Inflation Targeting

Inflation targeting has sometimes been defined very broadly: "the monetary authorities choose a long run goal for inflation and act transparently."[6] But usually something more specific is implied by the term. For one thing, the price target is virtually always the Consumer Price Index (though sometimes "core" rather than "headline" CPI). The contribution of this paper is to consider other price indices that are possible alternatives to the CPI for the role of nominal anchor, within what could still be called Inflation Targeting.

[6] Among many references in the large literature on inflation targeting, three that are internationally oriented are: Svensson (1995); Bernanke, Laubach, Mishkin, and Posen (1999); and Truman (2003).

2.1 What, exactly, is meant by Inflation Targeting?

The narrow definition of inflation targeting would have the central bank governor committing each year to a goal for the CPI over the course of the coming year, and then putting 100% weight on achieving that objective to the exclusion of all others. Some proponents make clear that they are talking about something broader than this: flexible inflation targeting, under which the central bank puts some weight on the output objective rather than everything on the inflation objective – as in a Taylor Rule -- over the one-year horizon. This study will not deal especially with the eternal question of how much weight should be placed in the short term on a nominal anchor, such as a price index, relative to real output; nor with the question of how much discretion a central bank should be allowed, as opposed to strict adherence to a rule. The central focus will, rather, be on another specific question: to whatever extent weight is to be placed on a nominal anchor -- whether it is 100% as under a fixed exchange rate, or a more flexible range – what are the advantages and disadvantages of various nominal anchors?

2.2 What is different about Latin American economies? Low credibility, procyclical finance, supply shocks, and terms of trade volatility

Which regimes are most suitable for countries in the region? Table 1 reports the exchange rate and monetary regimes currently followed officially by 18 LAC countries. Inflation, the exchange rate, and the money supply are all represented among their choices of targets.[7] We begin with a consideration of some structural characteristics that tend to differentiate these countries from others, though it is important to acknowledge heterogeneity within the region.

Studies of monetary policy in developing or emerging-market countries, and of inflation targeting in particular, make the point that they tend to have less developed institutions and lower central bank credibility than industrialized countries.[8] Lower central bank credibility usually stems from a history of price instability, which in turn is attributable in part to past reliance on seignorage in the absence of a well-developed fiscal system. Another common feature is an uncompetitive banking system, which is again in part attributable to a public finance problem: a traditional reliance on the banks as a source of finance, through a combination of financial repression and controls on capital outflows. These countries also have higher default risk, of course, which is one aspect of imperfect financial markets.

[7] Mishkin and Savastano (2002).

[8] E.g., Fraga, Goldafjn and Minella (2003).

Table 1: LAC Countries' Current Regimes and Monthly Correlations of Exchange Rate Changes ($/local currency) with Dollar Import Price Changes

Note: Import price changes are changes in the dollar price of oil.

	Exchange Rate Regime	Monetary Policy	1970-1999	2000-2008	1970-2008
ARG	Managed floating	Monetary aggregate target	-0.0212	-0.0591	-0.0266
BOL	Other conventional fixed peg arrangements	Against a single currency	-0.0139	0.0156	-0.0057
BRA	Independently floating	Inflation targeting framework (1999)	0.0366	0.0961	0.0551
CHL	Independently floating	Inflation targeting framework (1990)*	-0.0695	0.0524	-0.0484
CRI	Crawling pegs	Exchange rate anchor	0.0123	-0.0327	0.0076
GTM	Managed floating	Inflation targeting framework	-0.0029	0.2428	0.0149
GUY	Other conventional fixed peg arrangements	Monetary aggregate target	-0.0335	0.0119	-0.0274
HND	Other conventional fixed peg arrangements	Against a single currency	-0.0203	-0.0734	-0.0176
JAM	Managed floating	Monetary aggregate target	0.0257	0.2672	0.0417
NIC	Crawling pegs	Exchange rate anchor	-0.0644	0.0324	-0.0412
PER	Managed floating	Inflation targeting framework (2002)	-0.3138	0.1895	-0.2015
PRY	Managed floating	The country has an IMF-supported or other monetary program	-0.023	0.3424	0.0543
SLV	Dollar	Exchange rate anchor	0.1040	0.0530	0.0862
URY	Managed floating	Monetary aggregate target	0.0438	0.1168	0.0564

Oil Exporters

	Exchange Rate Regime	Monetary Policy	1970-1999	2000-2008	1970-2008
COL	Managed floating	Inflation targeting framework (1999)	-0.0297	0.0489	0.0046
MEX	Independently floating	Inflation targeting framework (1995)	0.1070	0.1619	0.1086
TTO	Other conventional fixed peg arrangements	Against a single currency	0.0698	0.2025	0.0698
VEN	Other conventional fixed peg arrangements	Against a single currency	-0.0521	0.0064	-0.0382

* Chile proclaimed an inflation target as early as 1990; nevertheless, it had an exchange rate target, under an explicit band-basket-crawl regime, until 1999.

Source: IMF De Facto Classifications of Exchange Rate regimes and Monetary Policy approach.
http://www.imf.org/external/np/mfd/er/2006/eng/0706.htm

The standardly drawn implications of underdeveloped institutions and low inflation-fighting credibility are that it is particularly important (i) that their central banks have independence[9] and (ii) that they make regular public commitments to a transparent and monitorable nominal target. Some Latin American countries have given their central banks legal independence, beginning with Chile, Colombia, Mexico, and Venezuela in the 1990s.[10] Sure enough, Jácome (2001), Gutiérez (2003) and Jácome and Vázquez (2008) find a negative statistical relationship between central bank independence and inflation among LAC countries. There are also some skeptics, however, who argue that central bank independence won't be helpful if a country's political economy dictates budget deficits regardless of monetary policy. [11]

The principle of commitment to a nominal anchor in itself says nothing about what economic variables are best suited to play that role. Public promises to hit targets that cannot usually be fulfilled subsequently will do little to establish credibility.[12]

Most analysis of inflation targeting is more suited to large industrialized countries than to small developing countries, in several respects.[13] First, the theoretical models usually do not feature a role for exogenous shocks in trade conditions or difficulties in the external accounts. The theories tend to assume that countries need not worry about financing trade deficits internationally. Many assume that international capital markets function well enough to smooth consumption in the face of external shocks.[14] In reality, however, financial market imperfections are serious for developing countries.[15] International capital flows do not tend to moderate external shocks, to smooth consumption or to optimize intertemporally. Booms -- featuring capital inflows, excessive currency overvaluation and associated current account deficits -- are often followed by busts, featuring sudden stops in inflows, abrupt depreciation, and recession.[16] An analysis of monetary policy that did not take into account the international financial

[9] E.g., Cukierman, Miller and Neyapti (2002).

[10] Junguito and Vargas (1996) and Anone, Laurens and Segalotto (2006).

[11] Mas (1995).

[12] The Bundesbank had enough credibility that a record of proclaiming M1 targets and then missing them did little to undermine its reputation or expectations of low inflation in Germany. Latin America does not enjoy the same luxury.

[13] This is not to forget the many studies of inflation targeting for emerging market and developing countries. Savastano (2000) offers offered a concise summary of much of the research as of that date. Subsequent contributions include Debelle (2001); Fraga, Goldfajn, and Minella (2003); McKibbin and Singh (2003); Mishkin (2000; 2004); and Laxton and Pesenti (2003).

[14] One of the few exceptions is Caballero and Krishnamurthy (2003).

[15] See Caballero (2000) and comments thereon.

[16] Calvo, Leiderman and Reinhart (1993); Kaminsky, Reinhart, and Vegh (2005); Reinhart and Reinhart (2009); Perry (2009); Gavin, Hausmann, Perotti, and Talvi (1997); Gavin, Hausmann and Leiderman (1996); Mendoza and Terrones (2008).

crises of 1982, 1994-2001, or 2008-09 would not be useful to policy makers in Latin America and the Caribbean.

Capital flows are strikingly prone to exacerbate rather than offset fluctuations when the source of the fluctuations is trade shocks.[17] This observation leads us to the next relevant respect in which developing countries differ from industrialized countries.

Analysis of how IT works in practice sometimes gives insufficient attention to the consequences of supply shocks. Supply shocks tend to be larger for developing countries than for industrialized countries. One reason is the larger role of farming, fishing, and forestry in the economy. Droughts, floods, hurricanes, and other weather events – good as well as bad -- tend to have a much larger effect on GDP in developing countries. When a hurricane hits a Caribbean island, it can virtually wipe out the year's banana crop and tourist season – thus eliminating the two biggest sectors in some of those tropical economies. A second reason for larger supply shocks is terms of trade volatility, which is notoriously high for small developing countries. This is especially true of those dependent on agricultural and mineral exports.[18] Another feature of these countries is that they tend to be more dependent on imported inputs. In large rich countries, the fluctuations in the terms of trade are both smaller and less likely to be exogenous.

As has been shown by a variety of authors, Inflation Targeting (defined narrowly) is not robust with respect to supply shocks.[19] Under strict IT, to prevent the price index from rising in the face of an adverse supply shock monetary policy must tighten so much that the entire brunt of the shock is borne by real GDP. Most reasonable objective functions would, instead, tell the monetary authorities to allow part of the shock to show up as an increase in the price level. Of course this is precisely the reason why many IT proponents favor *flexible* inflation targeting, often in the form of the Taylor Rule which does indeed call for the central bank to share the pain between inflation and output. It is also a reason for pointing to the "core" CPI rather than "headline" CPI. But these accommodations are insufficient.

2.3 "Headline" CPI and Core CPI

In practice, inflation-targeting central bankers usually say they respond to large temporary shocks in the prices of oil and other agricultural and mineral products by excluding them from the measure of the CPI that is targeted. Central banks have two approaches to doing this. Some publicly explain *ex ante* that their target for the year is inflation in the core CPI, a measure that excludes volatile components, usually farm and energy products. The virtue of this approach is that the central banks are able to abide by their public commitments when the supply shock comes. (This logic assumes the

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[17] E.g., Hausmann and Rigobon (2003).

[18] E.g., Fraga, Goldfajn, and Minella, op cit. The old structuralist school in Latin America believed that specialization in primary commodities was undesirable because they faced a low elasticity of demand.

[19] Among other examples: Frankel (1985) ; Frankel, Smit, and Sturzenegger (2008).

shock is located in the agricultural or energy sectors. It doesn't work, for example, for labor unrest or power failures that disrupt industrial activity.) The disadvantage of declaring core CPI as the official target is that the person in the street is less likely to understand it, compared to the simple CPI. Transparency and communication of a target that the public can monitor are the original reasons for declaring a specific nominal target in the first place.

The alternative approach is to talk about the ordinary CPI *ex ante*, but then in the face of an adverse supply shock to explain *ex post* that the increase in farm or energy prices is being excluded due to special circumstances. This strategy can be a public relations disaster. The people in the street are told that they should not be concerned by the increase in the CPI because it is "only" occurring in the cost of filling up their auto fuel tanks and buying their weekly groceries.

Either way, ex ante or ex post, the effort to explain away supply-induced fluctuations in the CPI undermines the credibility of the monetary authorities. This credibility problem is especially severe in countries where there are serious grounds for believing that government officials fiddle with the consumer price indices for political purposes, which includes Argentina (recently) and Brazil (in the more distant past), among others.

Given the value that most central bankers place on transparency and their reputations, it would be surprising if their public emphasis on the CPI did not lead them to be at least a bit more contractionary in response to adverse supply shocks, and expansionary in response to favorable supply shocks, than they would otherwise be. In other words, it would be surprising if they felt able to take full advantage of the escape clause offered by the idea of core CPI. There is some reason to think that this is indeed the case. A simple statistic: the exchange rates of all major inflation-targeting countries (in dollars per national currency) are positively correlated with the dollar price on world markets of their import baskets.[20] Why is this fact revealing? The currency should not respond to an increase in world prices of its imports by appreciating, to the extent that these central banks target core CPI (and to the extent that the commodities excluded by core CPI include all imported commodities that experience world price shocks, which is a big qualifier). *If anything, floating currencies should depreciate in response to such an adverse terms of trade shock.* When these IT currencies respond by appreciating instead, it suggests that the central bank is tightening monetary policy to reduce upward pressure on the CPI.

Three columns of Table 1 repeat the correlation calculations for our LAC countries, on monthly data. We take the example of dollar oil prices, since they are the most important source of variation in dollar import prices, for oil-importing countries. Six of the 18 countries are inflation targeters currently. We might exclude Guatemala, because its transition to inflation targeting is recent, and perhaps not even complete. We should also exclude those LAC countries that are oil producers. Regardless, every one of the inflation targeters shows correlations between dollar import pries and the dollar values of their currencies that are both positive over the period 2000-2008 and greater than the correlations during the pre-IT period. The evidence supports the idea inflation targeters – in particular, Brazil, Chile and Peru -- tended to react to the positive oil shocks of the past decade by tightening monetary policy and thereby appreciating their

[20] Frankel (2005).

currencies. The implication seems to be that the CPI which they target does not in practice entirely exclude oil price shocks. Apparently "flexible inflation targeting" is not quite as flexible as one would think. (Argentina, by contrast, is not an inflation targeter, and allows its peso to depreciate when world prices of its import goods rise.)

What is wanted as candidate for nominal target is a variable that is simpler for the public to understand *ex ante* than core CPI, and yet that is robust with respect to supply shocks. Being robust with respect to supply shocks means that the central bank should not have to choose *ex post* between two unpalatable alternatives: an unnecessary economy-damaging recession or an embarrassing credibility-damaging violation of the declared target.

2.4 Terms of trade shocks

If the supply shocks are terms of trade shocks, then the choice of CPI to be the price index on which IT focuses is particularly inappropriate. The alternative is an output-based price index such as an index of export prices, the GDP deflator, PPI, or a specially constructed Product Price Index. The important difference is that imported goods show up in the CPI, but not in the output-based price indices and vice versa for exported goods: they show up in the output-based prices but much less in the CPI. Proponents of inflation targeting do not seem to have considered this point. One reason may be that the difference is not, in fact, as important for large industrialized countries as for small developing countries, especially those that export mineral and agricultural products.

Terms of trade volatility is particularly severe for commodity exporters, which includes most countries in Latin America and the Caribbean. If one uses the World Bank's terms of trade index, a list of 40 countries with the greatest volatility out of 166 countries, is dominated by Africans and oil exporters.[21] But seven LAC countries are in the group of 40: Mexico, Venezuela, Haiti, Ecuador, Chile, Peru and Bolivia, in descending order of volatility. Some countries in the region have a large share of their exports concentrated in a product – such as coffee, copper, or oil -- that is so volatile that it periodically experiences swings in world market conditions that double or halve their prices. The export markets for the manufactured goods and services produced by industrialized countries, on the other hand, tend to be much more stable. This is especially true for the larger industrialized countries such as the United States, who have more monopoly power and whose exports are more diversified.

[21] The terms of trade measure is from *World Development Indicators*. It appears to be based on unit value measures of import and export prices, which many researchers consider highly unreliable, due to shifts in the what shows up as unit. Below we report measures calculated from export and import price indices of the Economist Intelligence Unit.

Table 2: Major Commodity Exports in LAC countries and Standard Deviation of Prices on World Markets

	Leading Commodity Export*	Standard Deviation of Log of Dollar Price 1970-2008
ARG	Soybeans	0.2781
BOL	Natural Gas	1.8163
BRA	Steel	0.5900
CHL	Copper	0.4077
COL	Oil	0.7594
CRI	Bananas	0.4416
ECU	Oil	0.7594
GTM	Coffee	0.4792
GUY	Sugar	0.4749
HND	Coffee	0.4792
JAM	Aluminum	0.4176
MEX	Oil	0.7594
NIC	Coffee	0.4792
PAN	Bananas	0.4416
PER	Copper	0.4077
PRY	Beef	0.2298
SLV	Coffee	0.4792
TTO	Natural Gas	1.8163
URY	Beef	0.2298
VEN	Oil	0.7594

* World Bank Analysis (2007 data). Source: Global Financial Data

Table 2 reports the leading export commodity for each of twenty LAC countries, and the standard deviation of the dollar price of that commodity on world markets. Natural gas and oil are by far the most variable in price. But the prices of aluminum, bananas, coffee, copper, and sugar all show standard deviations above .4; assuming a normal distribution this implies that price swings of plus or minus 80% occur 5% of the time. Only beef and soybeans -- the leading products of Argentina, Paraguay and Uruguay – have price volatilities less than this.

Appendix Table 1 reports standard deviations of an export price index, import price index, and (the ratio of the two) the terms of trade, for 149 countries and regions. The data come from the Economist Intelligence Unit. Eight of the 20 countries with the highest terms of trade volatility are in Latin American and the Caribbean: Dominican Republic, Chile, Venezuela, Honduras, Paraguay, Trinidad and Tobago, Jamaica and Ecuador. (Nine of the top 20 are in Africa and the Middle East. Nine are oil producers.) The extended Mercosur grouping shows higher terms of trade volatility than any other geographical grouping worldwide, even the Arabian peninsula, and Latin America is higher than any other large grouping.

The ranking of countries by terms of trade volatility is rather different from the ranking by export price volatility. Some countries that face highly variable prices for

their exports on world markets do not in fact have highly variable terms of trade; in other words the dollar prices of their exports are correlated with the dollar prices of their imports so that the two partially cancel out.[22]

2.5 The option of an exchange rate target

Many Inflation Targeting central banks in developing countries have all along put more emphasis on the exchange rate than they officially admitted.[23] This tendency is the famous Fear of Floating of Calvo and Reinhart (2002). When booming markets for their export commodities put upward pressure on their currencies (2003-2008), they intervened heavily to dampen appreciation. Colombia was one of many examples.[24] Then, when the global financial crisis hit and especially when it put more severe downward pressure on their currencies in the latter part of 2008 -- partly in the form of an abrupt reversal of the commodity price spike -- some of these same countries intervened heavily to dampen the depreciation of their currencies. With the rapid restoration of the boom in emerging market countries in 2010, their central banks again found themselves intervening to dampen strong appreciations. In 2011 even free floating Chile threw in the towel and began to buy dollars to dampen the appreciation of its peso. The point is that central banks still do – and should – pay a lot of attention to their exchange rates.

The point applies to the entire spectrum from managed floaters to peggers. Fixed exchange rates are still an option to be considered for many countries, especially small ones. For very small countries, especially those that are highly integrated with the United States (many countries in Central America and the Caribbean, in particular), an institutional peg or even full dollarization remain reasonable options.

Fixed exchange rates have many advantages, in addition to their use as a nominal anchor for monetary policy. They reduce transactions costs and exchange risk, which in turn facilitates international trade and investment. This is especially true for institutionally locked-in arrangements, such as dollarization. Influential research by Rose (2000) and others over the last decade has shown that fixed exchange rates and, especially, monetary unions, increase trade and investment substantially. In addition they avoid the speculative bubbles to which floating exchange rates are occasionally subject.

Of course fixed exchange rates have disadvantages too. Most importantly, to the extent financial markets are integrated, a fixed exchange rate means giving up monetary independence; the central bank can't increase the money supply, lower the interest rate, or devalue the currency, in response to a downturn in demand for its output.

It has been argued that Latin American governments have misused monetary discretion more often than they have used it to achieve the textbook objectives, so that the loss of monetary independence under a fixed exchange rate is not to be lamented. A second disadvantage of a fixed rate, however, presupposes no discretionary abilities. It

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[22] Examples in Appendix 1 appear to be Sri Lanka, Kazakhstan, and Colombia. But we need to detrend or first-difference the series for import prices and export price, which we have not yet done.

[23] Edwards (2006) considers whether the exchange rate should play a role in determining monetary policy under IT.

[24] Vargas (2005)

means giving up the automatic accommodation of trade shocks that comes with floating: a depreciation when world market conditions for the export commodity weaken, and vice versa.[25] Berg, Borensztein, and Mauro (2003) say it well:

> "Another characteristic of a well-functioning floating exchange rate is that it responds appropriately to external shocks. When the terms of trade decline, for example, it makes sense for the country's nominal exchange rate to weaken, thereby facilitating the required relative price adjustment. Emerging market floating exchange rate countries do, in fact, react in this way to negative terms of trade shocks. In a large sample of developing countries over the past three decades, countries that have fixed exchange rate regimes and that face negative terms of trade shocks achieve real exchange rate depreciations only with a lag of two years while suffering large real GDP declines. By contrast, countries with floating rates display large nominal and real depreciations on impact and later suffer some inflation but much smaller output losses."

Besides the inability to respond monetarily to shocks, there are three more disadvantages of rigidity in exchange rate arrangements. It can impair the central bank's lender of last resort capabilities in the event of a crisis in the banking sector, as Argentina demonstrated in 2001. It entails a loss of seignorage, especially for a country that goes all the way to dollarization. And, finally, for a country that stops short of full dollarization, pegged exchange rates are occasionally subject to unprovoked speculative attacks of the "second-generation" type.[26]

Econometric attempts to discern what sort of regime delivers the best economic performance across countries – firmly fixed, floating, or intermediate – have not been successful.[27] Clearly the answer depends on the circumstances of the country in question. Among the many country characteristics that should help determine this choice according to the literature is one that features prominently in the simple model of the Section 4: less exposure to external shocks than to domestic and monetary shocks. makes it more likely that an exchange rate target dominates other monetary regimes.[28]

For Mexico, Central America, most of the Caribbean, and the northwestern part of South America, an exchange rate target would naturally mean a dollar target, because so much of their trade and other transactions are with the United States. But Argentina, Brazil and Chile trade roughly as much with Europe (or, for that matter, East Asia) as they do with the United States. To peg to the dollar is to introduce volatility vis-à-vis Europe, Japan, and other important trading partners. For them, one must not take as given that the relevant anchor currency would be the dollar. It could be the euro or, more likely, a weighted basket. One possibility is the SDR.

In 2001, when Argentina's rigid peg to the dollar was in its death throes, it was observed that the country's trade problems could in a sense be attributed to the original

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[25] Among peggers, terms-of-trade shocks are amplified and long-run growth is reduced, as compared to flexible-rate countries, according to Edwards and Yeyati (2005). Also see Broda (2004).

[26] Obstfeld (1986).

[27] Levy-Yeyati and Sturzenegger (2003) find that floats do a better job than firmly fixed rates or intermediate regimes. Unfortunately, other equally reputable studies find that floats do the best or that intermediate regimes do the best.

[28] Frankel (2004) reviews the literature on the choice of exchange rate regime for developing countries.

1991 decision to link to the currency of a country with which Argentina traded relatively little, and to the subsequent 1995-2001 appreciation of the dollar against the euro, Brazilian real, and currencies of other major trading partners, as much as it could be attributed to the rigidity of the regime *per se*. The alternative of a basket that would be half dollars and half euros was apparently considered by the authorities at that time.

Among the eight monetary regimes to be considered in this study are three exchange rate targets: a peg to the dollar, a peg to the euro, and a peg to the SDR.

3. Alternative choices of price index for inflation targeting

As noted, of the possible price indices that a central bank could target, the CPI is the usual choice. The CPI is indeed the natural candidate to be the measure of the inflation objective for the long-term. But it may not be the best choice for intermediate target on an annual basis. There is a case to be made for targeting a price index that reflects commodities produced domestically rather than commodities *consumed* domestically. The idea of targeting an output-based price index in place of the CPI is a moderate version of a more exotic proposed monetary regime that I have written about in the past, called Peg the Export Price – or PEP, for short.[29]

3.1 PEP

I have proposed PEP explicitly for those countries that happen to be heavily specialized in the production of oil or some other particular mineral or agricultural export commodity. (The original idea was a very special case: an African gold exporter could consider going on the gold standard.[30]) The proposal is to fix the price of that commodity in terms of domestic currency. For example, Chile would peg its currency to copper – in effect adopting a metallic standard. Ecuador, Trinidad and Venezuela would peg to oil.[31] Jamaica would peg to bauxite. The Dominican Republic would peg to sugar. Central American coffee producers would peg to coffee. Argentina would peg to soybeans. And so forth.

How would this work operationally? Conceptually, one can imagine the government holding reserves of gold or copper or oil, and buying or selling the commodity whenever necessary to keep the price fixed in terms of local currency. Operationally, a more practical method would be for the central bank each day to announce an exchange rate vis-à-vis the dollar, following the rule that the day's exchange rate target (dollars per local currency unit) moves precisely in proportion to the day's price of gold or copper or oil on the New York market (dollars per commodity). Then the central bank could intervene via the foreign exchange market to achieve the day's target. The dollar would be the vehicle currency for intervention -- precisely as it has

[29] Frankel and Saiki (2002) and Frankel (2003).

[30] Frankel (2002).

[31] In recent years – especially as a result of the large increase in world oil prices toward the end of our statistical sample – oil became the leading export commodity of Brazil and Colombia, both of which traditionally export coffee and a wide variety of other goods.

long been when a small country defends a peg to some non-dollar currency. Either way, the effect would be to stabilize the daily price of the commodity in terms of local currency. Or perhaps, since these commodity prices are determined on world markets, a better way to express the same policy is stabilizing the price of local currency in terms of the commodity.

The argument for the export targeting proposal, relative to an exchange rate target, can be stated succinctly: It delivers one of the main advantages that a simple exchange rate peg promises, namely a nominal anchor, while simultaneously delivering one of the main advantages that a floating regime promises, namely automatic adjustment in the face of fluctuations in world prices of the countries' exports. Textbook theory says that when there is an adverse movement in the terms of trade, it is desirable to accommodate it via a depreciation of the currency. When the dollar price of exports rises, under PEP the currency per force appreciates in terms of dollars. When the dollar price of exports falls, the currency depreciates in terms of dollars. Such accommodation of terms of trade shocks is precisely what is wanted. In past currency crises, countries that have suffered a sharp deterioration in their export markets have often eventually been forced to give up their exchange rate targets and devalue anyway. The adjustment was far more painful -- in terms of lost reserves, lost credibility, and lost output -- than if the depreciation had happened automatically.

The desirability of accommodating terms of trade shocks is also a particularly good way to summarize the attractiveness of export price targeting relative to the reigning champion, CPI targeting. Consider the two categories of adverse terms of trade shocks: first, a fall in the dollar price of the export in world markets and, second, a rise in the dollar price of the import on world markets. In the first case, a fall in the export price, one wants the local currency to depreciate against the dollar. As already noted, PEP delivers that result automatically; CPI targeting does not. In the second case, a rise in the import price, the terms-of-trade criterion suggests that one again might want the local currency to depreciate. Neither regime delivers that result.[32] But CPI targeting actually has the implication that the central bank tightens monetary policy so as to *appreciate* the currency against the dollar, by enough to prevent the local-currency price of imports from rising. This implication – reacting to an adverse terms of trade shock by appreciating the currency – is perverse. It can be expected to exacerbate swings in the trade balance and output.

3.2 PEPI

Some responded to the PEP proposal by pointing out, quite correctly, that the side-effect of stabilizing the local-currency price of the export commodity in question is that it would destabilize the local-currency price of *other* export goods. If agricultural or mineral commodities constitute virtually all of exports, then this may not be an issue. But for a heavy majority of countries, including most of those in Latin America and the

[32] There is a reason for that. In addition to the goal of accommodating terms of trade shocks, there is also the goal of price stability; but to depreciate in the face of an increase in import prices would exacerbate an inflation shock.

Caribbean, no single commodity constitutes more than half of exports. Moreover, even those that *are* heavily specialized in a single mineral or agricultural product may wish to encourage diversification further into new products in the future, so as to be less dependent on that single commodity. For these two sorts of countries, the strict version of PEP is not appropriate. For those countries where export diversification is important, a moderated version of PEP is more likely to be suitable.

One way to moderate the proposal is to interpret it as targeting a broad index of all export prices, rather than the price of only one export commodity. I have abbreviated this moderate form of the proposal as PEPI, for Peg the Export Price *Index*.[33]

Some countries are intermediate with respect to the extent of diversification: Exports are dominated by agricultural and mineral commodities, but it is a diversified basket of commodities, rather than just oil or coffee. Examples include Argentina (soybeans, wheat, maize and beef), Bolivia (hydrocarbons, zinc, soybeans, iron ore and tin) or Jamaica (bauxite, sugar, bananas, rum and coffee). In that case, the natural price index would be a basket of those four or five commodity prices, omitting manufactures and services for simplicity.

The proposal is not to be confused, however, with proposals in the 1930s or 1980s to improve on the gold standard by targeting a diversified basket of commodities.[34] Those proposals explicitly included the prices of imported commodities in the index. e.g., oil for an oil-importer The PEPI proposal explicitly excludes them. It also *includes* commodities that may be minor and obscure from the world's viewpoint but important from the viewpoint of the producing country.[35] These two differences are crucial when the terms of trade fluctuate.

3.3 PPT

A way to moderate the proposal still further is to target a broad index of all domestically produced goods, whether exportable or not. PPT stands for Product Price Targeting. The GDP deflator is one possible output-based price index, but has the disadvantage of only being available quarterly, and being subject to lags in collection, measurement errors, and subsequent revisions. The PPI is superior in that – just like the CPI – it is generally collected monthly. Even in a small poor country with limited capacity to gather statistics, government workers can survey a sample of firms every month to construct a primitive PPI as easily as they can survey a sample of retail outlets to construct a primitive CPI. The PPI is a familiar non-threatening variable; inflation targeters should be open-minded enough to consider it as an alternative to the CPI.

A possible disadvantage of the PPI as traditionally calculated (the old Wholesale Price Index) is that it weights products according to their shares in gross sales by businesses. An implication is that raw materials and other inputs get counted multiple times, because they are reflected in the gross sales price at each stage of production. It

[33] Frankel (2005).

[34] In the 1930s: Graham (1937); and Keynes (1938). In the 1980s: Hall (1982, 1985).

[35] Such as antimony, tungsten and lithium, for the case of Bolivia.

would probably be better to weight product prices by the product's share of final sales.[36] A simple product price index could be computed monthly by surveying major establishments, and applying to their price changes the sectoral weights that are taken from longer-term GDP data.

3.4 Targeting the price index

If a broad index of export or product prices were to be the nominal target, it would of course be impossible in practice for the central bank to hit the target exactly, in contrast to the way that it is possible to hit virtually exactly a target for the exchange rate, the price of gold, or even the price of a basket of four or five exchange-traded agricultural or mineral commodities. There would instead be a declared band for the price index target, which could be wide if desired, just as with the targeting of the CPI, money supply, or other nominal variables. Open market operations to keep the export price index inside the band if it threatens to stray outside could be conducted either in terms of foreign exchange or in terms of domestic securities.

For some countries, it might help to monitor on a daily or weekly basis the price of a basket of agricultural and mineral commodities that is as highly correlated as possible with the country's overall price index, but whose components are observable on a daily or weekly basis in well-organized markets. The central bank could even announce what the value of the basket index would be one week at a time, by analogy with high-frequency announcements of monetary aggregates or interbank interest rates. The weekly targets could be set so as to achieve the medium-term goal of keeping the comprehensive price index inside the pre-announced bands; and yet the central bank could hit the weekly targets very closely, if it wanted, for example, by intervening in the foreign exchange market. This feature would enhance transparency from the viewpoint of those who operate in financial markets, even though the average household should not realistically be expected to follow such arcane details.

[36] The US Bureau of Economic Analysis in 2007 took steps in the direction of a price index for value added. Going back to 1998, it computes a sort of final-sales price index through its method of "double deflation" – netting intermediate inputs out against gross output. In 2007 it began releasing a new index of aggregate net output prices, which nets out double-counting of transactions within each aggregate industry.

4. Targeting the Export Price Index vs. Exchange Rate vs. CPI, in a Simple Theoretical Model

We apply two methodologies, one theoretical and one statistical. This section models theoretically the effects of relative prices on output under three alternative regimes. One finding is that a high variability of export price shocks makes it more likely that PEPI (Peg the Export Price Index) stabilizes the economy better than an exchange rate target. Another finding is that high sectoral elasticities of supply with respect to relative prices make it more likely that PEPI dominates CPI targeting. The heart of the paper, however, is Section 5. There we report statistical implications of 7 alternative regimes for movements in key relative prices, without explicitly modeling the effects on real output, an exercise that has the virtue of being largely model-free.

4.1 Assumptions

The theoretical model is a two-sector version of Frankel (1995), which closely followed Rogoff (1985), which in turn introduced shocks into the Barro-Gordon model of dynamically-consistent monetary policy.

Assume a **supply** relationship in each of two production sectors:

$$y_n = \overline{y_n} + b(p_n - p_n^e) + u_n \qquad (1)$$

$$y_x = \overline{y_x} + d(p_x - p_x{}^e) + u_x \qquad (2)$$

where

y_n & y_x ≡ output of nontraded & export sectors, respectively;

$\overline{y_n}$ & $\overline{y_x}$ ≡ potential output in the two sectors;

p_n & p_x ≡ prices in two sectors (in domestic currency)

p_n^e & p_x^e ≡ expected prices;

u_n & u_x ≡ supply disturbances; all in logs.

The country is a **price-taker** on world markets **for exports and imports**:

$$p_x = s + \varepsilon_x \,, \qquad (3)$$

$$p_{im} = s + \varepsilon_{im} \,, \qquad (4)$$

where

s ≡ exchange rate, spot price domestic currency / \$,

ε_x ≡ fluctuating \$ price of export commodity;

ε_{im} ≡ fluctuating \$ price of import good.

Price indices (CPI & GDP deflator) include the nontraded good and the international good, with weights *f* and *(1-f)*, respectively:

$$cpi = (f)p_{im} + (1\text{-}f)p_n \quad , \qquad (5)$$

$$p = (f)p_x + (1\text{-}f)\,p_n \quad . \qquad (6)$$

Money market equilibrium:

$$m = p + y - v, \qquad (9)$$

and **exchange rate** equation

$$s = m - y + e. \qquad (10)$$

where
$m \equiv$ money supply,
$y \equiv$ an index of total output,
$v \equiv$ velocity shocks
$e \equiv$ shocks in exchange rate equation.

Objective is to minimize quadratic loss function:

$$L = a\,(cpi)^2 + f(y_x - y_x')^2 + (1-f)(y_n - y_n')^2, \qquad (7)$$

Minimization of the quadratic loss function under each of the three possible regimes yields a set of equations reported in Appendix 3. The equations determine that the value of the loss function under each regime, and therefore which regimes are best at stabilizing the economy, as a function of the variances of the five shocks. The key conclusions are reported here.

4.2 Implications for PEPI vs. Exchange rate peg

Even if there are no export price shocks, the expected loss is smaller under the PEPI rule if $f > 1/2$, i.e., if the foreign sector is larger than the domestic sector.

To the extent that export price shocks are greater than 0, the case is stronger, because ε_x shocks affect output of both exports and nontraded goods, whereas PEPI insulates the real economy against them. If ε_x shocks are large, then PEPI dominates regardless of parameter values. This finding corresponds to the conventional result that exchange rate pegs are less suited to countries with volatile export prices, because they are unable to accommodate terms of trade shocks.

4.3 Implications for PEPI vs. CPI rule:

If a is large, i.e., if stabilizing the CPI per se is top priority, then terms of trade and exchange rate shocks hurt more under the PEPI rule than under inflation targeting. But shocks to world prices destabilize both output terms under the CPI rule, while PEPI insulates the real economy. Thus if a is small, PEPI dominates the CPI target. Also, if b and d are large, i.e., if supply curves are relatively flat, then PEPI again dominates.

5. Analysis of competing monetary targets with respect to ability to stabilize relative prices

The remainder of this paper is a counterfactual empirical analysis of alternative monetary regimes. We examine a set of countries in Latin America and the Caribbean,

comparing the historical paths of prices under the historical monetary regime with what would have happened under eight other possible regimes: dollar target, euro target, SDR target, CPI target, PEP target, PEPI target, and PPT. For simplicity, we continue to assume that the targets are hit precisely under each regime, even though we realize that in a stochastic model this would not be possible with half the regimes (the price index targets).

Sectoral weights in the price indices

In the empirical analysis we decompose traded goods more than in the model of the preceding section, into three different traded goods. But the countries we are interested in are still small open economies. Thus we continue to assume that the law of one price holds, not just for commodity exports but also for other exportables and importables, and that the prices of these goods are exogenous in world markets in terms of dollars. So the local-currency prices of the tradable goods are given by the exchange rate (actual or hypothetical, as the case may be) times the dollar prices.

The price index for non-traded goods is determined differently. They are not subject to the law of one price. Indeed, if all goods were subject to the law of one price, then the choice of currency regime would not make very much difference. The choice of monetary regime does make a difference, primarily because wages and prices of nontraded goods are sticky in the short run in terms of whatever is the local currency. In the longer run, however, purchasing power parity holds. Thus, in the case of the dollar peg, the local inflation rate – including nontraded goods – converges to the global inflation rate, which is here for simplicity taken to be that of the United States. Inasmuch as many Latin American countries suffered very high inflation rates in the 1970s and 1980s, even hyperinflations, it makes a big difference whether the counterfactual to the historical experience is that the country was credibly and rigorously tied to a nominal target all along, or that the country would have switched at some point during the sample period, and would have undergone a period of gradual disinflation in non-traded goods.[37] Eventually it would be good to try both kinds of counterfactual. For now, we consider the first: hypothetically, what would have happened if the country had always followed the dollar peg or inflation target, from the beginning.

We define the CPI and PPI each as weighted averages of prices in four sectors, working in logs:

$$CPI = w_{ntg} P_{ntg} + w_{cx} P_{cx} + w_{pm} P_{pm} + w_{otg} P_{otg}$$

$$PPI = v_{ntg} P_{ntg} + v_{cx} P_{cx} + v_{pm} P_{pm} + v_{otg} P_{otg}$$

[37] In theoretical models that were popular with monetary economists in the 1980s and 1990s, a change to a credibly firm nominal anchor would fundamentally change expectations so that all inflation, in traded and non-traded goods alike, would disappear instantly. In reality, exchange-rate based stabilization attempts generally show a lot of inflation inertia. (E.g., Kiguel and Liviatan, 1992.) Some might claim that an exchange rate peg is not a completely credible commitment. But there can be no more credibly firm nominal anchor than full dollarization. Yet when Ecuador gave up its currency in favor of the dollar, neither the inflation rate nor the price level converged rapidly to US levels. Inflationary momentum, rather, continued for a long time.

Definitions:
P_{ntg} ≡ price of nontraded goods in local terms. We assume that, at a horizon of less than 1 year, these prices would not be affected by differences in the exchange rate. Under the hypothetical counterfactual where a country would have been on a dollar peg all along, then its NTG prices are given by the US CPI, since we assume that convergence would have taken place in the long run.

P_{cx} ≡ price of exports of leading mineral/agricultural commodities in local terms. We ignore trade barriers and define these TG prices to equal the actual historically observed world dollar prices, times the exchange rate, which will differ depending on the monetary regime assumed.

P_{ox} ≡ price of other exports. Again, we assume perfect passthrough: the local price is the exchange rate times the exogenous world price.

P_{pm} ≡ price of petroleum product imports (oil & natural gas, refined or nonrefined), determined again as actual world dollar price times the simulated exchange rate.

P_{otg} ≡ price of other tradable goods (i.e., excluding oil and the other commodities that are measured explictly). We assume P_{otg} is equal to world prices of the TGs times the exchange rate. We need not have data on these prices directly. We are assuming these countries are all price-takers for all tradable goods, not just for commodities. Thus in a counterfactual simulation which says that some alternative regime would have caused the peso/$ exchange rate to have been 5% higher than it was historically, we simply assume this component of the price index P_{otg} would similarly have been 5% higher, relative to the historical baseline.

w_{ntg} ≡ weight on ntg in CPI
w_{cx} ≡ weight on cx in CPI
w_{pm} ≡ weight on pm in CPI
w_{otg} ≡ weight on otg in CPI

v_{ntg} ≡ weight on ntg in PPI
v_{cx} ≡ weight on cx in PPI
v_{pm} ≡ weight on pm in PPI
v_{otg} ≡ weight on otg in PPI

We impose $w_{ntg} \equiv v_{ntg}$.

The key difference between the two price indices is that the weight of the commodity export should be far smaller in the CPI than in the PPI, and the weight of the import commodity the other way around.

Table 3 reports the estimated weights that the countries' CPI and PPI, respectively, place on each of three sectors: non-tradable goods, the leading commodity export (which in two cases is oil), and other tradables (which includes imports, exports other than the leading commodity export, and any other goods that are perfect substitutes

for internationally traded goods). The methods for estimating the weights are described in Appendix 4. Mexico (located next to the United States and having followed open trade policies for 20 years) shows the lowest share of goods that are not internationally traded, while Argentina (which is distant, and generally protectionist) registers the highest.

As one would expect, the share of the commodity export in the CPI is usually lower than its share in the PPI, sometimes far lower (Argentina, Bolivia, Jamaica, Peru and Uruguay). The two exceptions are Mexico and Paraguay. One can guess a possible explanation for Mexico: petroleum products are heavily subsidized in domestic consumption, and oil production has been declining in recent years. Paraguay is a puzzle. The explanation might simply be that it is one of the few Latin American countries that is not heavily specialized in the production and export of a small number of agricultural or mineral commodities.

Table 3: Estimation for each country of weights placed by national price index on 3 sectors: nontradable goods, leading commodity export, and other tradable goods

Country	Price index	Non Tradables	Leading Commodity Export	Oil	Other Tradables	Total
ARG	CPI	0.6939	0.0063	0.0431	0.2567	1.000
	PPI	0.6939	0.0391	0.0230	0.2440	1.000
BOL	CPI	0.5782	0.0163	0.0141	0.3914	1.000
	PPI	0.5782	0.1471	0.0235	0.2512	1.000
CHL	CPI	0.5235	0.0079	0.0608	0.4078	1.000
	PPI	0.5235	0.0100	0.1334	0.3332	1.000
COL*	CPI	0.5985	--	0.0168	0.3847	1.000
	PPI	0.5985	--	0.0407	0.3608	1.000
JAM	CPI	0.6413	0.0002	0.0234	0.3351	1.000
	PPI	0.6413	0.1212	0.0303	0.2072	1.000
MEX*	CPI	0.3749	--	0.0366	0.5885	1.000
	PPI	0.3749	--	0.0247	0.6003	1.000
PRY	CPI	0.3929	0.1058	0.0676	0.4338	1.000
	PPI	0.3929	0.0880	0.0988	0.4204	1.000
PER	CPI	0.6697	0.0114	0.0393	0.2796	1.000
	PPI	0.6697	0.040504	0.021228	0.268568	1.000
URY	CPI	0.6230	0.0518	0.0357	0.2895	1.000
	PPI	0.6230	0.2234	0.1158	0.0378	1.000

* Oil is the leading commodity export.

5.2 Simulations of the relative prices of tradables and nontradables.

The subsequent analysis presumes that, for commodity-producing countries such as those in Latin America and the Caribbean, a highly volatile terms of trade is perhaps

the most important issue to be addressed by currency policy, second to the fundamental decision to anchor inflationary expectations by a nominal target. Of course small countries are assumed to have no control over the price of their exports relative to the price of their imports. That relative price is the terms of trade, and is determined exogenously on world markets. But the currency regime does help determine variation in the relative price of traded goods (both the export commodities and other traded goods), that is, the price relative to the price of nontraded goods or relative to the CPI or to wages.

Relative to floating, the goal is to moderate a cycle where a strong, but perhaps temporary, upward swing in the world price of the export commodity causes a large real appreciation in the currency (Dutch Disease), an increase in spending (especially by the government), an increase in the price of nontraded goods relative to non-export-commodity traded goods, a resultant shift of resources out of non-export-commodity traded goods, and a current account deficit -- all of which are painfully reversed when the world price of the export commodity goes back down. Relative to a fixed exchange rate or a CPI target, PEP and PPT might show an advantage in accommodating fluctuations in the terms of trade. The goal is that a worsening in the terms of trade induces a weaker currency under PPT than it would under CPI-targeting, and therefore raises the price of tradable goods relative to nontraded goods so as to encourage more of their production.

For those who wonder what the market failure is, the distortion at which monetary policy is aimed, the answer is that such price swings induce current account deficits and capital inflows that are not optimizing in the way standard theory says. Facets of the market failure could be excessively procyclical capital flows (including perhaps the absence of an effective international mechanism for handling default), or a political economy proclivity for governments to over-spend when the purchasing power of their revenues goes up (due to soaring commodity export tax receipts[38]), or speculative bubbles in real estate[39] (as investors jump on the bandwagon of rising nontraded goods prices).

We will simulate the variability of the real prices of exports. It captures the unwanted side-effects of commodity booms (and busts): (1) the excessive swings in price signals that historically have induced labor and land to move into the production of commodities during the boom, only to reverse when the crash comes, and (2) the excessive swings in government revenue (royalties and corporate taxes on the commodity sector) in terms of purchasing power over local goods and services, which historically have tempted governments into pro-cyclical spending.

More specifically, our analysis is guided by the assumption that the goals are, to the extent possible, to minimize variability in the real price of commodity exports (to moderate resource swings into that sector when its world price temporarily rises, especially) and to minimize variability in the real price of other traded goods (to moderate resource swings out of that sector, especially into nontraded goods). Again,

[38] E.g., Tornell and Lane (1998).

[39] Aizenman and Jinjarak (2008) find a strong positive association between current account deficits and the real increase in real estate prices.

these two objectives are second to the objective of anchoring inflationary expectations. But any nominal anchor can do that.[40]

We could choose to measure the relative price of traded goods in terms of non-traded goods, or in terms of wages. Instead we choose to measure the prices of these traded goods relative to the CPI. This comes pretty much to the same thing, because nontraded goods are the only other component in the CPI, other than traded goods (and the relative price of commodity exports versus other traded goods is deemed exogenous).

The charts in Appendix 5 illustrate the simulated paths of the nominal and real prices of major export commodities and of a commodity price index in twenty Latin American and Caribbean countries. Each graph shows the historical price path and several counterfactual alternatives, depending on the currency peg or price target that could hypothetically have been in effect.

The various panels of Table 4 present the corresponding results in terms of the variability of real prices under alternative regimes. In each case, the first column reports the actual historical variability experienced by the country in question, under whatever regime or (more often) sequence of regimes it chose to follow. One can see the high variability of nominal prices for the leading export commodities. The highest standard deviations are copper for Chile, oil for Ecuador and Venezuela, and beef for Uruguay.

These prices in Table 4(a) are in domestic currency, so variability depends in part on the stability of the exchange rate regime, and not solely on the volatility of the world export market (Table 2). Some small countries that have been pegged to the dollar during most of their history show price variability that is lower than others despite commodities that are at least as variable: dollarized Panama with bananas, Trinidad with oil, and Guatemala with coffee. In theory, the floating peso of Mexico or Chile, respectively, could have appreciated precisely in proportion when dollar prices of oil or copper rise, thereby eliminating variation in the peso price of oil or copper. In practice, this tendency does not come close to fully insulating them from variation in the domestic prices of their leading export commodities; indeed floating exchange rates may offer some extraneous volatility. Interestingly, the standard deviation of an aggregate export price index (PEPI) is in many cases not much less than (or is even greater than) the standard deviation for individual commodities, suggesting that the commodity prices are highly correlated.

5.3 Comparison of the ability of alternative regimes to stabilize real export prices

The remaining columns in Table 4 are the counterfactuals. We begin with the case of a hypothetical peg to the dollar. Notice that it is the same as the historical peg in the case of Panama. In the other cases, we can simulate precisely what the price of soy, copper, etc. would have been in terms of pesos (let's call the domestic currency the peso) under the counterfactual, by using the historical series for the exchange rate between the peso and the dollar: if the peso historically depreciated against the dollar by 1% in some given month, we know that the price of soy would have been lower by precisely 1% if the

[40] Except to the extent that the variable chosen for nominal anchor is too likely to lead to intolerably big distortions when faced with shocks and thereby is not credible from the beginning. (This was the case with M1 targeting and, I would argue, would be also with strict CPI targeting.)

peso had instead been pegged to the dollar. In general, the dollar pegs would have produced far more stable prices in domestic terms. This is true of all six nominal anchors, and simply illustrates the tremendous price instability that almost all these countries experienced in the 1970s and 1980s.

The next two columns of Table 4(a) show what the variability of the commodity export prices would have been under an SDR peg or euro peg, respectively. Variability of the domestic price of the commodity export is often lower under the euro peg than under the dollar peg: for natural gas and oil; iron and steel; copper, aluminum and gold; bananas and sugar; and soy and beef. Coffee is virtually the only exception. This illustrates a point frequently missed by observers who read too much into the fact that international trade in these commodities is usually invoiced in dollars. While the use of the dollar as currency of invoice and payment may introduce some dollar-stickiness in the very short run, it does not carry over to the medium run. When the effective foreign exchange value of the dollar rises, dollar prices of these commodities tend to fall rather quickly. The offset is not fully proportionate; but the point is that the prices are not more stable in terms of dollars than in terms of euros. Table 4(a) shows that in some cases (soy, coffee and beef), the basket offered by the SDR would stabilize commodity prices better than either the dollar or euro. Even in these cases, however, the difference is small, and this benefit would hardly seem worth giving up the simplicity of a single-currency peg.

After the currency peg columns comes PEP (Peg the Export Price). Variability of the local-currency price of the leading export commodities is zero, by construction. The same is true of the full basket of exports in the case of PEPI (Peg the Export Price Index). Recall the essence of this regime: every time the dollar price of coffee falls by one per cent on world markets, the dollar value of the local currency falls by one per cent, leaving the local price of coffee unchanged. Nominal variability is far lower than under floating, and yet there is a clear nominal target to anchor inflation expectations. The best of both regimes. An overall judgment on the merits of the alternative regimes would have to be based on far more than this, of course. The column of zeros is a conspicuous "stacking of the deck" in favor of PEP and PEPI.

Table 4(b) reports the standard deviations of the percentage *changes* in the local-currency commodity prices across the seven regimes. Again the currency pegs stabilize prices relative to the historical regime. (As one would expect, the reduction in volatility no longer looks quite so dramatic). The euro peg no longer dominates the dollar peg in terms of reducing local-currency price volatility; this is again what one would expect from a dollar-stickiness of commodity prices that pertains only to the short term.

Table 4(c) shows the standard deviation of *real* prices of the commodity exports, across the seven regimes. Real is here defined in terms of the CPI, but we could just as well be looking at the relative price in terms of non-traded goods. This is the most important of the three measures of price volatility. It captures the unwanted side-effects of the commodity cycle: (1) the excessive swings in relative price signals that historically have induced resources to move in and out of the production of commodities, and (2) the excessive swings in real government revenue, which historically have yielded pro-cyclical spending.

The comparison of a PPI target with a CPI target, as an alternate possible interpretation of inflation targeting, is the unique point of this study. The comparison in terms of ability to stabilize domestic prices of the principle export commodities appears in the last two columns of Tables 4(a) through 4(c). In most cases the standard deviation of the domestic price of the export commodity is lower under the PPI target than under the CPI target. In a few cases, it is less than half the size: Jamaica for aluminum and Uruguay for beef. The only times when variability is higher under the PPI target than under the CPI target is Mexico for oil and Paraguay for beef. The reason is immediately apparent: these were the only two countries where the export commodity strangely received a heavier estimated weight in the CPI than in the PPI. This cannot be the normal situation.

The aspect of these tables that might be considered surprising is that, even though variability of the export commodity price tends to be lower under a PPI target than under a CPI target, under *either* form of inflation targeting it is generally substantially higher than under a currency peg, and often higher even than under the various historical regimes. Perhaps this is an artifact of our approach that operationalizes inflation targeting as the precise hitting of the price index target, whether PPI or CPI. In practice this would be impossible to achieve. In our results, it is possible to achieve, but perhaps only at the expense of imposing wild fluctuations in the exchange rate to offset fully fluctuations in any one sector of the price index. Perhaps a more reasonable and realistic approach that allowed a band or cone for the targeted price index would yield more realistic results. In any case, the methods for implementing the CPI and PPI targets bear further examination in future research.

Stabilizing domestic prices of the export commodity is far from the only criterion that should be considered in comparing alternative candidates for nominal anchor. Another one is stabilizing domestic prices of *other* tradable goods. A valid critique of PEP and PEPI is that it transfers uncertainty that would otherwise occur in the real price of commodity exports into uncertainty (which otherwise might not occur) in the real price of non-commodity exportables and importables. This critique is particularly relevant if diversification of the economy is valued.

5.4 Comparison of ability of alternative regimes to stabilize real traded goods prices overall

In Table 5 we show the outcomes of simulations, under the same seven alternative regimes, of the domestic prices of *import* goods. From the viewpoint of a small country, imports, like exports, have their prices determined on world markets. The biggest source of variability in the world price of LAC imports is bound to be oil price shocks (for the countries that are oil importers, rather than exporters). Tables 5(a) and 5(b) report the statistics on the variability of the nominal import price, measured in terms of levels or changes respectively. Again, the currency pegs cut nominal price variability substantially relative to the historical regime, but the euro peg and SDR peg both slightly dominate the dollar peg. The commodity peg (PEP) does indeed introduce some extra volatility into import prices, through exchange rate fluctuations, but the difference is not large. When we look at the level of local import prices, PPI targeting dominates CPI targeting. This supports the claim that the CPI target, if interpreted literally, forces the

monetary authorities to tighten and appreciate in a perverse response to an increase in the world price of oil import (in the case of oil importers), and that the PPI target does not. When we look at *changes* in local import prices, the standard deviations under the CPI target and the PPI target are very close to each other, and close to the standard deviation under the currency pegs as well.

An attempt to construct anything like a comprehensive evaluation of regimes rooted in a theoretically established welfare criterion is far beyond the ambitions of this study. On the other hand, we cannot end the study with a state of affairs where the only horse race insures by construction that PEP wins.[41] Instead, we conclude with an examination, in Table 6, of the implications of the alternative regimes for a simple objective function that is a weighted average of the standard deviation of the real price of commodity exports and the standard deviation of the real price of other tradables (just oil in this case, or another largest single import good: steel). In other words we pursue the logic that stabilizing the relative price of commodity exports is not much of an accomplishment if it comes at the expense of a corresponding destabilization of the relative price of other traded goods.

The commodity price peg (PEP) is the winner in the competition to reduce relative price variability, by a fairly substantial margin when we look at the level of nominal prices (Table 6a) or the level of real prices (Table 6c), and by a smaller margin when we look at changes in nominal prices (Table 6b). The three currency pegs are again fairly similar to each other, showing less price variability than the historical regime but more than the commodity peg. In the central competition of the last two columns, the PPI target produces less relative price variability than the CPI target in most cases. Looking at real price variability in Table 6c, the only exception is Peru; the gain is substantial in the case of Jamaica and Uruguay, smaller for the others.

6. Summary of Conclusions

What nominal variable is the best candidate for an anchor to monetary policy? Inflation Targeting, with its usual focus on the CPI, has over the past decade been the most popular choice among monetary economists, at least with respect to large industrialized countries. But developing countries differ in a number of relevant

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[41] The first PEP papers pursued counterfactual simulations for the paths of exports, trade balances, and debt under alternative possible nominal anchors, for a wide variety of commodity-producing countries (Frankel, 2002, 03, 05; Frankel and Saiki, 2002). There nothing was foreordained. But PEP did tend to product the result that in the late 1990s, when dollar commodity prices fell and many emerging market countries experienced currency crises, PEP automatically depreciated the currency, stimulated exports, and mitigated the debt problem – all without the need to abandon the pre-declared nominal anchor. LAC countries that appear in those simulations include Argentina (wheat); Bolivia, Ghana and Peru (gold), Brazil, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Peru (coffee); Chile (copper); Colombia, Ecuador, Mexico and Venezuela (oil); Bolivia and Peru (silver); and Jamaica and Surinam (aluminum). Of course commodity composition of exports evolves over time; some of these associations may not be as relevant looking forward.

structural ways. They tend to be smaller, and thus to take prices of both imports and exports as given on world markets. They tend to be more vulnerable to supply shocks, particularly terms of trade shocks. This is especially true of countries that depend on the exports of agricultural and mineral commodities, a description that fits most countries in Latin America and the Caribbean. But terms of trade variability is not the same as export price variability; movements in dollar prices of imports also play a big role. Three countries with very high variability in the terms of trade overall are Chile, the Dominican Republic, and Venezuela.

The regimes currently followed by the LAC countries are generally distributed across three categories: monetary targets, exchange rate targets, and inflation targets. These are official regimes; in practice many of the countries deviate from the declared targeting policy. Money-targeters, for example, let the monetary aggregates run well outside the proclaimed range, and inflation targeters intervene heavily in the foreign exchange market.

This study has focused on a comparison of exchange rate pegs and inflation targets, but has also highlighted a new untried set of proposals. These proposals call for targeting prices of whatever commodities are the important products of the country in question. The proposals range from the most exotic to the more down-to-earth. The most exotic is the idea of Pegging the Export Price (PEP): Bolivia would fix the dollar price of the sole to the dollar price of natural gas; Chile would intervene to keep the value of its peso constant in terms of copper; Jamaica would peg its dollar to aluminum; and Uruguay would peg its peso to the price of beef. A less radical version that takes export diversification into account is Peg the Export Price Index (PEPI), which aims to stabilize a basket, perhaps a comprehensive basket, of export prices in terms of the local currency. Finally, the new improved version is Product Price Targeting (PPT): to target in place of the CPI the Producer Price Index or a specially constructed index of product prices weighted by shares in output. All three of the output-based price targets appear to dominate a policy of targeting the CPI, to the extent that terms of trade shocks are important. All three have the desirable property that the currency appreciates when prices for exports go up on world markets and depreciates when they go down; the CPI does not have that desirable property.

In addition, if inflation targeting is interpreted strictly as a commitment to the CPI, it has the *undesirable* property that the currency appreciates when the prices of imports such as oil go up on world markets, and depreciates when they go down; PEP, PEPI and PPT targeting don't have this undesirable property. Table 1 provides a preliminary indication that ever since 1999, when Brazil and Chile switched from exchange rate targeting to CPI targeting, they have experienced a higher correlation between the dollar price of their currencies and the dollar price of oil imports. This suggests that, language about core CPI notwithstanding, the monetary authorities in these two countries have found it necessary to respond to the oil price increases of the last decade by contracting monetary policy enough to appreciate their currencies. The production-based price targets would not have this problem.

The heart of the analysis is the comparison of seven alternative nominal targets according to how they would affect the variability of the real prices of tradables: commodity exports in Table 4, imports in Table 5, and both together in Table 6. Some conclusions are very predictable. First, according to the simulations the currency anchors

offer far more price stability than does the historical reality, because our counterfactual was that the countries had the benefits of the anchor from before the beginning of the sample. Second, PEP perfectly stabilizes the domestic price of export commodities, by construction.

The more interesting findings are the comparison of a CPI target and a Product Price target as alternative interpretations of inflation targeting. The results show that the PPI target generally delivers more stability in the prices of traded goods, especially the export commodity. This is a natural consequence of the larger weight on commodity exports in the PPI than in the CPI. Perhaps surprisingly, both the CPI target and the PPI target deliver more relative price variability than any of the three exchange rate targets (dollar, euro and SDR). More research is clearly needed here, to see if the estimation of the sectoral weights and the price series can be improved, and to make the comparison more realistic by allowing the CPI and Product Price Index to fall within a target range rather than requiring the central bank to hit a target precisely.

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Table 4: Variability of Export Prices under Alternative Currency Regimes
(a) Standard Deviation of Level of Nominal Export Prices

		Nominal Export Prices						
		Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	Soy	1.927	0.278	0.251	0.265	0.000	1.271	1.037
ARG	Basket	1.966	0.331	0.281	0.260	0.000	--	--
ARG	PEPI	2.433	0.104	0.064	0.093	0.000	--	--
BOL	Nat. Gas	1.997	0.627	0.591	0.594	0.000	0.907	0.584
BOL	PEPI	1.685	0.581	0.594	0.581	0.000	--	--
BRA	Steel	2.240	0.590	0.495	0.418	0.000	--	--
BRA	Iron Ore	2.180	0.460	0.388	0.333	0.000	--	--
BRA	Basket	2.186	0.415	0.333	0.281	0.000	--	--
BRA	PEPI	2.601	0.405	0.320	0.236	0.000	--	--
CHL	Copper	3.178	0.408	0.342	0.311	0.000	1.113	0.952
COL	Oil	2.315	0.759	0.697	0.623	0.000	1.123	0.974
COL	Coffee	1.752	0.479	0.494	0.504	0.000	--	--
COL	PEPI	0.553	0.186	0.155	0.166	0.000	--	--
CRI	Bananas	1.930	0.442	0.372	0.306	0.000	--	--
CRI	Coffee	1.577	0.479	0.494	0.504	0.000	--	--
ECU	Oil	3.288	0.759	0.697	0.623	0.000	--	--
ECU	PEPI	3.044	0.491	0.457	0.426	0.000	--	--
GTM	Coffee	0.910	0.479	0.494	0.504	0.000	--	--
GUY	Sugar	2.059	0.475	0.433	0.436	0.000	--	--
GUY	PEPI	1.914	0.404	0.372	0.325	0.000	--	--
HND	Coffee	0.971	0.479	0.494	0.504	0.000	--	--
HND	PEPI	0.937	0.277	0.305	0.334	0.000	--	--
JAM	Aluminium	1.959	0.418	0.361	0.303	0.000	1.222	0.565
JAM	PEPI	1.579	0.167	0.155	0.199	0.000	--	--
MEX	Oil	3.238	0.759	0.697	0.623	0.000	0.975	1.030
NIC	Coffee	2.185	0.479	0.494	0.504	0.000	--	--
PAN	Bananas	0.442	0.442	0.372	0.306	0.000	--	--
PER	Copper	1.923	0.408	0.342	0.311	0.000	0.671	0.688
PER	Gold	1.909	0.708	0.638	0.536	0.000	--	--
PER	PEPI	1.951	0.378	0.320	0.288	0.000	--	--
PRY	Beef	1.623	0.230	0.206	0.224	0.000	0.694	0.715
SLV	Coffee	0.670	0.479	0.494	0.504	0.000	--	--
TTO	Nat. Gas	0.929	0.627	0.591	0.594	0.000	--	--
URY	Beef	3.641	0.230	0.206	0.224	0.000	0.893	0.410
VEN	Oil	2.931	0.759	0.697	0.623	0.000	--	--

(b) Standard Deviation of First Difference of Nominal Export Prices

		First Difference of Nominal Export Prices						
		Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	Soy	0.201	0.067	0.068	0.073	0.000	0.061	0.041
ARG	Basket	0.179	0.051	0.052	0.059	0.000	--	--
ARG	PEPI	1.798	1.385	1.299	1.570	0.000	--	--
BOL	Nat. Gas	0.417	0.106	0.105	0.106	0.000	0.102	0.071
BOL	PEPI	0.204	0.055	0.059	0.066	0.000	--	--
BRA	Steel	0.149	0.090	0.091	0.095	0.000	--	--
BRA	Iron Ore	0.123	0.050	0.054	0.059	0.000	--	--
BRA	Basket	0.127	0.046	0.048	0.055	0.000	--	--
BRA	PEPI	0.969	0.097	0.101	0.131	0.000	--	--
CHL	Copper	0.122	0.078	0.076	0.078	0.000	0.070	0.073
COL	Oil	0.078	0.075	0.076	0.080	0.000	0.067	0.059
COL	Coffee	0.083	0.083	0.085	0.090	0.000	--	--
COL	PEPI	0.036	0.033	0.033	0.042	0.000	--	--
CRI	Bananas	0.159	0.154	0.156	0.158	0.000	--	--
CRI	Coffee	0.096	0.083	0.085	0.090	0.000	--	--
ECU	Oil	0.089	0.075	0.076	0.080	0.000	--	--
ECU	PEPI	0.177	0.170	0.171	0.174	0.000	--	--
GTM	Coffee	0.092	0.083	0.085	0.090	0.000	--	--
GUY	Sugar	0.135	0.105	0.105	0.108	0.000	--	--
GUY	PEPI	0.379	0.217	0.217	0.224	0.000	--	--
HND	Coffee	0.109	0.083	0.085	0.090	0.000	--	--
HND	PEPI	0.282	0.259	0.260	0.267	0.000	--	--
JAM	Aluminium	0.065	0.049	0.052	0.059	0.000	0.048	0.018
JAM	PEPI	0.192	0.128	0.124	0.150	0.000	--	--
MEX	Oil	0.090	0.075	0.076	0.080	0.000	0.064	0.067
NIC	Coffee	0.184	0.083	0.085	0.090	0.000	--	--
PAN	Bananas	0.154	0.154	0.156	0.158	0.000	--	--
PER	Copper	0.168	0.078	0.076	0.078	0.000	0.076	0.076
PER	Gold	0.158	0.051	0.049	0.051	0.000	--	--
PER	PEPI	0.218	0.136	0.138	0.142	0.000	--	--
PRY	Beef	0.065	0.044	0.047	0.055	0.000	0.027	0.031
SLV	Coffee	0.096	0.083	0.085	0.090	0.000	--	--
TTO	Nat. Gas	0.109	0.106	0.105	0.106	0.000	--	--
URY	Beef	0.076	0.044	0.047	0.055	0.000	0.028	0.022
VEN	Oil	0.116	0.075	0.076	0.080	0.000	--	--

(c) Standard Deviation of Level of Real Export Prices

		Real Export Prices						
		Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	Soy	0.561	0.497	0.523	0.483	0.000	0.858	0.767
ARG	Basket	0.578	0.418	0.443	0.408	0.000	--	--
ARG	PEPI	0.312	0.140	0.128	0.110	0.000	--	--
BOL	Nat. Gas	0.556	0.402	0.431	0.483	0.000	0.438	0.322
BOL	PEPI	0.523	0.616	0.650	0.638	0.000	--	--
BRA	Steel	0.496	0.427	0.403	0.363	0.000	--	--
BRA	Iron Ore	0.412	0.332	0.353	0.335	0.000	--	--
BRA	Basket	0.355	0.360	0.370	0.336	0.000	--	--
BRA	PEPI	0.403	0.191	0.220	0.206	0.000	--	--
CHL	Copper	0.418	0.485	0.496	0.451	0.000	0.909	0.815
COL	Oil	0.456	0.485	0.482	0.490	0.000	1.123	0.974
COL	Coffee	0.528	0.690	0.717	0.680	0.000	--	--
COL	PEPI	0.121	0.153	0.128	0.138	0.000	--	--
CRI	Bananas	0.273	0.252	0.283	0.281	0.000	--	--
CRI	Coffee	0.566	0.690	0.717	0.680	0.000	--	--
ECU	Oil	0.456	0.485	0.482	0.490	0.000	--	--
ECU	PEPI	0.302	0.381	0.406	0.404	0.000	--	--
GTM	Coffee	0.603	0.690	0.717	0.680	0.000		
GUY	Sugar	0.823	0.677	0.676	0.624	0.000	--	--
GUY	PEPI	0.692	0.375	0.400	0.396	0.000	--	--
HND	Coffee	0.594	0.690	0.717	0.680	0.000	--	--
HND	PEPI	0.414	0.507	0.525	0.491	0.000	--	--
JAM	Aluminium	0.272	0.281	0.321	0.316	0.000	1.222	0.565
JAM	PEPI	0.239	0.363	0.383	0.356	0.000	--	--
MEX	Oil	0.479	0.485	0.482	0.490	0.000	0.975	1.030
NIC	Coffee	0.482	0.690	0.717	0.680	0.000	--	--
PAN	Bananas	0.210	0.252	0.283	0.281	0.000	--	--
PER	Copper	0.408	0.485	0.496	0.451	0.000	0.437	0.434
PER	Gold	0.250	0.440	0.422	0.406	0.000	--	--
PER	PEPI	0.338	0.349	0.345	0.308	0.000	--	--
PRY	Beef	0.312	0.425	0.468	0.441	0.000	0.694	0.715
SLV	Coffee	0.945	0.690	0.717	0.680	0.000	--	--
TTO	Nat. Gas	0.357	0.402	0.431	0.483	0.000	--	--
URY	Beef	0.494	0.425	0.468	0.441	0.000	0.893	0.410
VEN	Oil	0.429	0.485	0.482	0.490	0.000	--	--

Table 5: Variability of Import Prices under Alternative Currency Regimes *

(a) Standard Deviation of Level of Nominal Import Prices

		Nominal Import Prices						
		Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	Oil	2.242	0.759	0.697	0.623	0.647	0.886	0.740
ARG	Steel	2.134	0.527	0.428	0.349	0.428	0.982	0.749
BOL	Oil	1.939	0.759	0.697	0.623	0.358	0.771	0.659
BOL	Steel	2.052	0.527	0.428	0.349	0.478	0.586	0.501
BRA	Oil	2.290	0.759	0.697	0.623	0.538	--	--
CHL	Oil	3.636	0.759	0.697	0.623	0.597	0.771	0.578
CHL	Steel	3.372	0.527	0.428	0.349	0.345	0.817	0.677
COL	Steel	2.166	0.527	0.428	0.349	0.538	1.193	1.073
CRI	Oil	2.142	0.759	0.697	0.623	0.484	--	--
CRI	Steel	1.967	0.527	0.428	0.349	0.405	--	--
ECU	Steel	3.187	0.527	0.428	0.349	0.538	--	--
GTM	Oil	1.444	0.759	0.697	0.623	0.765	--	--
GTM	Steel	1.323	0.527	0.428	0.349	0.669	--	--
GUY	Oil	2.463	0.759	0.697	0.623	0.766	--	--
GUY	Steel	2.367	0.527	0.428	0.349	0.581	--	--
HND	Oil	1.504	0.759	0.697	0.623	0.765	--	--
HND	Steel	1.370	0.527	0.428	0.349	0.669	--	--
JAM	Oil	2.207	0.759	0.697	0.623	0.452	1.074	0.777
MEX	Steel	3.125	0.527	0.428	0.349	0.538	1.050	1.094
NIC	Oil	2.389	0.759	0.697	0.623	0.765	--	--
NIC	Steel	2.338	0.527	0.428	0.349	0.669	--	--
PAN	Oil	0.759	0.759	0.697	0.623	0.484	--	--
PAN	Steel	0.527	0.527	0.428	0.349	0.405	--	--
PER	Oil	2.115	0.759	0.697	0.623	0.597	0.792	0.718
PER	Steel	2.059	0.527	0.428	0.349	0.345	0.803	0.613
PRY	Oil	2.049	0.759	0.697	0.623	0.625	0.792	0.718
PRY	Steel	1.939	0.527	0.428	0.349	0.444	0.803	0.613
SLV	Oil	1.153	0.759	0.697	0.623	0.765	--	--
SLV	Steel	1.012	0.527	0.428	0.349	0.669	--	--
TTO	Oil	1.089	0.759	0.697	0.623	0.358	--	--
TTO	Steel	0.914	0.527	0.428	0.349	0.478	--	--
URY	Oil	3.966	0.759	0.697	0.623	0.625	0.693	0.639
URY	Steel	3.896	0.527	0.428	0.349	0.444	0.562	0.408
VEN	Steel	2.835	0.527	0.428	0.349	0.538	--	--

* Commodity peg refers to regime where the country's currency is pegged to the price of the leading commodity export.

(b) Standard Deviation of First Difference of Nominal Import Prices

		First Difference of Nominal Import Prices						
		Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	Oil	0.197	0.075	0.076	0.080	0.099	0.058	0.076
ARG	Steel	0.209	0.106	0.105	0.107	0.112	0.105	0.106
BOL	Oil	0.218	0.075	0.076	0.080	0.183	0.207	0.137
BOL	Steel	0.223	0.106	0.105	0.107	0.261	0.287	0.205
BRA	Oil	0.140	0.075	0.076	0.080	0.111	--	--
CHL	Oil	0.124	0.075	0.076	0.080	0.097	0.062	0.050
CHL	Steel	0.143	0.106	0.105	0.107	0.125	0.109	0.110
COL	Steel	0.104	0.106	0.105	0.107	0.125	0.106	0.106
CRI	Oil	0.087	0.075	0.076	0.080	0.174	--	--
CRI	Steel	0.110	0.106	0.105	0.107	0.189	--	--
ECU	Steel	0.116	0.106	0.105	0.107	0.125	--	--
GTM	Oil	0.086	0.075	0.076	0.080	0.110	--	--
GTM	Steel	0.116	0.106	0.105	0.107	0.134	--	--
GUY	Oil	0.112	0.075	0.076	0.080	0.124	--	--
GUY	Steel	0.135	0.106	0.105	0.107	0.151	--	--
HND	Oil	0.103	0.075	0.076	0.080	0.110	--	--
HND	Steel	0.128	0.106	0.105	0.107	0.134	--	--
JAM	Oil	0.085	0.075	0.076	0.080	0.077	0.063	0.079
MEX	Steel	0.117	0.106	0.105	0.107	0.125	0.106	0.106
NIC	Oil	0.182	0.075	0.076	0.080	0.110	--	--
NIC	Steel	0.194	0.106	0.105	0.107	0.134	--	--
PAN	Oil	0.075	0.075	0.076	0.080	0.174	--	--
PAN	Steel	0.106	0.106	0.105	0.107	0.189	--	--
PER	Oil	0.191	0.075	0.076	0.080	0.097	0.068	0.086
PER	Steel	0.189	0.106	0.105	0.107	0.125	0.111	0.117
PRY	Oil	0.088	0.075	0.076	0.080	0.085	0.068	0.086
PRY	Steel	0.114	0.106	0.105	0.107	0.116	0.111	0.117
SLV	Oil	0.080	0.075	0.076	0.080	0.110	--	--
SLV	Steel	0.111	0.106	0.105	0.107	0.134	--	--
TTO	Oil	0.078	0.075	0.076	0.080	0.117	--	--
TTO	Steel	0.110	0.106	0.105	0.107	0.145	--	--
URY	Oil	0.284	0.075	0.076	0.080	0.085	0.070	0.068
URY	Steel	0.196	0.106	0.105	0.107	0.116	0.109	0.110
VEN	Steel	0.137	0.106	0.105	0.107	0.125	--	--

* Commodity peg refers to regime where the country's exchange rate is pegged to the price of the leading commodity export.

(c) Standard Deviation of Level of Real Import Prices

		Real Import Prices						
		Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	Oil	0.760	0.485	0.482	0.490	0.482	0.654	0.591
ARG	Steel	0.684	0.380	0.359	0.315	0.378	0.646	0.567
BOL	Oil	0.520	0.485	0.482	0.490	0.277	0.539	0.574
BOL	Steel	0.483	0.380	0.359	0.315	0.435	0.523	0.452
BRA	Oil	0.549	0.485	0.482	0.490	0.374	--	--
CHL	Oil	0.601	0.485	0.482	0.490	0.597	0.771	0.578
CHL	Steel	0.478	0.380	0.359	0.315	0.345	0.817	0.677
COL	Steel	0.368	0.380	0.359	0.315	0.538	1.193	1.073
CRI	Oil	0.568	0.485	0.482	0.490	0.484	--	--
CRI	Steel	0.330	0.380	0.359	0.315	0.405	--	--
ECU	Steel	0.393	0.380	0.359	0.315	0.538	--	--
GTM	Oil	0.416	0.485	0.482	0.490	0.765	--	--
GTM	Steel	0.368	0.380	0.359	0.315	0.669	--	--
GUY	Oil	1.021	0.485	0.482	0.490	0.766	--	--
GUY	Steel	0.970	0.380	0.359	0.315	0.581	--	--
HND	Oil	0.471	0.485	0.482	0.490	0.765	--	--
HND	Steel	0.398	0.380	0.359	0.315	0.669	--	--
JAM	Oil	0.405	0.485	0.482	0.490	0.424	0.518	0.400
MEX	Steel	0.387	0.380	0.359	0.315	0.000	1.050	1.094
NIC	Oil	0.539	0.485	0.482	0.490	0.677	--	--
NIC	Steel	0.467	0.380	0.359	0.315	0.529	--	--
PAN	Oil	0.413	0.485	0.482	0.490	0.411	--	--
PAN	Steel	0.370	0.380	0.359	0.315	0.388	--	--
PER	Oil	0.480	0.485	0.482	0.490	0.342	0.403	0.424
PER	Steel	0.385	0.380	0.359	0.315	0.307	0.464	0.458
PRY	Oil	0.514	0.485	0.482	0.490	0.625	0.792	0.718
PRY	Steel	0.469	0.380	0.359	0.315	0.444	0.803	0.613
SLV	Oil	0.555	0.485	0.482	0.490	0.765	--	--
SLV	Steel	0.572	0.380	0.359	0.315	0.669	--	--
TTO	Oil	0.410	0.485	0.482	0.490	0.358	--	--
TTO	Steel	0.408	0.380	0.359	0.315	0.478	--	--
URY	Oil	0.515	0.485	0.482	0.490	0.625	0.693	0.639
URY	Steel	0.482	0.380	0.359	0.315	0.444	0.562	0.408
VEN	Steel	0.441	0.380	0.359	0.315	0.538	--	--

* Commodity peg refers to regime where the country's exchange rate is pegged to the price of the leading commodity export.

Table 6: Average of the Variability of Export's and Import's Prices*

(a) Average of the Standard Deviation of Level of Nominal Prices

	Nominal Prices						
	Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	2.084	0.519	0.474	0.444	0.324	1.078	0.888
BOL	1.968	0.693	0.644	0.609	0.179	0.839	0.621
BRA	2.265	0.675	0.596	0.520	0.269	--	--
CHL	3.407	0.584	0.519	0.467	0.298	0.942	0.765
COL	2.315	0.759	0.697	0.623	0.000	1.123	0.974
CRI	2.036	0.600	0.534	0.464	0.242	--	--
ECU	3.288	0.759	0.697	0.623	0.000	--	--
GTM	1.177	0.619	0.595	0.563	0.383	--	--
GUY	2.261	0.617	0.565	0.529	0.383	--	--
HND	1.237	0.619	0.595	0.563	0.383	--	--
JAM	2.083	0.588	0.529	0.463	0.226	1.148	0.671
MEX	3.238	0.759	0.697	0.623	0.000	0.975	1.030
NIC	2.287	0.619	0.595	0.563	0.383	--	--
PAN	0.600	0.600	0.534	0.464	0.242	--	--
PER	2.019	0.584	0.519	0.467	0.298	0.732	0.703
PRY	1.836	0.495	0.451	0.423	0.312	0.743	0.716
SLV	0.911	0.619	0.595	0.563	0.383	--	--
TTO	1.009	0.693	0.644	0.609	0.179	--	--
URY	3.804	0.495	0.451	0.423	0.312	0.793	0.525
VEN	2.931	0.759	0.697	0.623	0.000	--	--

* Average of leading commodity export standard deviation and oil price standard deviation under different regimes.

(b) Standard Deviation of First Difference of Nominal Prices:

Export Price Standard Deviation and Import Price Standard Deviation Averaged

	First Difference of Nominal Prices						
	Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	0.199	0.071	0.072	0.076	0.049	0.059	0.058
BOL	0.317	0.090	0.090	0.093	0.092	0.154	0.104
BRA	0.145	0.082	0.083	0.087	0.056	--	--
CHL	0.123	0.076	0.076	0.079	0.049	0.066	0.061
COL	0.078	0.075	0.076	0.080	0.000	0.067	0.059
CRI	0.123	0.114	0.116	0.119	0.087	--	--
ECU	0.089	0.075	0.076	0.080	0.000	--	--
GTM	0.089	0.079	0.080	0.085	0.055	--	--
GUY	0.123	0.090	0.090	0.094	0.062	--	--
HND	0.106	0.079	0.080	0.085	0.055	--	--
JAM	0.075	0.062	0.064	0.069	0.039	0.056	0.049
MEX	0.090	0.075	0.076	0.080	0.000	0.064	0.067
NIC	0.183	0.079	0.080	0.085	0.055	--	--
PAN	0.114	0.114	0.116	0.119	0.087	--	--
PER	0.180	0.076	0.076	0.079	0.049	0.072	0.081
PRY	0.076	0.059	0.061	0.067	0.043	0.047	0.058
SLV	0.088	0.079	0.080	0.085	0.055	--	--
TTO	0.093	0.090	0.090	0.093	0.058	--	--
URY	0.180	0.059	0.061	0.067	0.043	0.049	0.045
VEN	0.116	0.075	0.076	0.080	0.000	--	--

* Average of leading commodity export price standard deviation and oil price standard deviation under different regimes.

(c) Standard Deviation of Level of Real Prices

Export Price Standard Deviation and Import Price Standard Deviation Averaged

	Real Prices**						
	Historical Regime	Dollar Peg	SDR Peg	Euro Peg	Comm. Peg	CPI Target	PPI Target
ARG	0.661	0.491	0.503	0.486	0.241	0.756	0.679
BOL	0.538	0.443	0.457	0.486	0.138	0.488	0.448
BRA	0.522	0.456	0.442	0.426	0.187	--	--
CHL	0.510	0.485	0.489	0.470	0.298	0.840	0.696
COL	0.456	0.485	0.482	0.490	0.000	1.123	0.974
CRI	0.420	0.368	0.383	0.385	0.242	--	--
ECU	0.456	0.485	0.482	0.490	0.000	--	--
GTM	0.510	0.588	0.600	0.585	0.383	--	--
GUY	0.922	0.581	0.579	0.557	0.383	--	--
HND	0.533	0.588	0.600	0.585	0.383	--	--
JAM	0.338	0.383	0.401	0.403	0.212	0.870	0.483
MEX	0.479	0.485	0.482	0.490	0.000	0.975	1.030
NIC	0.511	0.588	0.600	0.585	0.339	--	--
PAN	0.312	0.368	0.383	0.385	0.206	--	--
PER	0.444	0.485	0.489	0.470	0.171	0.420	0.429
PRY	0.413	0.455	0.475	0.466	0.312	0.743	0.716
SLV	0.750	0.588	0.600	0.585	0.383	--	--
TTO	0.383	0.443	0.457	0.486	0.179	--	--
URY	0.504	0.455	0.475	0.466	0.312	0.793	0.525
VEN	0.429	0.485	0.482	0.490	0.000	--	--

* Average of leading commodity export standard deviation and oil price standard deviation under different regimes.

** Minimum standard deviation across alternative regimes is shown in bold.

Appendix 1: Volatilities of terms of trade, export prices and import prices

RANK BY VOLATILITY	**Standard deviation of log of price indices**			
Country / Region	Terms of Trade (as reported by EIU)	Calculated Terms of Trade	Export Price Index in US$	Import Price Index in US$
Libya	0.9043	1.1917	1.0280	0.1731
Expanded Mercosur	0.7432	0.7431	0.2748	0.7886
Dominican Republic	0.5700	0.0722	0.1187	0.4122
Chile	0.5375	0.5375	0.3261	0.2384
Venezuela	0.5118	0.5219	0.5448	0.0972
Iran	0.4786	0.4786	0.4482	0.3037
Nigeria	0.4538	0.4526	0.6003	0.2613
Arabian Peninsula	0.4381	0.4385	0.4439	0.2432
Oil Exporters (e	0.4350	0.4348	0.4904	0.2190
Honduras	0.4341	0.4342	0.1564	0.4769
Algeria	0.4326	0.4282	0.5326	0.3426
Papua New Guinea	0.4300	0.4259	0.4005	0.2758
Kuwait	0.4174	0.4202	0.5031	0.1793
Uganda	0.4162	0.4161	0.2750	0.4002
Latin America	0.4066	0.4067	0.2101	0.3728
All Arab countries	0.3713	0.3715	0.4554	0.1577
Russia	0.3501	0.3443	0.4212	0.2448
Gabon	0.3397	0.3399	0.5386	0.4112
Norway	0.3379	0.3379	0.4032	0.1531
Kenya	0.3347	0.3458	0.3970	0.3698
Paraguay	0.3333	0.3333	0.2447	0.2607
Trinidad & Tobago	0.3113	0.3111	0.4099	0.2269
Jamaica	0.3080	0.3080	0.1791	0.4554
North Africa	0.3070	0.3071	0.4921	0.2412
Middle East and	0.2905	0.2906	0.3598	0.2460
MENA (excl Iraq)	0.2905	0.2906	0.3598	0.2460
Zambia	0.2905	0.2904	0.4921	0.5817
Main CIS	0.2846	0.2847	0.4371	0.2560
Ecuador	0.2712	0.2369	0.4454	0.4203
Cameroon	0.2705	0.2705	0.3768	0.2456
Syria	0.2685	0.3154	0.5011	0.3624
Ghana	0.2644	0.3319	0.3980	0.5687
Nicaragua	0.2555	0.2617	0.2073	0.2020
Zimbabwe	0.2553	0.2553	0.2933	0.3116

South Korea	0.2552	0.2553	0.1581	0.1947
Oman	0.2495	0.2493	0.3582	0.1539
Pakistan	0.2484	0.2458	0.0976	0.2896
Tanzania	0.2475	0.2313	0.4305	0.2615
Sudan	0.2392	0.2405	0.4572	0.2875
Ethiopia	0.2198	0.2729	0.1887	0.1338
Myanmar	0.2186	0.2189	0.3543	0.3879
Japan	0.2169	0.2169	0.2676	0.1594
Namibia	0.2140	0.2156	0.2483	0.3446
Cote d'Ivoire	0.2130	0.2096	0.2589	0.2772
Mexico	0.2077	0.1833	0.2018	0.1861
Egypt	0.2066	0.1938	0.3127	0.3873
Moldova	0.2042	0.2041	0.1720	0.2834
Serbia	0.1942	0.1852	0.5102	0.3295
Uruguay	0.1917	0.1914	0.2517	0.4059
Guatemala	0.1831	0.1830	0.1850	0.2329
Malawi	0.1819	0.1782	0.5443	0.5042
Spain	0.1768	0.1786	0.2374	0.1448
India	0.1681	0.1490	0.1836	0.1461
Andean Community	0.1673	0.1674	0.2901	0.1408
Central America	0.1655	0.1653	0.0955	0.2429
Colombia	0.1591	0.1562	0.5637	0.5237
Botswana	0.1564	0.1388	0.3098	0.3310
Panama	0.1548	0.1552	0.0941	0.2232
Yemen	0.1510	0.1511	0.4534	0.3828
Baltics	0.1510	0.1511	0.3142	0.2234
Mercosur	0.1491	0.1490	0.2997	0.2535
Brazil	0.1480	0.1496	0.4323	0.5080
Jordan	0.1480	0.1480	0.3591	0.4038
Argentina	0.1440	0.1437	0.1758	0.0771
Peru	0.1437	0.1475	0.4202	0.3037
Senegal	0.1429	0.1429	0.3183	0.2657
Taiwan	0.1398	0.1418	0.1004	0.1321
Singapore	0.1365	0.1344	0.1238	0.1548
Sub-Saharan Africa	0.1361	0.1361	0.3166	0.2208
Lithuania	0.1306	0.1306	0.2974	0.2454
El Salvador	0.1296	0.0887	0.0733	0.1275
Thailand	0.1282	0.1186	0.1998	0.2791
Mauritius	0.1277	0.1277	0.1978	0.2088
Australia	0.1258	0.1001	0.2004	0.1456
Sweden	0.1254	0.1272	0.1624	0.1801

Sri Lanka	0.1228	0.1227	0.8377	0.7748
Kazakhstan	0.1178	0.1207	0.6766	0.6402
Economies in transition	0.1140	0.1140	0.3150	0.2270
Economies in Tra	0.1140	0.1138	0.3191	0.2300
Turkey	0.1082	0.1093	0.1564	0.1885
China	0.1052	0.1053	0.5816	0.5039
Indonesia	0.1037	0.1041	0.2339	0.2256
New Zealand	0.0989	0.0974	0.2270	0.1386
Costa Rica	0.0984	0.1026	0.0766	0.1571
Morocco	0.0983	0.0983	0.2606	0.2717
Germany	0.0963	0.0984	0.1953	0.1587
Macedonia	0.0926	0.0958	0.1924	0.2418
Finland	0.0913	0.1142	0.1502	0.2162
Seychelles	0.0912	0.1183	0.1708	0.1251
Italy	0.0896	0.0932	0.4204	0.3497
Vietnam	0.0885	0.0896	0.1923	0.1479
Tunisia	0.0880	0.0848	0.2499	0.3015
Romania	0.0880	0.0846	0.2619	0.2078
Greece	0.0874	0.0969	0.6973	0.7781
Non-OECD	0.0868	0.0868	0.1889	0.1812
Australasia	0.0868	0.0869	0.2003	0.1420
Philippines	0.0857	0.0840	0.2446	0.1969
Latvia	0.0819	0.0818	0.2485	0.2146
South Asia	0.0812	0.0813	0.2058	0.1906
Croatia	0.0795	0.0795	0.2494	0.2525
Portugal	0.0759	0.0755	0.4695	0.4062
Scandinavia	0.0737	0.0737	0.1849	0.1444
Asia & Australia	0.0732	0.0732	0.1753	0.1493
Canada	0.0731	0.0732	0.1745	0.1090
Switzerland	0.0713	0.0778	0.2521	0.1986
South Africa	0.0699	0.0631	0.2357	0.1928
Israel	0.0690	0.0653	0.2126	0.1713
Bangladesh	0.0685	0.0726	0.0918	0.1603
Southern Europe	0.0684	0.0682	0.2439	0.1950
Cyprus	0.0661	0.0261	0.2114	0.2219
Malaysia	0.0649	0.0641	0.1254	0.0715
Ireland	0.0638	0.0629	0.1797	0.2179
Poland	0.0628	0.0616	0.2236	0.1962
Main SADC	0.0612	0.0611	0.2214	0.1878
G7	0.0609	0.0608	0.1812	0.1450
Eastn. Mediterranean	0.0602	0.0603	0.2241	0.1825

Main SACU	0.0600	0.0599	0.2335	0.2014
G10	0.0594	0.0593	0.1861	0.1516
Euro Area	0.0584	0.0584	0.2122	0.1796
Big Four	0.0583	0.0586	0.2005	0.1632
Iceland	0.0578	0.0568	0.2960	0.3094
Western Europe	0.0541	0.0542	0.2068	0.1714
ASEAN	0.0534	0.0535	0.1285	0.1612
Western Europe (	0.0534	0.0536	0.2084	0.1722
Balkans	0.0530	0.0530	0.2990	0.2571
Asia & Australia	0.0525	0.0526	0.1390	0.1672
European Union	0.0519	0.0517	0.2047	0.1733
EU27	0.0509	0.0510	0.2056	0.1749
Non-Oil Exporter	0.0499	0.0498	0.2845	0.2864
OECD	0.0497	0.0495	0.1844	0.1565
Hungary	0.0486	0.0497	0.1273	0.1633
Bulgaria	0.0483	0.0504	0.3806	0.3976
France	0.0482	0.0487	0.1642	0.1340
Greater China	0.0462	0.0461	0.2284	0.2093
Belgium	0.0453	0.0447	0.4123	0.4082
United States	0.0421	0.0421	0.1120	0.1489
Denmark	0.0409	0.0423	0.2387	0.2058
World	0.0403	0.0403	0.1880	0.1569
Netherlands	0.0361	0.0379	0.1424	0.1424
Slovakia	0.0317	0.0317	0.2387	0.2645
NAFTA	0.0253	0.0252	0.1296	0.1425
Czech Republic	0.0252	0.0224	0.2508	0.2421
Austria	0.0244	0.0253	0.4330	0.4485
United Kingdom	0.0234	0.0241	0.1832	0.1770
North America	0.0210	0.0209	0.1248	0.1391
Slovenia	0.0208	0.0199	0.5206	0.5257
Hong Kong	0.0181	0.0184	0.0852	0.0871
Eastern Europe	0.0170	0.0169	0.2466	0.2348
East-central Europe	0.0115	0.0115	0.2212	0.2161

Appendix 2: Each Candidate for Nominal Anchor has its Own Vulnerability

CPI targeting is not unique in having an Achilles heel, in the form of import price shocks. Other standard candidates for nominal anchor have their own problems. Table A1 summarizes how each of the variables that are candidates for nominal anchor has its own characteristic sort of extraneous fluctuations that can wreck havoc on a country's monetary system.

Table A1: Six proposed nominal anchors and the Achilles heel of each

Regime	Targeted nominal variable	Vulnerability	Historical Examples
Inflation targeting	CPI	Import price shocks	Oil shocks of 1973, 1980, 2000, 2008
Monetarist rule	M1	Velocity shocks	US 1982
Gold standard	Price of gold	Vagaries of world gold market	1849 boom; 1873-96 bust
Commodity standard	Price of commodity basket	Shocks in market for imported commodity	Oil shocks of 1973, 1980, 2000, 2008
Nominal income targeting	Nominal GDP	Measurement problems	Less developed countries
Fixed exchange rate	$ (or euro)	Appreciation of $ (or euro)	1995-2001 (or 2003-07 for the euro)

- A ***monetarist*** rule would specify a fixed rate of growth in the money supply. But fluctuations in the public's demand for money or in the behavior of the banking system can directly produce gratuitous fluctuations in velocity and the interest rate, 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.

- Under a ***gold standard***, the economy is 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. In the late 1890s, the gold rushes in Alaska and South Africa were each again followed by new upswings in the price level. Thus the system did not in fact guarantee stability.[42]

- 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.[43] The proposal might work if the basket reflected the commodities produced and exported by the country in question. 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. Chile should not peg to oil, and Trinidad should not peg to wheat.

- The need for robustness with respect to import price shocks argues for the superiority of ***nominal income targeting*** over inflation targeting.[44] Nominal income targeting is a regime that has the desirable property of taking supply shocks partly as P and partly as Y, without forcing the central bank to abandon the declared nominal anchor. Some argue that the measurement of GDP is too subject to lags and revisions. In any case, for some reason, nominal income targeting has not been seriously considered since the 1990s, either by rich or poor countries. Thus it is not analyzed in this paper.

- 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. Regardless the extent to which one considers the late-1990s dollar appreciation to have been based in the fundamentals of the US economy, there was no necessary connection to the fundamentals of smaller dollar-linked economies. The problem was particularly severe for some far-flung economies that had adopted currency boards over the preceding decade: Hong Kong, Argentina, and Lithuania.

Dollar-induced overvaluation was also one of the problems facing such victims of currency crisis as Mexico (1994), Thailand and Korea (1997), Russia (1998), Brazil (1999) and Turkey (2001), even though none of these countries had formal rigid links to the dollar. It is enough for the dollar to exert a large pull on the country's currency to

[42] Cooper (1985), Eichengrenn (1985) or Hall (1982).

[44] Velocity shocks argue for the superiority of nominal income targeting over a monetarist rule.). Frankel (1995) demonstrates the point mathematically, using the framework of Rogoff (1985). The proposal was popular among macroeconomists in the 1980s: Bean (1983); Feldstein and Stock (1994); Taylor (1985); Tobin (1980); West (1986).

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.

- This brings us back to the current fashion of ***targeting the inflation rate*** or CPI. To some, PEP may sound similar to inflation targeting. But, as already noted, a key difference between the CPI 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, while price level targeting can have the opposite implication. If the central bank has been constrained to hit an inflation target, oil price shocks (as in 1973, 1979, 2000, or 2008), for example, will require an oil-importing country to tighten monetary policy. 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.

Appendix 3: Targeting the Export Price vs. Exchange Rate and CPI, in a Simple Theoretical Model

Section 4 of the paper presented a simple model with five shocks, designed to compare the stabilizing properties of three alternative nominal targets: an export price index, the CPI, and the exchange rate. The following table reports the value of the objective function under each of the three regimes, in terms of the relative variability of the five shocks The details of the derivation are omitted to save space.

	Table A2b	***Objective: Stabilize CPI and output in the NTG and X sectors***				
	Coefficient on:	ε_{im}^2	ε_x^2	$(v-e)^2$	u_x^2	u_n^2
Exchange rate peg	(19)	af^2	$af^2 + fd^2 + f^2b^2\frac{1}{1-f}$	$a + b^2\frac{1}{1-f}$	f	$1-f$
CPI rule	(32)	b^2f^3 $(1-f)$	$d^2f^3 + fd^2 + b^2(f^3/1-f))]$	$fd^2 + b^2(f^2/1-f))$	f	$1-f$
PEP	(25)	af^2	af^2	$a[(1-f)/f]^2 + b^2/(1-f)$	f	$1-f$

Appendix 4: Data Sources and Computation Methods

Data Sources

Variable	Source
Commodity Prices	International Financial Statistics (IFS) and Global Financial Statistics (GFS)
Composition of commodity exports	World Bank analysis
Exports	IFS
Imports	IFS
Export Price Index	IFS
Consumer Price Index (CPI)	IFS
Producer Price Index (PPI)	IFS, Countries' National Statistical Institute and Central Bank
Wholesale Price Index (WPI)	IFS, Countries' National Statistical Institute and Central Bank
Exchange Rates	IFS
CPI detailed decomposition	Countries' National Statistical Institute
PPI detailed decomposition	Countries' National Statistical Institute
Non Tradables CPI	Countries' Central Bank
Tradables CPI	Countries' Central Bank

Computation Methods

1. Simulation of Export Prices

A profit-maximizing firm that is competitive in its product and input markets will produce in relation to the ratio of the price of the export good to the price of its variable inputs. If its production is for simplicity taken to be Cobb-Douglas, with labor the only variable factor of production, then in logs we have $LogX = \bar{x} + \sigma(p_x - w)$

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 σ the supply elasticity depends on labor's share.

$$p_x = p^{\$}_x - s^{\$}_{lc}$$

Where $p^{\$}_x$ is the log dollar price of the export good on world markets, which fluctuates exogenously; and
$s^{\$}_{lc}$ is the log dollar value of the local currency, which depends both on the country's exchange rate policy and fluctuations in the dollar's value.

A country can get into trouble under a regime where $s^{\$}_{lc}$ is fixed, because a decline in $p\$x$ hurts exports in proportion 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 domestic cost of variable inputs, w, by the domestic CPI).

To repeat from above, the key variable is p_x-w, the price of exports relative to the cost of variable inputs, which could be defined as the real exchange rate. The path under the seven 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 DM or euro peg [45], $S_{\$}^{lc} = S_{\$}^{DM}$, so $P_x = S_{\$}^{DM} P_x^{\$}$ and $w = CPI^{G}$.

Under a hypothetical SDR, $S_{\$}^{lc} = S_{\$}^{SDR}$, so $P_x = S_{\$}^{SDR} P_x^{\$}$ and $w = CPI^{SDR}$. [46]

Under a hypothetical commodity peg, $S_{\$}^{lc} = P_{\$}^{x}$, so $P_x = 1$ and $w = 1$.

Under a hypothetical CPI target[47], $S_{\$}^{lc} = (100 - w_{ntg} P_{ntg}) / (w_{cx} P_{cx\$} + w_{pm} P_{pm\$} + w_{otg} P_{otg\$})$,
$P_x = S_{\$}^{lc} P_x^{\$}$.

Under a hypothetical PPI target[48], $S_{\$}^{lc} = (100 - v_{ntg} P_{ntg}) / (v_{cx} P_{cx\$} + v_{pm} P_{pm\$} + v_{otg} P_{otg\$})$,
$P_x = S_{\$}^{lc} P_x^{\$}$.

Under the CPI and PPI target, we have approximated non tradable goods' prices using a 10-year moving average of the US CPI (assuming the target was implemented credibly since the start of the period under analysis).

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, SDR, or DM, then CPI_{Home} is taken to be the CPI of the US, SDR, or Germany, respectively, under the assumption that the peg is strong enough and permanent enough to achieve convergence of inflation rates[49].

The path of the real price of commodities under the seven possible regimes is calculated as follows:

Under actual history, $RP_x = S_{\$}^{lc} P_x^{\$} / CPI_{lc}$

---

[45] 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).

[46] The CPI for the SDR peg is constructed as a weighted average of USA CPI, UK CPI, France CPI and Germany CPI. To calculate this average we use the weight of each country's currency in the SDR.

[47] Rewrite the CPI equation from part 2. of this appendix as: $CPI = w_{ntg} P_{ntg} + w_{cx} S P_{cx\$} + w_{pm} S P_{pm\$} + w_{otg} S P_{otg\$}$ and solve for the exchange rate that maintains CPI constant.

[48] Rewrite the PPI equation from part 2. of this appendix as: $PPI = v_{ntg} P_{ntg} + v_{cx} S P_{cx\$} + v_{pm} S P_{pm\$} + v_{otg} S P_{otg\$}$ and solve for the exchange rate that maintains PPI constant.

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

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

Under a hypothetical SDR peg, $RP_x = (S_{\$}^{SDR} P_x^{\$} / CPI_{SDR})(K_{SDR})$

Under a hypothetical DM or euro peg, $RP_x = (S_{\$}^{DM} P_x^{\$} / CPI_G)(K_{DM})$

Under a hypothetical commodity peg, $RP_x = K_x$

Under a hypothetical CPI target, $RP_x = (S_{\$}^{lc} P_x^{\$})(K_{CPI})$

Under a hypothetical PPI target, $RP_x = (S_{\$}^{lc} P_x^{\$})(K_{PPI})$

Where $K_{\$}$, K_{SDR}, K_{DM}, K_x, K_{CPI} and K_{PPI} 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.

We simulated import prices for LAC countries using this same methodology; instead of using the price of the leading commodity export in dollars we used the most important import prices in dollar terms as can be seen in tables 5a.

2. Simulation of CPI and PPI

To simulate the Consumer Price Index (CPI) and Producer Price Index (PPI) under different regimes we impose the following equations.

$$CPI = w_{ntg} P_{ntg} + w_{wcx} P_{cx} + w_{pm} P_{pm} + w_{otg} P_{otg}$$
$$PPI = v_{ntg} P_{ntg} + v_{wcx} P_{cx} + v_{pm} P_{pm} + v_{otg} P_{otg}$$

where:

P_{ntg} ≡ Price of non-traded goods in local terms. We assume that, at a horizon of less than 1 year, these prices would not be affected by differences in the exchange rate. Under the hypothetical counterfactual where a country would have been on a dollar peg all along, then its non tradable prices are given by the US CPI, since we assume that convergence would have taken place in the long run.
P_{cx} ≡ Price of exports of leading mineral/agricultural commodity in local terms (we ignore trade barriers and define these tradable goods prices to equal the actual historically observed world dollar prices, times the exchange rate, which will differ depending on the regime assumed.
P_{ox} ≡ Price of other exports, which we approximate using P_{pm} ≡ Price of petroleum product imports. This is determined again as actual world dollar price times the simulated exchange rate.
P_{otg} ≡ Price of other tradable goods (i.e., excluding oil and the other commodities that are measured explicitly). Assume equal to world prices of the tradable goods times the exchange rate.

w_{ntg} ≡ weight on ntg in CPI w_{cx} ≡ weight on cx in CPI
w_{pm} ≡ weight on pm in CPI w_{otg} ≡ weight on otg in CPI
v_{ntg} ≡ weight on ntg in PPI v_{cx} ≡ weight on cx in PPI
v_{pm} ≡ weight on pm in PPI v_{otg} ≡ weight on otg in PPI .

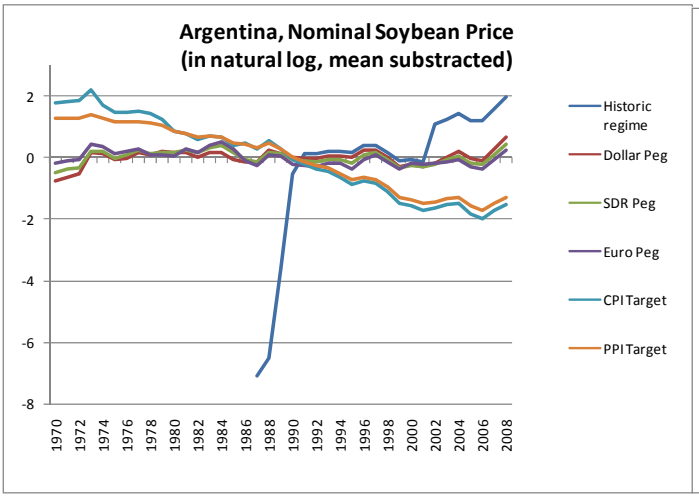
We impose $w_{ntg} \equiv v_{ntg}$

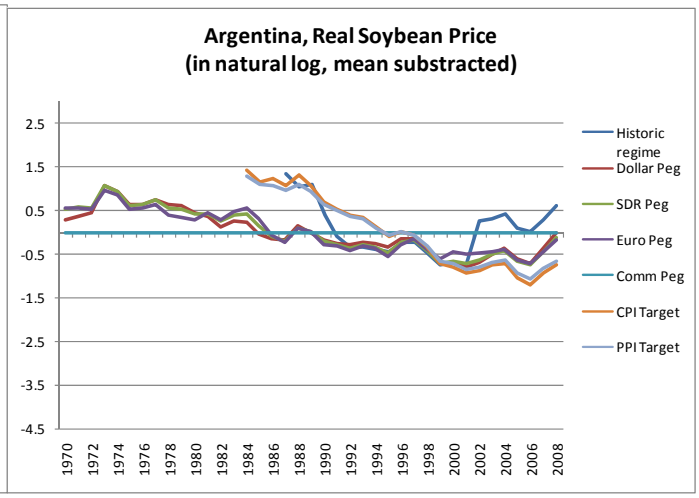
To estimate the above mentioned weights, we followed these steps:

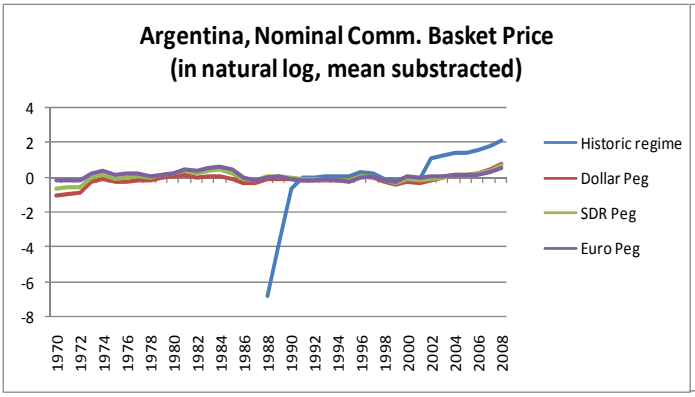
a. Obtain countries' Non Tradable CPI and Tradable CPI series.
b. Regress CPI against Non Tradable CPI to get $w_{ntg} = v_{ntg.}$
c. Obtain detailed decomposition of CPI and PPI, and calculate weight of leading commodity export (w_{cx} and v_{cx}) and weight of oil in CPI and PPI (w_{pm} and v_{pm}).
d. Calculate weight of other tradable goods as the complement (i.e., $1 - w_{cx} - w_{ntg} - w_{pm}$).

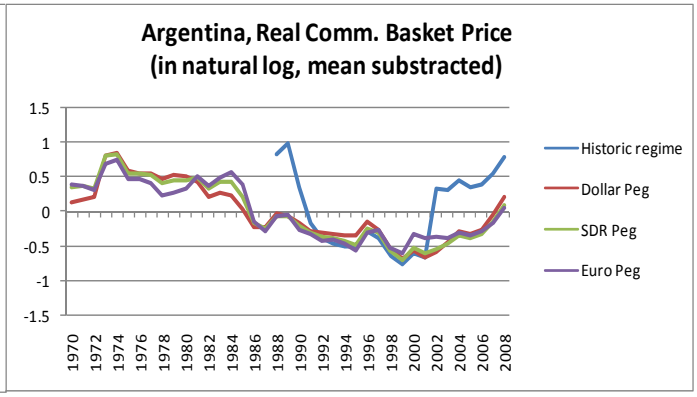
Appendix 5: Nominal and Real Log Export Prices, Simulated under alternative regimes

Argentina



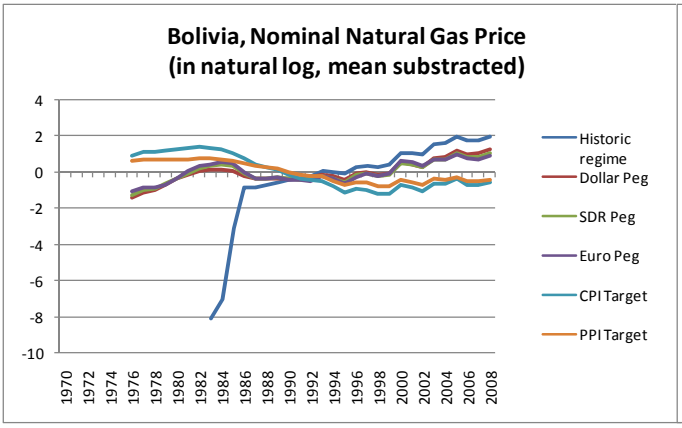


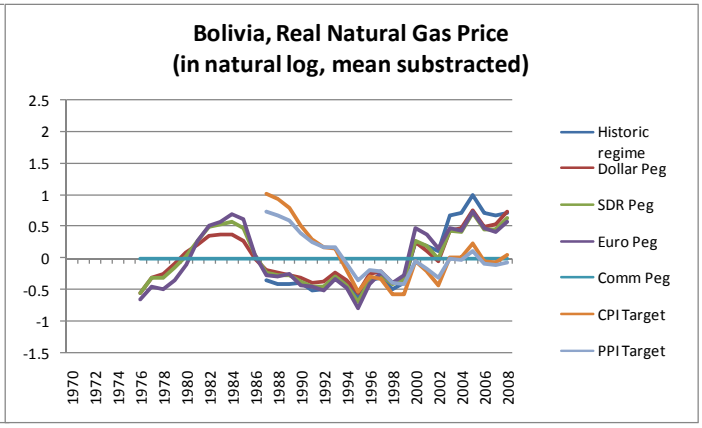


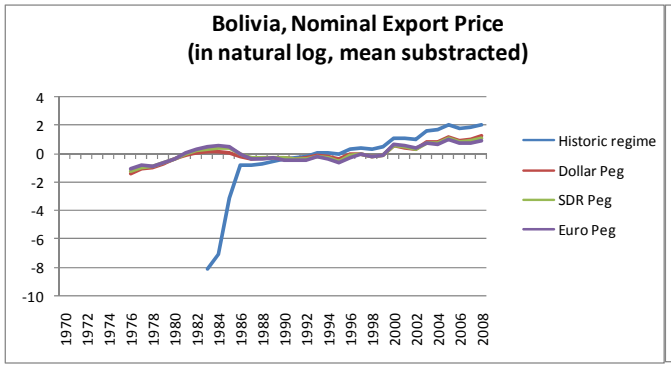


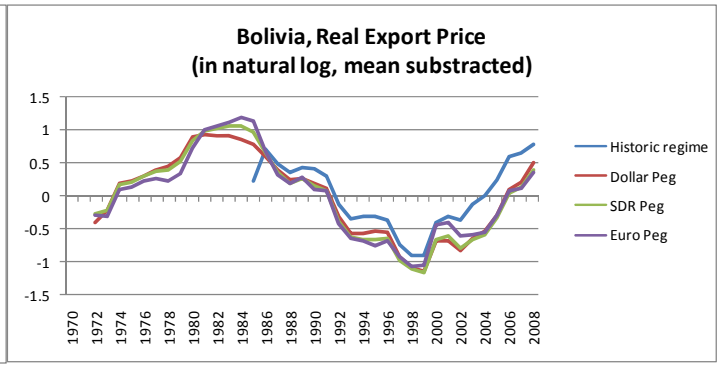
* Basket: Maize, soybeans, oil and wheat.

Bolivia

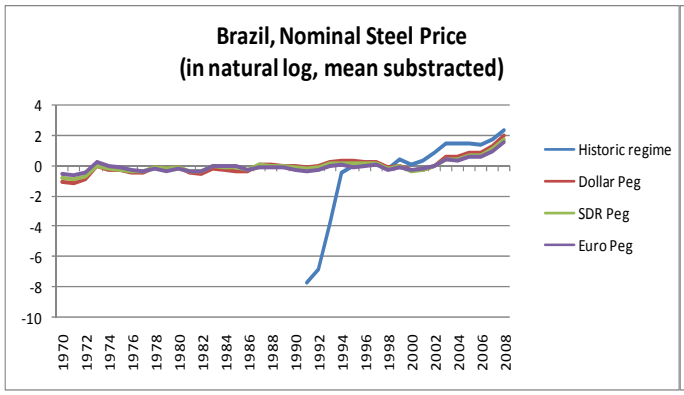


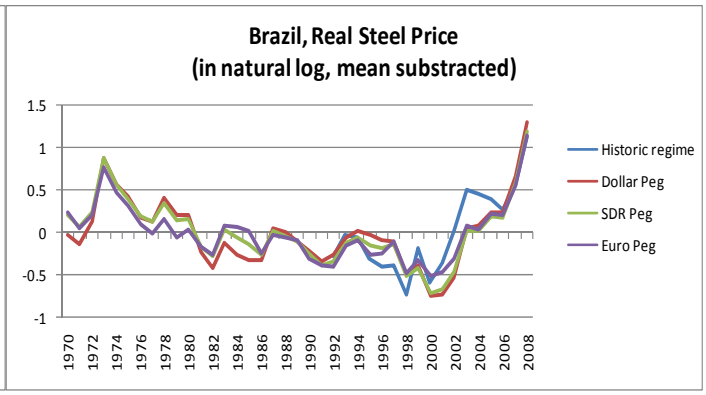


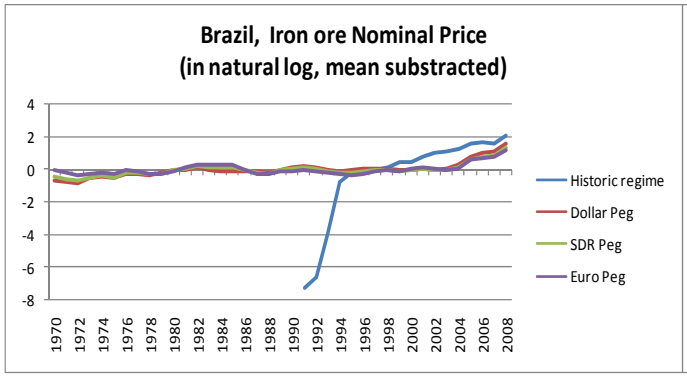


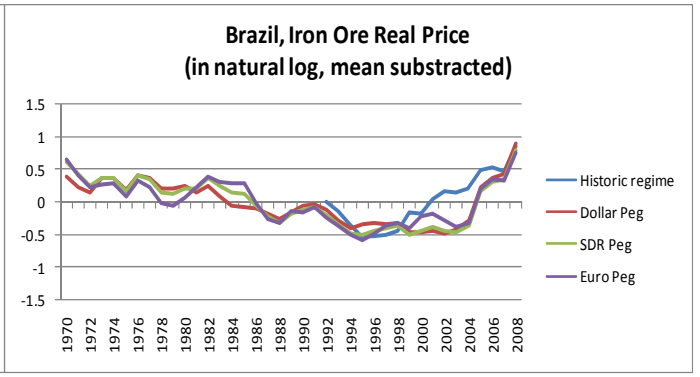


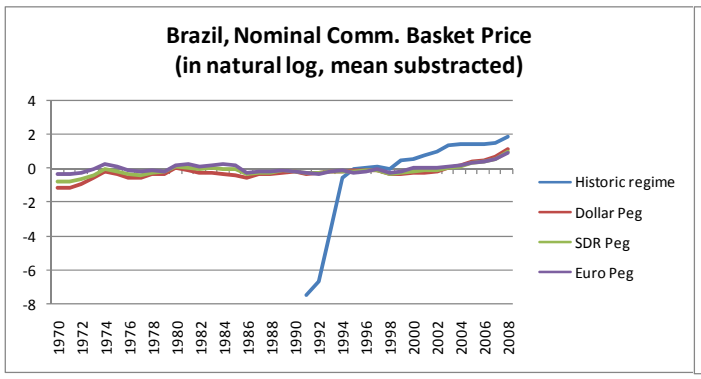
Brazil

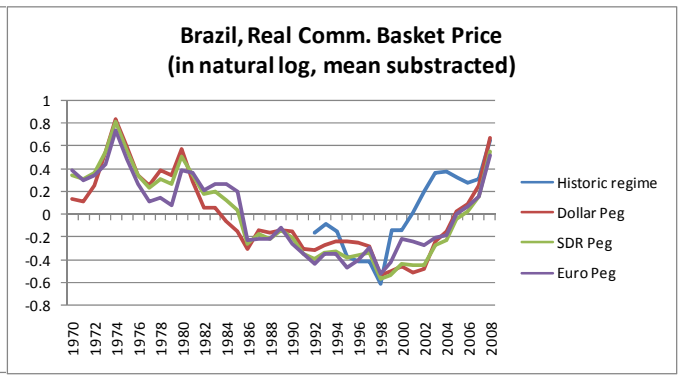




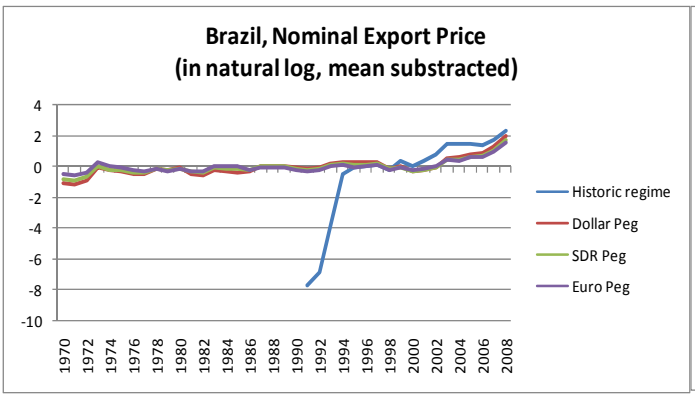


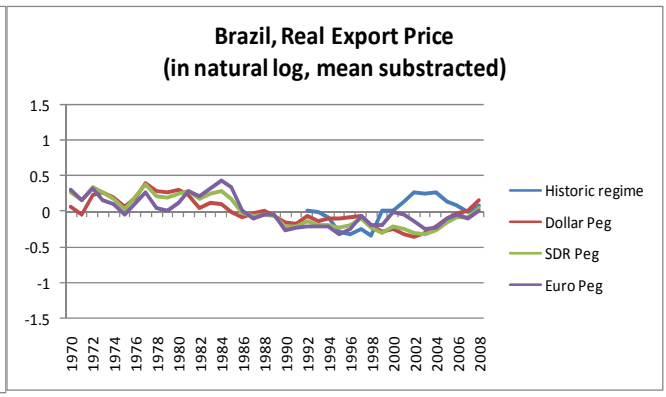




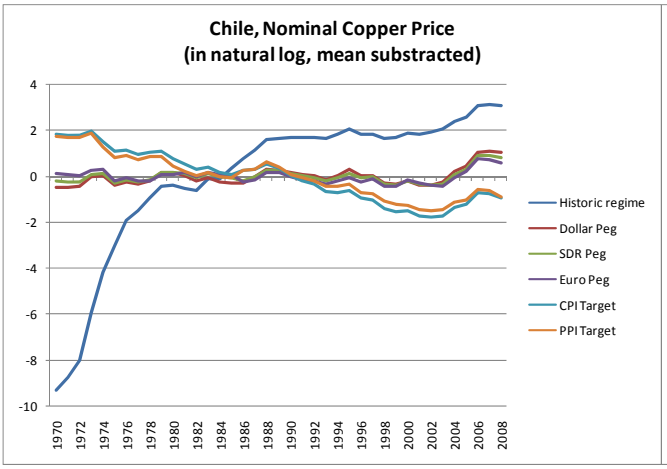


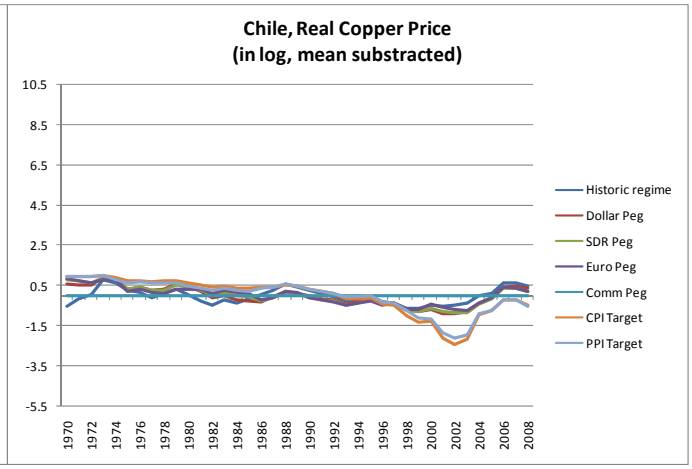
* Basket: Iron Ore, Steel scrap, oil and sugar.



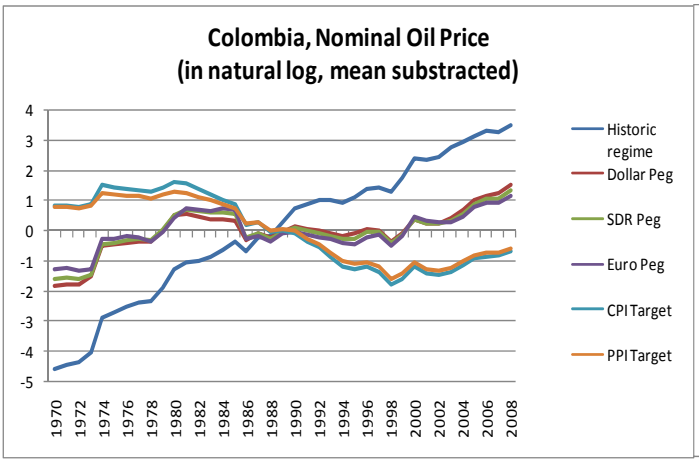


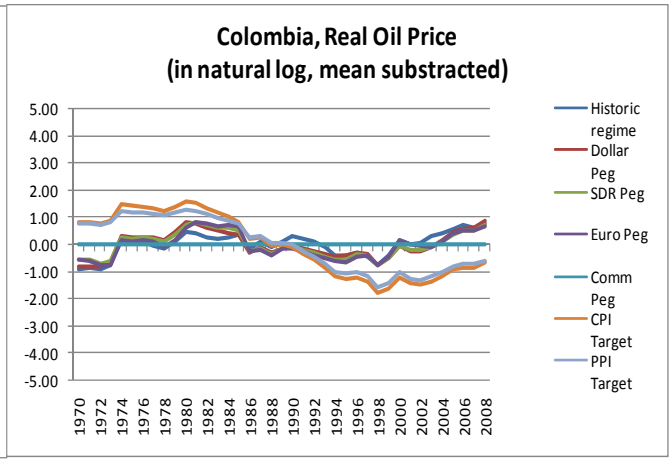
Chile

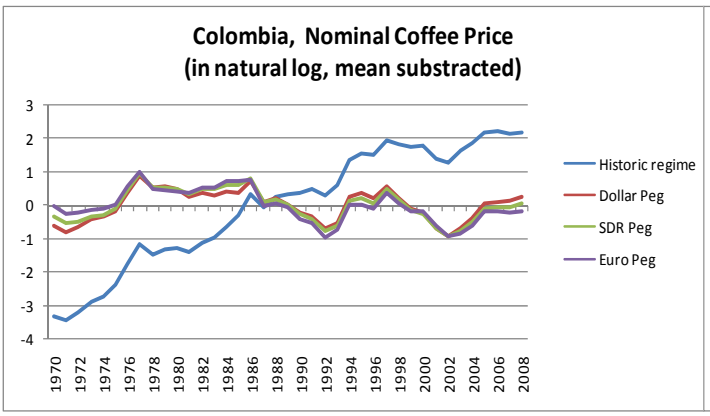


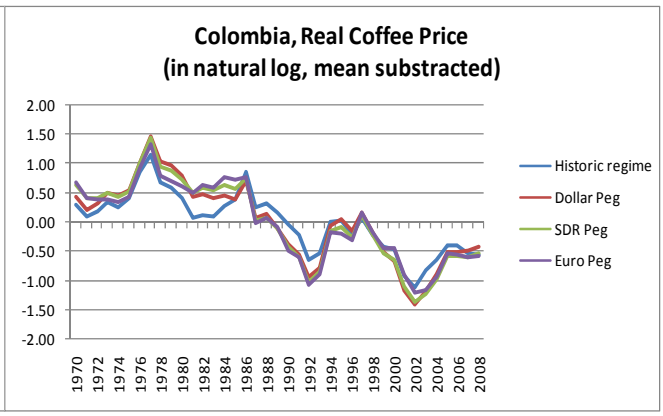


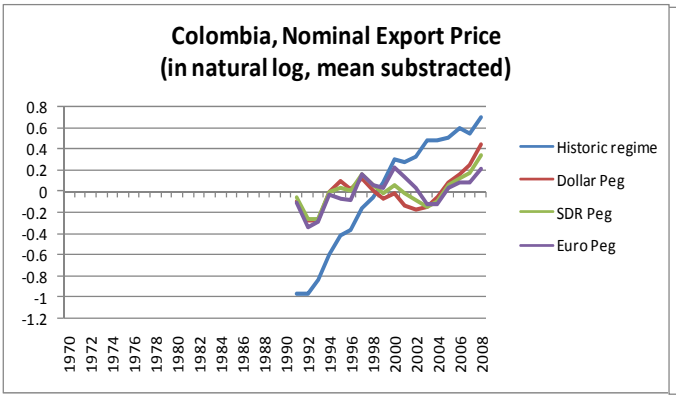
Colombia

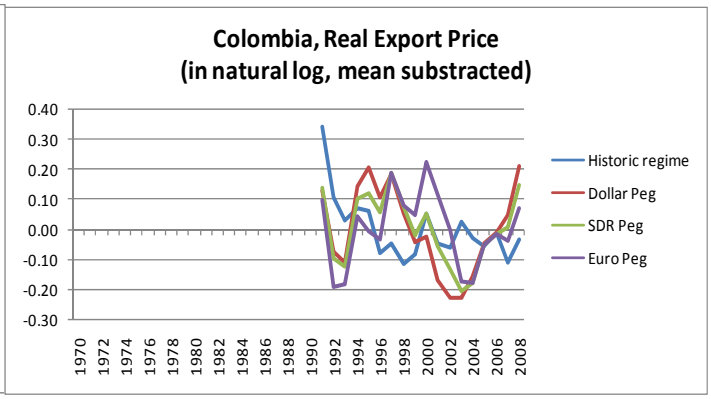




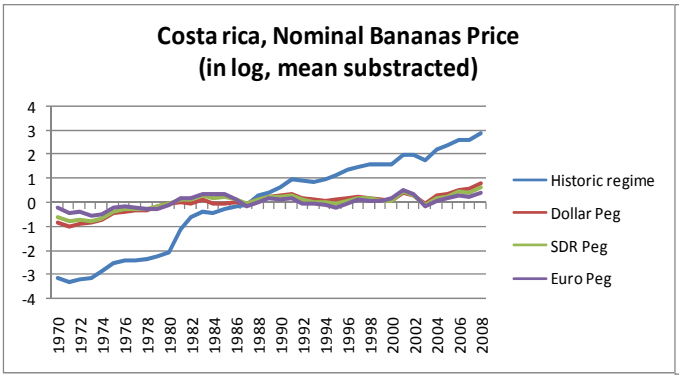

Colombia, Nominal Coffee Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

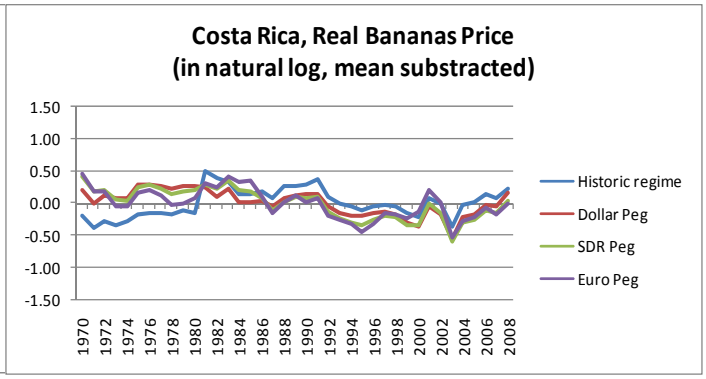

Colombia, Real Coffee Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

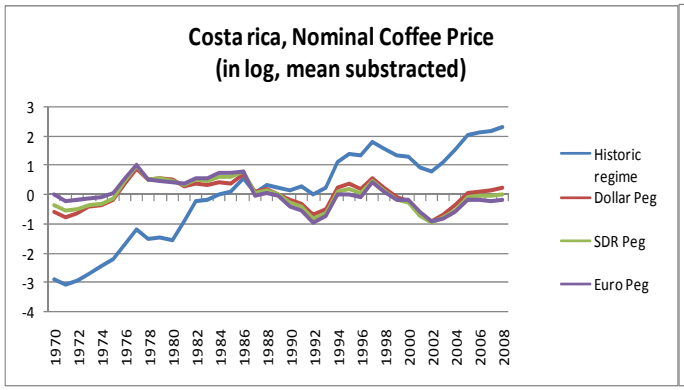

Colombia, Nominal Export Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

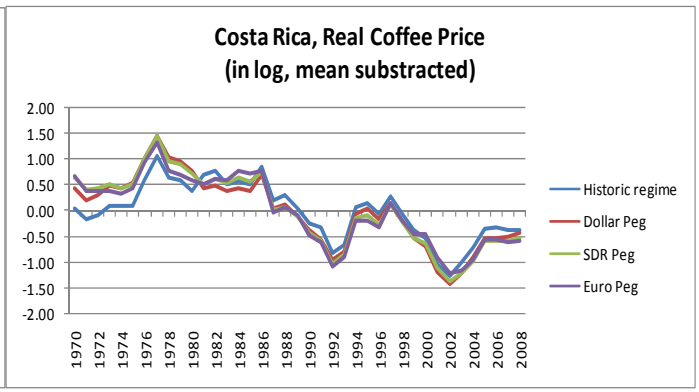

Colombia, Real Export Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

Costa Rica

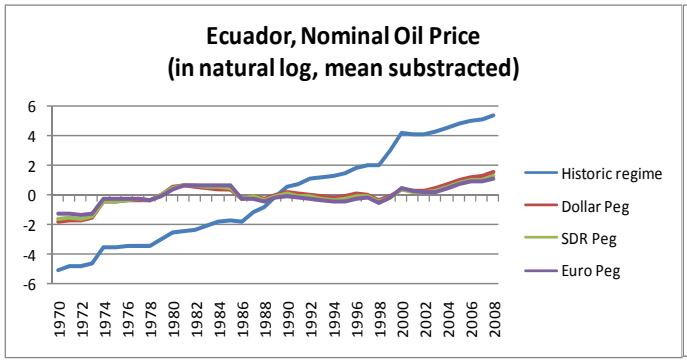

Costa rica, Nominal Bananas Price
(in log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

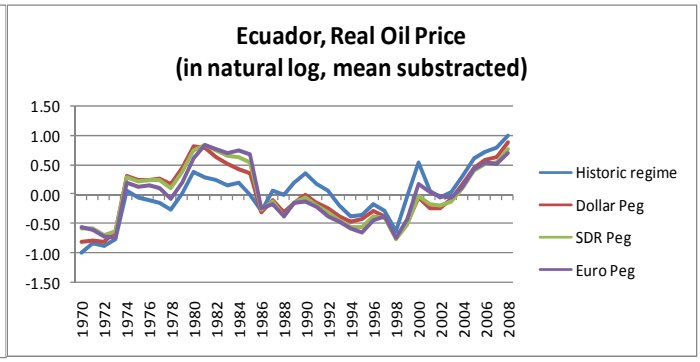

Costa Rica, Real Bananas Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

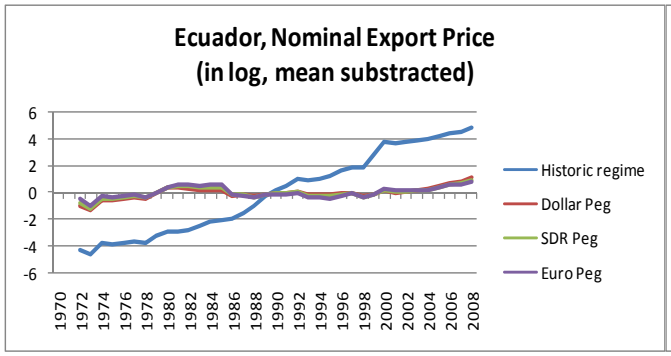

Costa rica, Nominal Coffee Price
(in log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

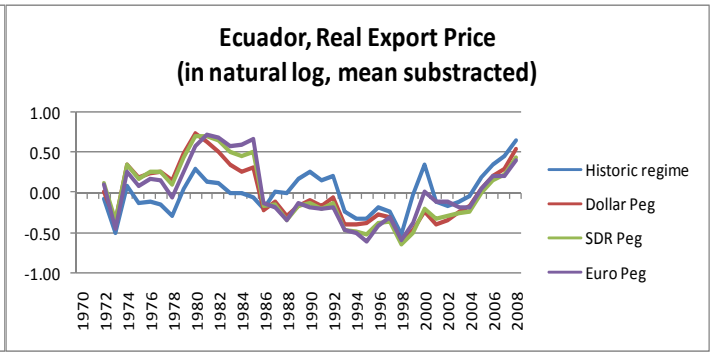

Costa Rica, Real Coffee Price
(in log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

Ecuador

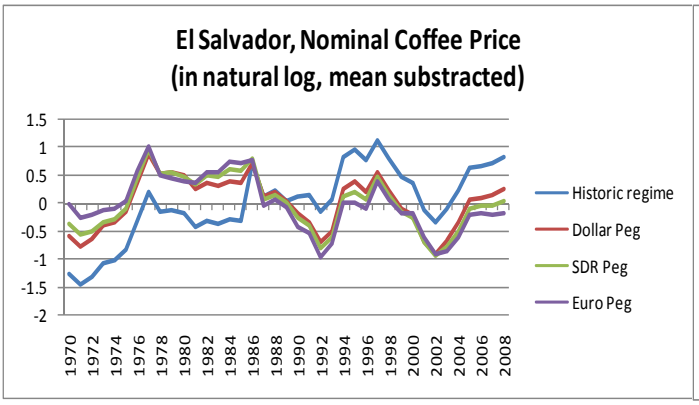

Ecuador, Nominal Oil Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

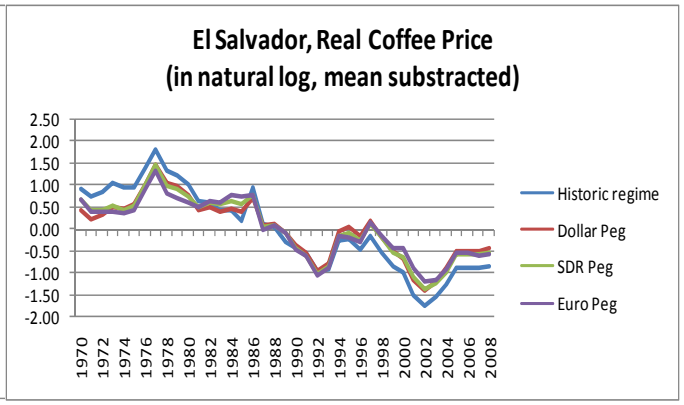

Ecuador, Real Oil Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg


Ecuador, Nominal Export Price
(in log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

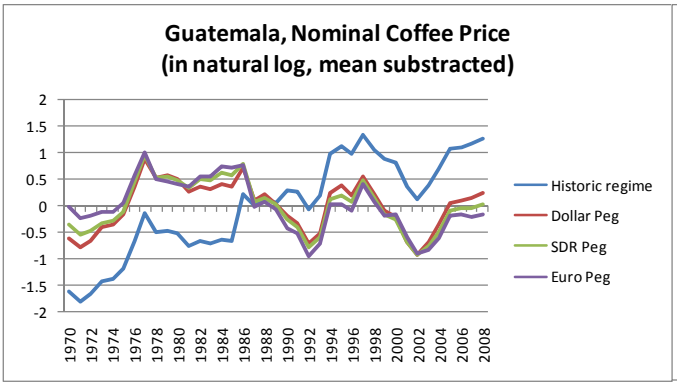

Ecuador, Real Export Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

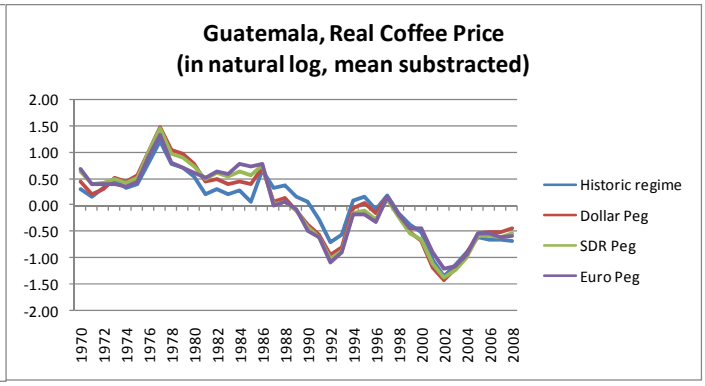
El Salvador



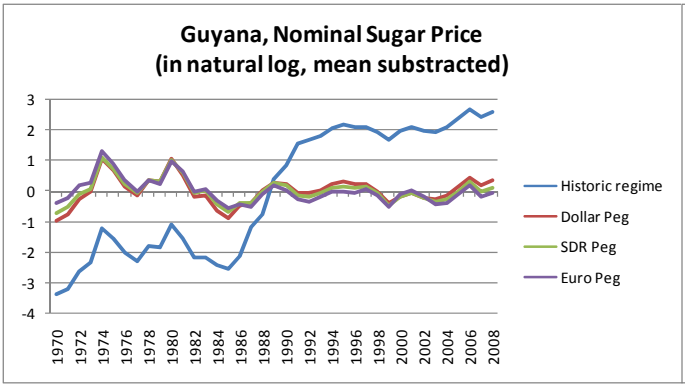


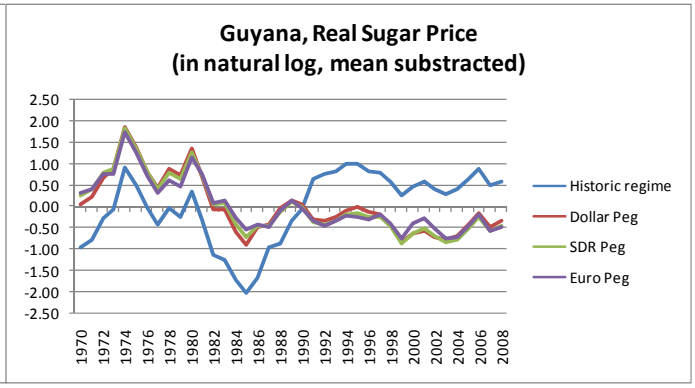
Guatemala



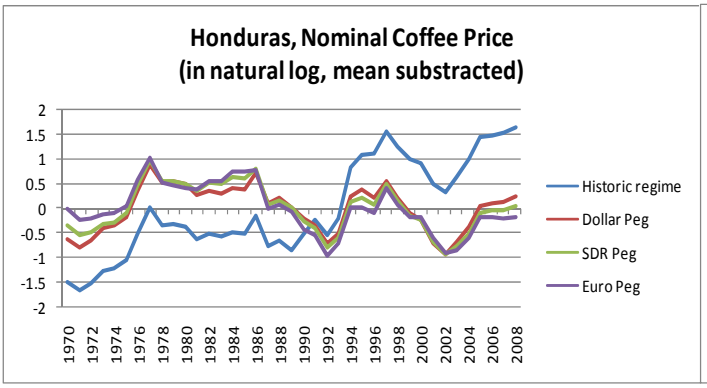


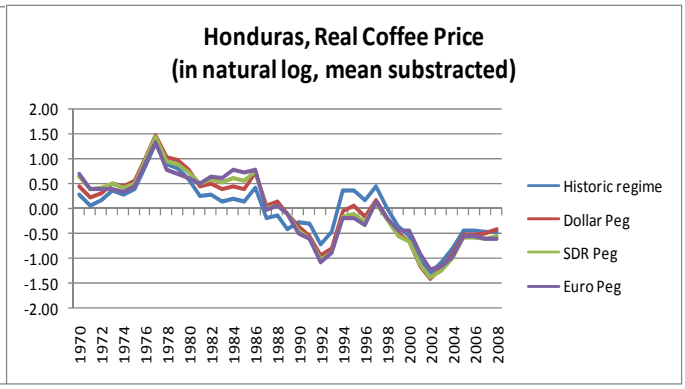
Guyana



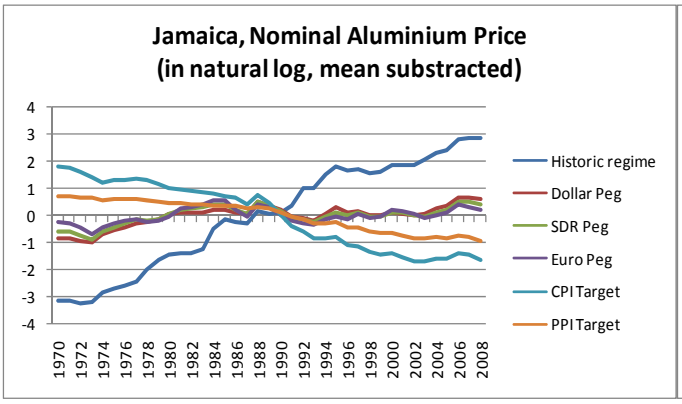


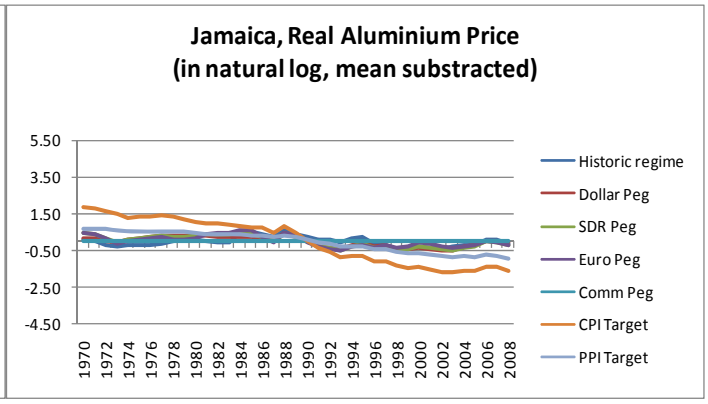
Honduras



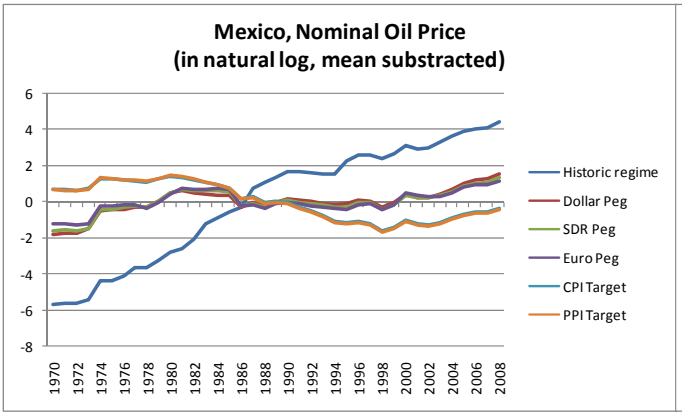


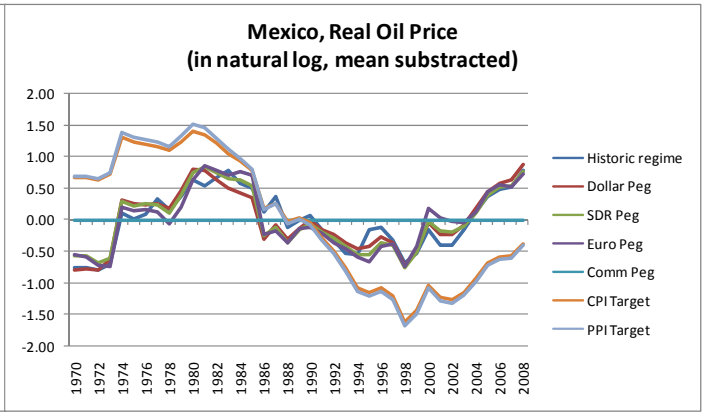
Jamaica



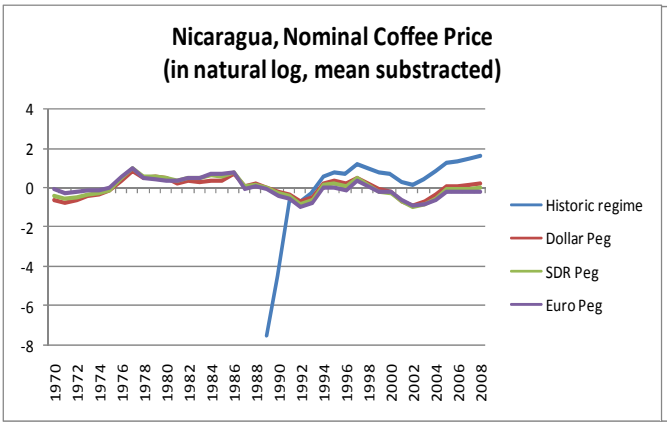


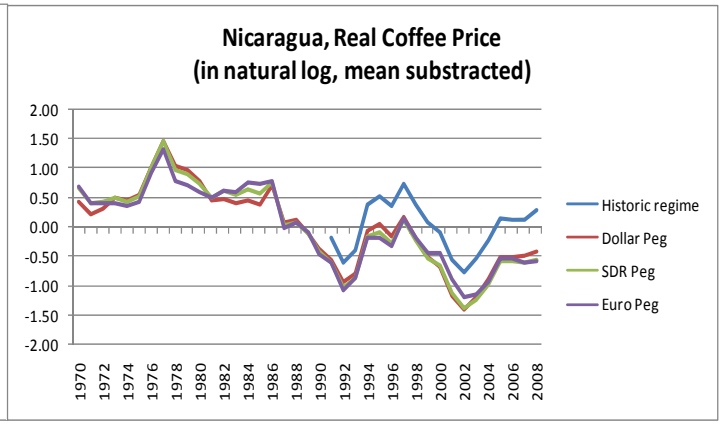
Mexico



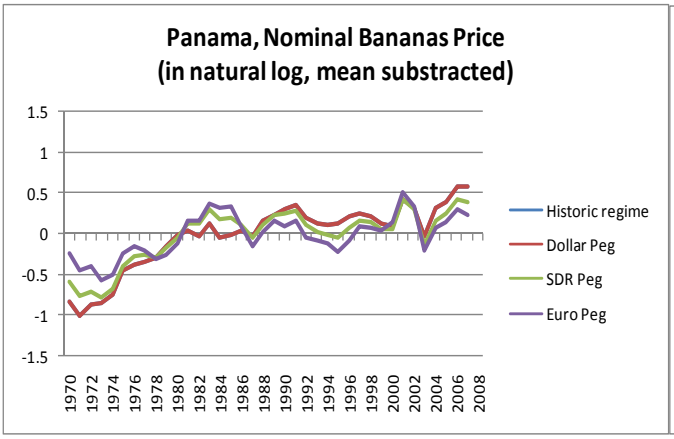


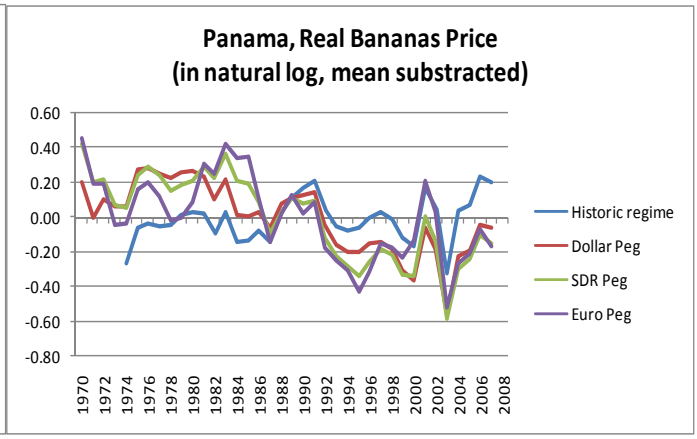
Nicaragua



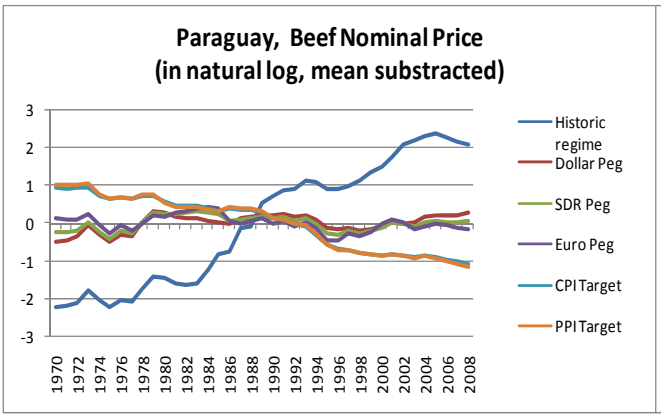


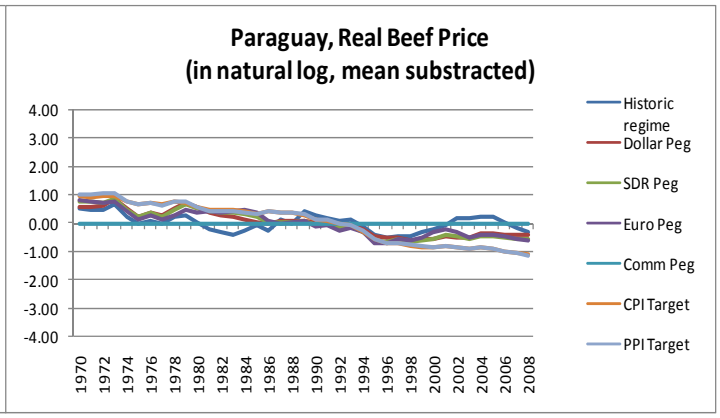
Panama



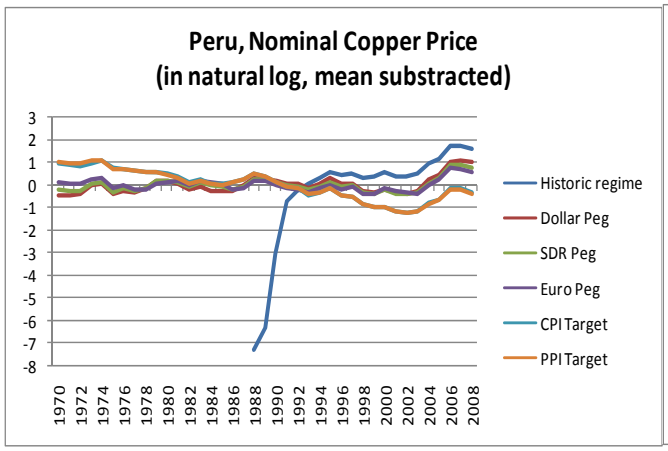


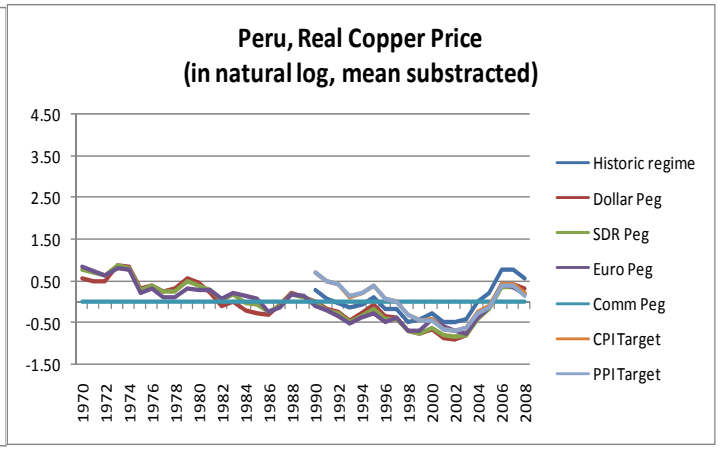
Paraguay

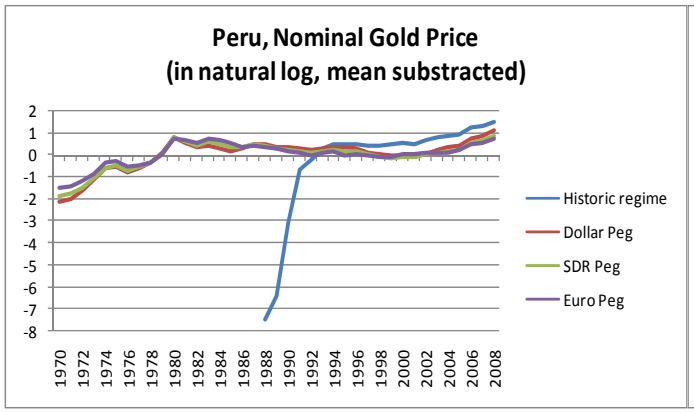


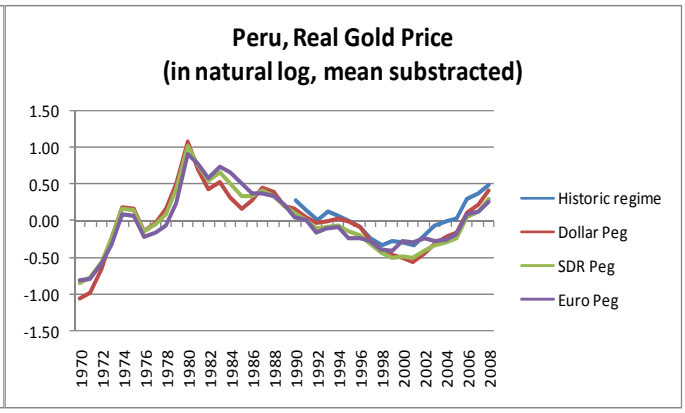


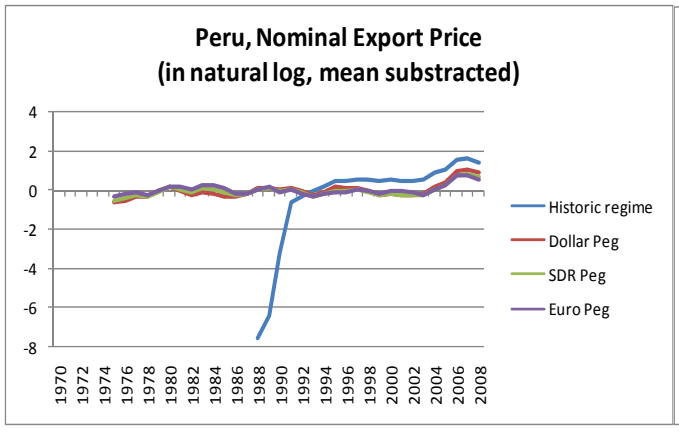
Peru

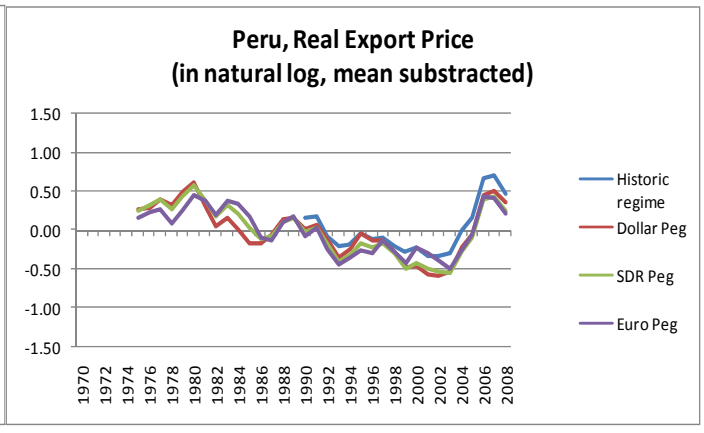

Peru, Nominal Copper Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg
CPI Target
PPI Target


Peru, Real Copper Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg
Comm Peg
CPI Target
PPI Target

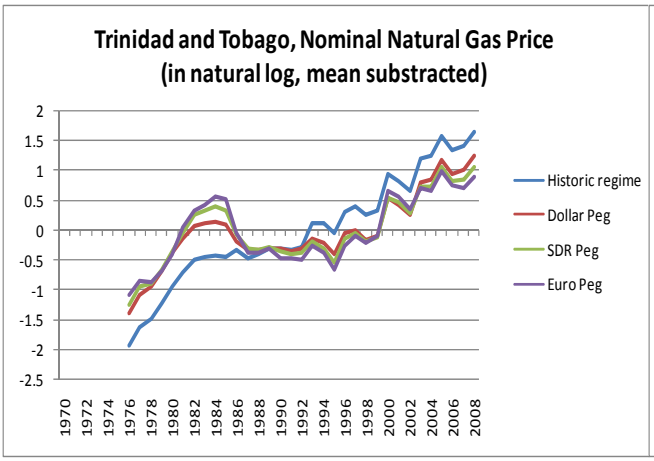

Peru, Nominal Gold Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

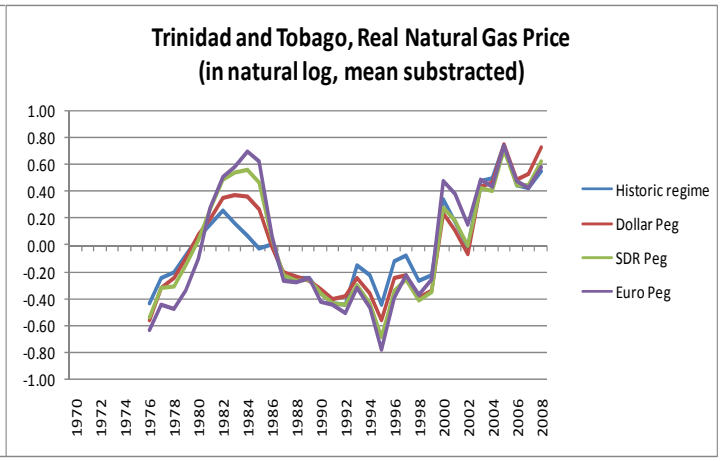

Peru, Real Gold Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg


Peru, Nominal Export Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

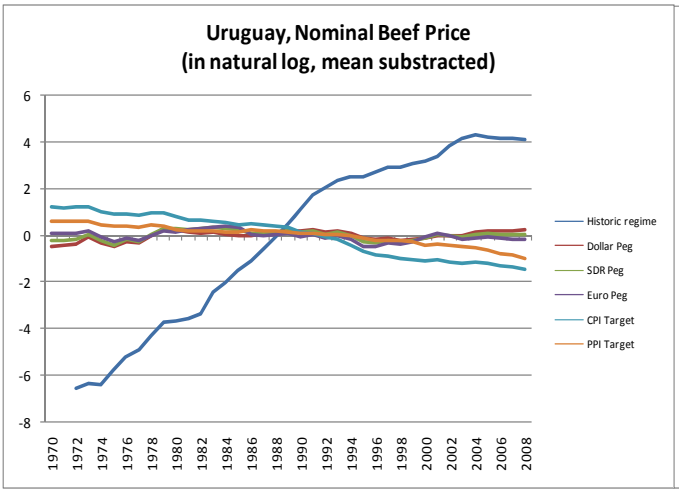

Peru, Real Export Price
(in natural log, mean substracted)
Historic regime
Dollar Peg
SDR Peg
Euro Peg

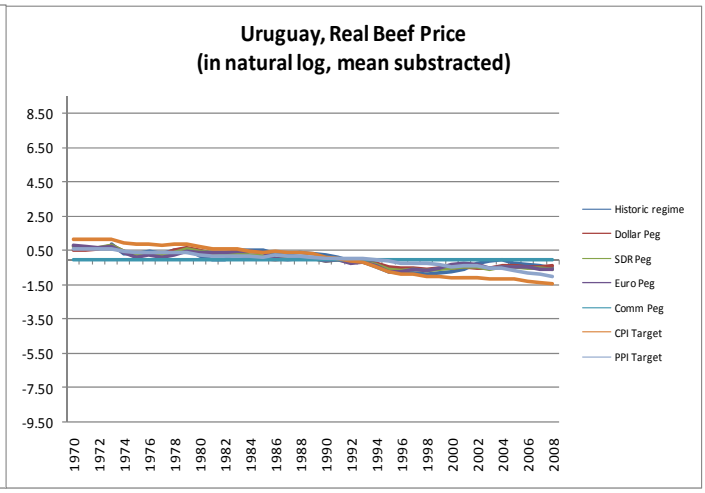
Trinidad and Tobago





Uruguay





Venezuela