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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 (for example, Argentina, Bolivia, Brazil, and Nicaragua). As a result, the need for a nominal anchor was apparent. In a nonstochastic model, any nominal variable is as good a choice for monetary anchor as any other. But in a stochastic model, and moreover in the real world, the nominal variable that monetary authorities choose and publicly commit to in advance makes quite a difference.[1] Should it be the money supply? Exchange rate? CPI? Other alternatives? The question of which nominal variable to choose 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 used as the nominal anchor with which to build the successful stabilization programs. This was true 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.

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

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 (including Mexico and Argentina) the abandonment of a cherished exchange rate anchor for monetary policy took place under the urgent circumstances of a speculative attack. A few countries (Chile and Colombia) made the jump preemptively to floating before a currency crisis could hit. Only a very few smaller countries responded to the ever rougher seas of international financial markets by moving in the opposite direction, to full dollarization (Ecuador, under pressure of crisis; and El Salvador, out of longer-run motivations). In the thirty-year time span, the general trend has been toward increased flexibility.[2]

With exchange rate targets somewhat out of favor by the end of the 1990s, and the gold standard and monetarism[3] already relegated to the scrap heap of history, there was an obvious vacancy for the position of preferred nominal anchor or intermediate target for monetary policy. (The table in appendix A summarizes the Achilles heel 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, arriving with an already-impressive résumé 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—Brazil, Chile, and Colombia—officially adopted inflation targeting in 1999 in place of exchange rate targeting.[4] Mexico had done so earlier, after the peso crisis of 1994–95. Peru followed suit

2. Collins (1996). The coexistence 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).

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 (Argentina, Guyana, Jamaica, and Uruguay) continue officially to list money supply as their anchoring variable. But one may doubt how strictly they try to keep any monetary aggregate within declared ranges in practice.

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.

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 percent 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 antimarket and inflationary pulled ahead in the polls.[5]

One could argue, however, that events of recent years, particularly the global financial crisis of 2008–09, 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, besides the CPI, have forced their way into the attention of central bankers. One nominal variable, the exchange rate, was never really forgotten—certainly not by 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 U.S. subprime mortgage crisis has forced central bankers to rethink 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.

Road Map 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. The second section, "Problems with Inflation Targeting" elaborates on the inflation-targeting regime, and some drawbacks that it has encountered as a result of focusing on the CPI. The third section, "Alternative Choices of Price Index for Inflation Targeting," discusses some proposed alternative versions

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

that center instead on production-oriented price indexes. In comparison to a CPI target, the selling point of a production-based price index is that it could serve as a nominal anchor while accommodating terms-of-trade shocks. The fourth section, "Targeting the Export Price Index versus Exchange Rate and CPI in a Simple Theoretical Model," 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 product price targeting. It is followed by the heart of the paper, "Analysis of Competing Monetary Targets with Respect to Ability to Stabilize Relative Prices," a counterfactual statistical analysis. Seven possible nominal variables are considered as candidates for anchor or target for monetary policy. Three anchor candidates are exchange rate pegs, respectively, to the dollar, euro, and SDR (special drawing rights). 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: these are 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 the simulations than the inflationary historical monetary regimes actually followed by LAC countries (with the exception of Panama). A dollar peg does not stabilize domestic commodity prices especially. The key finding is that, as hypothesized, a product price target generally does a better job of stabilizing the domestic real price 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.

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

6. Among many references in the extensive literature on inflation targeting, three that are internationally oriented are Svensson (1995); Bernanke and others (1999); and Truman (2003).

other price indexes, which are possible alternatives to the CPI, for the role of nominal anchor within what could still be called inflation targeting.

What, Exactly, Is Meant by Inflation Targeting?

A narrow definition of inflation targeting would have the governor of the central bank commit each year to a CPI goal for the course of the coming year, and then put 100 percent weight on achieving that objective to the exclusion of all other goals. Some proponents of this term make it clear that they are talking about something broader—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 does not deal particularly 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 is, rather, on another specific question: regardless of the weight placed on a nominal anchor—whether it is 100 percent, as under a fixed exchange rate, or a more flexible range—what are the advantages and disadvantages of various nominal anchors?

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 LAC region? Table 1 reports the official exchange rate and monetary regimes currently followed by eighteen LAC countries. Inflation, the exchange rate, and the money supply are all represented among their choices of targets.[7] I begin with a consideration of some structural characteristics that tend to differentiate these countries from others, though it is also 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 these countries 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, itself partly attributable to past reliance on seigniorage where there was an absence of a well-developed fiscal system. Another common feature

7. Mishkin and Savastano (2002).
8. See, for example, Fraga, Goldfajn, and Minella (2003).

TABLE 1. LAC Countries' Current Regimes and Monthly Correlations of Exchange Rate Changes ($/local currency) with Dollar Import Price Changes[a]

	Exchange rate regime	*Monetary policy*	*1970–99*	*2000–08*	*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)[b]	−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	IMF-supported or other monetary program	−0.0230	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					
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

Source: IMF De Facto Classifications of Exchange Rate Regimes and Monetary Policy Approach (www.imf.org/external/np/mfd/er/2006/eng/0706.htm).

a. Import price changes are changes in the dollar price of oil.

b. 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.

is an uncompetitive banking system, which, again, is somewhat 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, of course, also have higher default risk, which is one aspect of imperfect financial markets.

The standard implications of underdeveloped institutions and low inflation-fighting credibility are that it is particularly important (1) that their central banks have independence[9] and (2) 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), Gutiérrez (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 will not 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 which economic variables are best suited to play that role. Public promises to hit targets that usually cannot be fulfilled will do little to establish credibility.[12]

Most analysis of inflation targeting is more suited in several respects to large industrialized countries than to small developing ones.[13] First, the theoretical models usually do not feature a role for exogenous shocks in trade conditions or for 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

9. See, for example, Cukierman, Miller, and Neyapti (2002).
10. Junguito and Vargas (1996) and Arnone, 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 either 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 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); and Laxton and Pesenti (2003).
14. One of the few exceptions is Caballero and Krishnamurthy (2003).
15. See Caballero (2000) and comments thereon.

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 does not take into account the international financial crises of 1982, 1994–2001, or 2008–09 would not be useful to policymakers in Latin America and the Caribbean.

Capital flows are highly prone to exacerbate rather than offset fluctuations when the source of the fluctuations is trade shocks.[17] This observation leads us to another relevant aspect 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 economies of the former. 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 a tropical economy. 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 (narrowly defined) 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 to the extent 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

16. Calvo, Leiderman, and Reinhart (1993); Kaminsky, Reinhart, and Végh (2005); Reinhart and Reinhart (2009); Perry (2009); Gavin and others (1997); Gavin, Hausmann, and Leiderman (1996); Mendoza and Terrones (2008).

17. For example, Hausmann and Rigobon (2003).

18. For example, Fraga, Goldfajn, and Minella (2003). 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).

in the price level. Of course, this is precisely the reason 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.

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 supply shock is located in the agricultural or energy sectors. It does not work, for example, for social unrest or weather events that disrupt industrial activity.) The disadvantage of declaring core CPI, and not headline CPI, as the official target is that the person in the street is less likely to understand it. 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 occurring "only" in the cost of filling up their auto fuel tanks and in 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 indexes for political purposes—for example, in Argentina (recently) and in Brazil (in the more distant past), among others.

Given the value that most central bankers place on transparency and on 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 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—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 the LAC countries on monthly data. I 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 eighteen countries are currently inflation targeters. Guatemala might be excluded because its transition to inflation targeting is recent, and perhaps not even complete. Those LAC countries that are oil producers should also be excluded. Regardless, every one of the inflation targeters shows correlations between dollar import prices and the dollar values of their currencies, which are both positive over the 2000–08 period and greater than the correlations during the pre-IT period. The evidence supports the idea that 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 currencies. The implication seems to be that the CPI they targeted 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.)

A candidate for nominal target should be a variable that is simpler for the public to understand ex ante than core CPI, and yet is robust with respect to supply shocks. Being robust in this way 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.

20. Frankel (2005).

Terms-of-Trade Shocks

If the supply shocks are terms-of-trade shocks, then the choice of CPI as 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 (Producer Price Index), 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 indexes, 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 ones, especially those that export mineral and agricultural products.

Terms-of-trade volatility is particularly severe for commodity exporters, a category that includes most countries in Latin America and the Caribbean. If one uses the World Bank's terms-of-trade index, a list of top 40 countries (out of 166) with the greatest volatility is dominated by Africans and oil exporters.[21] But seven LAC countries are in the group of forty: Mexico, Venezuela, Haiti, Ecuador, Chile, Peru, and Bolivia, in descending order of volatility. A large share of exports of some countries in the region are concentrated in one product—such as coffee, copper, or oil—that is so volatile that it periodically experiences swings in world market conditions that double or halve its price. 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.

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 0.4; assuming a normal distribution, this implies that price swings of plus or minus 80 percent occur 5 percent of the time. Only beef and soybeans—the leading products of Argentina, Paraguay, and Uruguay—have lower price volatilities.

The table in appendix A reports standard deviations of an export price index, import price index, and the ratio of the two—the terms of trade—for

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 what shows up as a unit. Below I report measures calculated from export and import price indexes of the Economist Intelligence Unit.

TABLE 2. Major Commodity Exports in LAC Countries and Standard Deviation of Prices on World Markets

Country	*Leading commodity export*[a]	*Standard deviation of log 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

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

149 countries and regions. The data come from the Economist Intelligence Unit. Eight of the twenty countries with the highest terms-of-trade volatility are in Latin America and the Caribbean: Dominican Republic, Chile, Venezuela, Honduras, Paraguay, Trinidad and Tobago, Jamaica, and Ecuador. (Nine of the top twenty 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 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 each other out.[22]

22. Examples in appendix A appear to be Sri Lanka, Kazakhstan, and Colombia. But there is a need to detrend or first-difference the series for import prices and export prices, which has not yet been done.

The Option of an Exchange Rate Target

Many inflation-targeting central banks in developing countries have put more emphasis all along on the exchange rate than they have officially admitted.[23] This tendency is the famous "Fear of Floating" of Calvo and Reinhart (2002). When booming markets for export commodities in these developing countries put upward pressure on their currencies (2003–08), central banks intervened heavily to dampen appreciation. Colombia was one of many examples.[24] Then, when the global financial crisis hit, and especially when it put 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 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 for many countries, especially small ones. For very small countries, particularly those that are highly integrated with the United States (such as many countries in Central America and the Caribbean), an institutional peg or even full dollarization remains a reasonable option.

Fixed exchange rates have many advantages in addition to their use as nominal anchor for monetary policy. They reduce transaction 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 important, to the extent financial markets are integrated, a fixed exchange rate means giving up monetary independence; the central bank cannot increase the money supply, lower the interest rate, or devalue the currency in response to a downturn in demand for its output.

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

24. Vargas (2005).

It has been argued that Latin American governments have misused monetary discretion more often than they have used it to good purpose to achieve textbook objectives; so 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 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 seigniorage, 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. According to the literature, among the many country characteristics that should help determine this choice is one that features prominently in the simple model discussed in the fourth section (Targeting the Export Price Index): less exposure to external shocks than to domestic and

25. Among peggers, terms-of-trade shocks are amplified, as compared to flexible-rate countries, according to Edwards and Levy Yeyati (2005). Rafiq (2011) finds that this is true, in particular, for oil exporters. See also 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.

monetary shocks makes it more likely that an exchange rate target dominates other monetary regimes.[28]

For Mexico, other countries in 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, with 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, the relevant anchor currency is not necessarily the dollar. It could be the euro or, more likely, a weighted basket. Another 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 1991 decision to link to the currency of a country with which Argentina traded relatively little. Problems were also seen to stem from the subsequent 1995–2001 appreciation of the dollar against the euro, Brazilian real, and currencies of other major trading partners. These two factors were seen to be as much the cause of trade problems as 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 seven 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.

Alternative Choices of Price Index for Inflation Targeting

As noted, of the possible price indexes 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]

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

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

Peg the Export Price

I have proposed PEP explicitly for those countries that happen to be heavily specialized in the production of oil or another 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 Tobago, 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 to intervene via dollars. The central bank each day announces 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 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 price 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

30. Frankel (2002).

31. In recent years—especially as a result of the large increase in world oil prices toward the end of the 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.

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 required. In past currency crises, countries that have suffered a sharp deterioration in their export markets have often 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 in 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 again one might want the local currency to depreciate. Neither regime delivers that result.[32] But CPI targeting actually implies 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.

Peg the Export Price Index

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 the vast majority of countries, including most of those in Latin America and the 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 further diversification into new products in the future to be less dependent on that single commodity. For these two sorts of countries, the strict version of

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. However, to depreciate in the face of an increase in import prices would exacerbate an inflation shock.

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 in 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), and Jamaica (bauxite, sugar, bananas, rum, and coffee). In such cases, the natural price index would be a basket of those four or five commodity prices, omitting exported 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, for example, oil for an oil-importer. The PEPI proposal explicitly excludes prices of imported commodities. It *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.

Product Price Targeting

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 being available only 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 usually 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, nonthreatening variable; inflation targeters should be open-minded enough to consider it as an alternative to the CPI.

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 in the case of Bolivia.

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 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 the sectoral weights taken from longer-term GDP data to their price changes.

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 for the central bank to hit the target exactly; in contrast, 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 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 the value of the basket index, one week at a time, by analogy with high-frequency announcements of monetary aggregates or interbank interest rates. The weekly targets could be set to achieve the medium-term goal of keeping the comprehensive price index inside the pre-announced bands. Yet, if it wanted, the central bank could hit the weekly targets very closely by intervening, for example, 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 U.S. 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.

Targeting the Export Price Index versus Exchange Rate and CPI in a Simple Theoretical Model

I apply two methodologies, one theoretical and one statistical. This section theoretically models 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 more 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 the next section, "Analysis of Competing Monetary Targets with Respect to Ability to Stabilize Relative Prices." There I report statistical implications of seven 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.

Assumptions

The theoretical model is a two-sector version of Frankel (1995), closely following 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 productive sectors:

$$y_n = \overline{y_n} + b\left(p_n - p_n^e\right) + u_n, \tag{1}$$

$$y_x = \overline{y_x} + d\left(p_x - p_x^e\right) + u_x, \tag{2}$$

where

y_n & y_x ≡ output of nontraded and export sectors, respectively;
$\overline{y_n}$ & $\overline{y_x}$ ≡ potential output in the two sectors;
p_n & p_x ≡ prices in the 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:

$$p_x = s + \varepsilon_x, \tag{3}$$

$$p_{im} = s + \varepsilon_{im}, \tag{4}$$

where

$s \equiv$ exchange rate, spot price domestic currency / \$,
$\varepsilon_x \equiv$ fluctuating \$ price of export commodity,
$\varepsilon_{im} \equiv$ fluctuating \$ price of import good.

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

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

$$p = (f)p_x + (1 - f)p_n. \tag{6}$$

Money market equilibrium:

$$m = p + y - v, \tag{9}$$

and exchange rate equation:

$$s = m - y + e, \tag{10}$$

where

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

The objective is to minimize a quadratic loss function:

$$L = a(cpi)^2 + f(y_x - y'_x)^2 + (1 - f)(y_n - y'_n)^2. \tag{7}$$

Minimization of the quadratic loss function under each of the three possible regimes yields a set of equations reported in appendix C. The equations determine 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.

Implications for PEPI versus Exchange Rate Peg

Even if there are no export price shocks, the expected loss is smaller under the PEPI rule if $f > ½$, that is, if the foreign sector is larger than the domestic sector.

To the extent that export price shocks are greater than zero, 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.

Implications for PEPI versus CPI Rule

If *a* is large, that is, 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, that is, if supply curves are relatively flat, then PEPI again dominates.

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. I examine a set of countries in Latin America and the Caribbean, comparing the historical paths of prices under the historical monetary regime with possible outcomes under seven alternative regimes: dollar target, euro target, SDR target, CPI target, PEP target, PEPI target, and PPT. For simplicity, I continue to assume that the targets are hit precisely under each regime, even though in a stochastic model this would not be possible with half the regimes (the price index targets).

Sectoral Weights in the Price Indexes

In the empirical analysis, more than in the model of the preceding section, I decompose traded goods—into three different traded goods. But the countries of interest are still small, open economies. Thus I 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 nontraded 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 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, for simplicity, is taken here to be that of the United States. Inasmuch as many Latin American countries suffered very high inflation rates, even hyperinflations, in the 1970s and 1980s, 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 undergone a period of gradual disinflation in nontraded goods.[37] Eventually it would be good to try both kinds of counterfactuals. For now, I consider the first: hypothetically, what would have happened if the country had always followed the dollar peg or inflation target from the beginning?

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

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

and

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

Definitions:

$P_{ntg} \equiv$ price of nontraded goods in local terms. I assume that, at a horizon of less than one 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, the prices of

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 nontraded goods alike, would disappear instantly. In reality, exchange-rate–based stabilization attempts generally show a lot of inflation inertia. (For example, Kiguel and Leviatan, 1992.) Some might claim that an exchange rate peg is not a completely credible commitment. There can be no more credibly firm nominal anchor than full dollarization, however. Yet when Ecuador gave up its currency in favor of the dollar, neither the inflation rate nor the price level converged rapidly to U.S. levels. Inflationary momentum, rather, continued for a long time.

its nontraded goods (NTGs) are given by the U.S. CPI, since it is assumed that convergence would have taken place in the long run.

P_{cx} ≡ price of exports of leading mineral and agricultural commodities in local terms. I ignore trade barriers and define the prices of these traded goods (TGs) 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, I assume perfect pass-through: the local price is the exchange rate times the exogenous world price.

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

P_{otg} ≡ price of other tradable goods (that is, excluding oil and the other commodities, which are measured explicitly). I assume P_{otg} is equal to world prices of the TGs times the exchange rate. Data on these prices are not directly needed. It is assumed these countries are all price-takers for all tradable goods, not just for commodities. Thus if a counterfactual simulation says that some alternative regime would have caused the peso-dollar exchange rate to have been 5 percent higher than it was historically, it is simply assumed that this component of the price index P_{otg} would similarly have been 5 percent 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

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

The key difference between the two price indexes 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 should be the other way around.

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

TABLE 3. Estimation for Each Country of Weights Placed by National Price Index on Three Sectors: Nontradable Goods, Leading Commodity Exports, and Other Tradable Goods

Country	*Price index*	*Nontradables*	*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[a]	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[a]	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

Source: Author's calculations.
a. Oil is the leading commodity export.

substitutes for internationally traded goods). The methods for estimating the weights are described in appendix D. Mexico—located next to the United States and having followed open trade policies for twenty 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 offer 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.

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, after the fundamental decision to anchor inflationary expectations by a nominal target. Again, 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 and encourages 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 price swings induce current account deficits and capital inflows that are not optimizing in the way standard theory says. Facets of market failure could be excessively procyclical capital flows (including the absence of an effective international mechanism for handling default), or a political economy proclivity for governments to overspend 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).

In simulating the variability of the real prices of exports, one can capture 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

38. For example, Lane and Tornell (1999).

39. Aizenman and Jinjarak (2009) find a strong positive association between current account deficits and the real increase in real estate prices.

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 procyclical spending.

More specifically, my 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 especially when its world price temporarily rises) 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, 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 nontraded goods or in terms of wages. Instead we choose to measure the prices of these traded goods relative to the CPI. The actions are almost the same 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 figures in appendix E 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, with 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 whichever 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 in copper for Chile, in oil for Ecuador and Venezuela, and in beef for Uruguay.

These prices in table 4a 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

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 is thereby not credible from the beginning. (This was the case with M1 targeting and, I would argue, would also be the case with strict CPI targeting.)

TABLE 4. Variability of Export Prices under Alternative Currency Regimes

		Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
(a) Standard deviation of level of nominal export prices								
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	Aluminum	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								
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	. . .	. . .

TABLE 4. Variability of Export Prices under Alternative Currency Regimes (*Continued*)

		Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
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	Aluminum	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								
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	. . .	. . .

(*continued*)

TABLE 4. Variability of Export Prices under Alternative Currency Regimes (*Continued*)

		Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
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	Aluminum	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	. . .	. . .

pegged to the dollar during most of their history show price variability that is lower than others despite having commodities that are at least as variable: dollarized Panama with bananas, Trinidad and Tobago with oil, and Guatemala with coffee. In theory, the floating peso of Mexico or Chile could have appreciated precisely in proportion when dollar prices of oil or copper rose, 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 sometimes is even greater than) the standard deviation for individual commodities, suggesting that the commodity prices are highly correlated.

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, say, soy or copper would have been in terms of the domestic currency—say, pesos—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 percent in some given month, we know that the price of soy would have been lower by precisely 1 percent if the 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 seven 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 4a show what the variability of the commodity export prices would have been under an SDR peg or euro peg. Variability of the domestic price of the commodity export is often lower under the euro peg than under the dollar peg (for example, 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 4a 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 justify giving up the simplicity of a single-currency peg.

The next column, after the currency peg columns, is 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 1 percent on world markets, the dollar value of the local currency falls by 1 percent, leaving the local price of coffee unchanged. Nominal variability is far lower than variability 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 4b 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, again, is what one would expect from the dollar-stickiness of commodity prices that pertains only to the short term.

Table 4c shows the standard deviation of *real* prices of the commodity exports across the seven regimes. Real is defined here in terms of the CPI, but we could just as well be looking at the relative price in terms of nontraded 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, which 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 purpose of this study. The comparison in terms of ability to stabilize domestic prices of the principal export commodities appears in the last two columns of tables 4a through 4c. 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 (for example, Jamaica for aluminum and Uruguay for beef). The only times when variability is higher under the PPI target than under the CPI target is in Mexico for oil and Paraguay for beef. The reason is immediately apparent: these were the only two countries where the export commodity 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, variability is generally substantially higher than under a currency peg, and often even higher than under the various historical regimes. Perhaps this is an artifact of an 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 my results it is possible to achieve, but

perhaps only at the expense of imposing wild fluctuations in the exchange rate to fully offset fluctuations in any one sector of the price index. Perhaps a more reasonable and realistic approach, which 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 criterion is stabilizing domestic prices of *other* tradable goods. A valid critique of PEP and PEPI is that they transfer uncertainty that would otherwise occur in the real price of commodity exports into uncertainty that otherwise might not occur in the real price of noncommodity exportables and importables. This critique is particularly relevant if diversification of the economy is valued.

Comparison of Overall Ability of Alternative Regimes to Stabilize Real Traded Goods' Prices

In table 5 we show the outcomes of simulations of the domestic prices of *import* goods under the seven alternative regimes. 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 5a and 5b report the statistics on the variability of the nominal import price, measured in terms of levels or changes, respectively. Again, the currency pegs substantially cut nominal price variability, relative to that of the historical regime, but both the euro peg and SDR peg 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 imports (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.

TABLE 5. Variability of Import Prices under Alternative Currency Regimes[a]

		Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
(a) Standard deviation of level of nominal import prices								
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	. . .	. . .
(b) Standard deviation of first difference of nominal import prices								
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

TABLE 5. Variability of Import Prices under Alternative Currency Regimes[a] (*Continued*)

		Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
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	. . .	. . .
(c) Standard deviation of level of real import prices								
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	. . .	. . .

(*continued*)

TABLE 5. Variability of Import Prices under Alternative Currency Regimes[a] (*Continued*)

		Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
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	. . .	. . .

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

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 ensures 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

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, 2003, 2005; Frankel and Saiki, 2002). There nothing was foreordained. But PEP did tend to produce a good result 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 predeclared nominal anchor. LAC countries that appear in those simulations include Argentina (wheat); Bolivia, Guyana, 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 when looking forward.

TABLE 6. Average of the Variability of Export and Import Prices[a]

	Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
(a) Average of the standard deviation of level of nominal prices							
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	. . .	. . .
(b) Standard deviation of first difference of nominal prices: export price standard deviation and import price standard deviation averaged							
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	. . .	. . .

(*continued*)

TABLE 6. Average of the Variability of Export and Import Prices[a] (*Continued*)

	Historical regime	*Dollar peg*	*SDR peg*	*Euro peg*	*Comm. peg*	*CPI target*	*PPI target*
(c) Standard deviation of level of real prices: export price standard deviation and import price standard deviation averaged							
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	. . .	. . .

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

the standard deviation of the real price of other tradables (oil in this case or another largest single import good, such as 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 but smaller for the others.

Summary of Conclusions

Which 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 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 overall variability in the terms of trade 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; however, 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 the commodities that 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 boliviano 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), which targets the producer

price index or a specially constructed index of product prices weighted by shares in output in place of the CPI. 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 do not 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 their effect on 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 were predictable. First, according to the simulation, the currency anchors offer far more price stability than historical reality. 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.

Appendix A. Volatilities of Terms of Trade, Export Prices, and Import Prices

Rank of volatility / *Country / region*	*Standard deviation of the log of price indexes*			
	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 (excluding Iraq)	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 North Africa (excluding 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

(*continued*)

APPENDIX A. (*Continued*)

Rank of volatility / *Country / region*	*Standard deviation of the log of price indexes*			
	Terms of trade (as reported by EIU)	*Calculated terms of trade*	*Export price index in US$*	*Import price index in US$*
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 (excluding Yugoslavia)	0.1140	0.1140	0.3150	0.2270
Economies in transition	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

APPENDIX A. (*Continued*)

Rank of volatility / *Country / region*	*Standard deviation of the log of price indexes*			
	Terms of trade (as reported by EIU)	*Calculated terms of trade*	*Export price index in US$*	*Import price index in US$*
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
G-7	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
G-10	0.0594	0.0593	0.1861	0.1516
Euro area	0.0584	0.0584	0.2122	0.1796
Big Four (Germany, France, Italy, United Kingdom)	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 (excluding Turkey)	0.0534	0.0536	0.2084	0.1722
Balkans	0.0530	0.0530	0.2990	0.2571
Asia & Australia (excluding Japan)	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 exporters	0.0499	0.0498	0.2845	0.2864
OECD	0.0497	0.0495	0.1844	0.1565

(*continued*)

APPENDIX A. (*Continued*)

Rank of volatility / *Country / region*	*Standard deviation of the log of price indexes*			
	Terms of trade (as reported by EIU)	*Calculated terms of trade*	*Export price index in US$*	*Import price index in US$*
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
Slovak Republic	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

Source: Author's calculations.

Appendix B. 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 B1 summarizes how each of the variables that are candidates for nominal anchor has its own characteristic sort of extraneous fluctuations, which can wreak havoc on a country's monetary system.

Monetarist Rule

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 to abandon the money growth

TABLE B1. Six Proposed Nominal Anchors and the Achilles Heel of Each

Regime	*Targeted nominal variable*	*Vulnerability*	*Historical examples*
Monetarist rule	M1	Velocity shocks	United States 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)
Inflation targeting	CPI	Import price shocks	Oil shocks of 1973, 1980, 2000, 2008

rule it had adopted two years earlier, or else face a prolonged and severe recession.

Gold Standard

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 nineteenth century, global monetary conditions depended on the output of the world's gold mines. The California gold rush of 1849 was associated with a midcentury 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 rush in Alaska and the one in South Africa were each again followed by new upswings in the price level. Thus the system did not, in fact, guarantee stability.[1]

Commodity Standard

The proposal that monetary policy should target a basket of basic mineral and agricultural commodities suggests 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. 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

1. Cooper (1985); Eichengreen (1985); and Hall (1982).

creates precisely the wrong outcome 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 and Tobago should not peg to wheat.

Nominal Income Targeting

The need for robustness with respect to import price shocks argues for the superiority of nominal income targeting over inflation targeting.[2] 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.

Fixed Exchange Rate

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 all currencies linked to the dollar. Regardless of the extent to which one considers the late-1990s dollar appreciation to have been based in the fundamentals of the U.S. 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, for example, 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 links to the dollar, the dollar still exerted a large pull on their currency to create strains. The loss of competitiveness in non-dollar export markets adversely impacts such measures of economic health as real overvaluation, exports, the trade balance, and growth; or such measures of financial health

2. 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); and West (1986).

as the ratios of current account to GDP, debt to GDP, debt service to exports, or reserves to imports.

Inflation Targeting

This brings us back to the current fashion of targeting the inflation rate or CPI. To some, PEP or PPT 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 C. Targeting the Export Price versus Exchange Rate and CPI, in a Simple Theoretical Model

The fourth section of the paper, "Targeting the Export Price Index versus Exchange Rate and CPI," presents 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 C1. Stabilization Properties of Three Alternative Monetary Targets Objective: Stabilize CPI and Output in the NTG and X Sectors

	Coefficients in determining loss L in equation 7				
Rule	ε_{im}^2	ε_x^2	$(v-e)^2$	u_x^2	u_n^2
Exchange rate peg	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	$b^2f^3(1-f)$	$d^2f^3 + fd^2 + b^2(f^3/1-f)$	$fd^2 + b^2(f^2/1-f)$	f	$1-f$
PEP	af^2	af^2	$a[(1-f)/f]^2 + b^2/(1-f)$	f	$1-f$

Source: Author's calculations.

Appendix D. Data Sources and Computation Methods

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
Nontradables CPI	Countries' Central Bank
Tradables CPI	Countries' Central Bank

Computation Methods

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

$$LogX = \bar{x} + \sigma\left(p_x - w\right),$$

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 + σ] 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,[1] $S^{lc}_{\$} = S^{DM}_{\$}$, 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 $w = (CPI^{SDR})$.[2]

1. The exchange rate of the German mark after 1999 is calculated as follows:
   S(DM/$) in 1999 = S(Euro/$) in 1999 * S(DM/Euro) in 1999;
   S(DM/$) in 2000 = S(DM/$) in 1999 * (1 + percent change of the euro exchange rate).
2. The CPI for the SDR peg is constructed as a weighted average of U.S. CPI, U.K. CPI, France CPI, and Germany CPI. To calculate this average, we use the weight of each country's currency in the SDR.

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

Under a hypothetical CPI target,[3] $S_{\$}^{lc} = (100 - w_{ntg}P_{ntg})/(w_{cx}P_{cx\$} + w_{pm}P_{pm\$} + w_{otg}P_{otg\$})$, $P_x = S_{\$}^{lc}P_x^{\$}$.

Under a hypothetical PPI target,[4] $S_{\$}^{lc} = (100 - v_{ntg}P_{ntg})/(v_{cx}P_{cx\$} + v_{pm}P_{pm\$} + v_{otg}P_{otg\$})$, $P_x = S_{\$}^{lc}P_x^{\$}$.

Under the CPI and PPI target, we have approximated nontradable goods' prices using a ten-year moving average of the U.S. 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 United States, SDR, or Germany, respectively, under the assumption that the peg is strong enough and permanent enough to achieve convergence of inflation rates.[5]

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

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

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 to make the log of the real price of the commodity on average over the thirty-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 table 5a.

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:

3. Rewrite the CPI equation from the section of the appendix titled Simulation of CPI and PPI 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.

4. Rewrite the PPI equation from the section of the appendix titled Simulation of CPI and PPI 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.

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

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

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

Where:

P_{ntg} ≡ Price of nontraded goods in local terms. We assume that, at a horizon of less than one 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, its nontradable prices are given by the U.S. 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 (that is, 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 $w_{ntg} \equiv v_{ntg}$.

The following steps were followed to obtain an estimate of the above-mentioned weights:

a. Obtain countries' nontradable CPI and tradable CPI series.

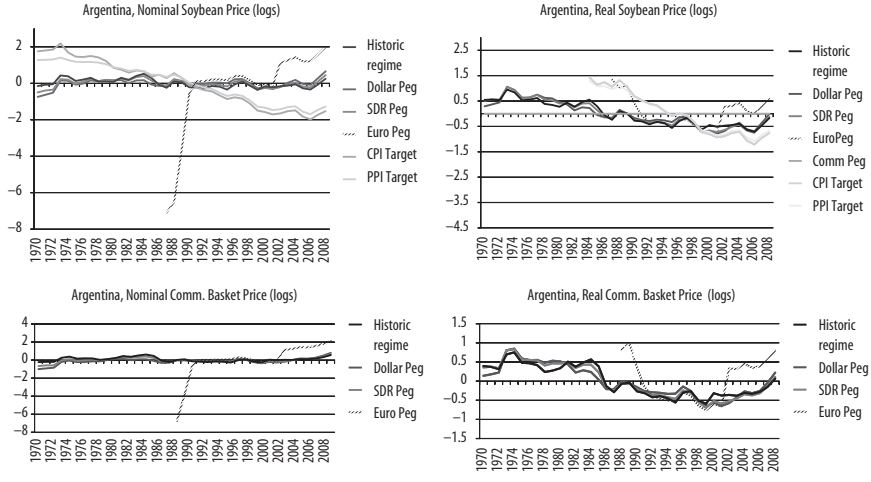
b. Regress CPI against nontradable CPI to get $w_{ntg} = v_{ntg}$.

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 (that is, $1 - w_{cx} - w_{ntg} - w_{pm}$).

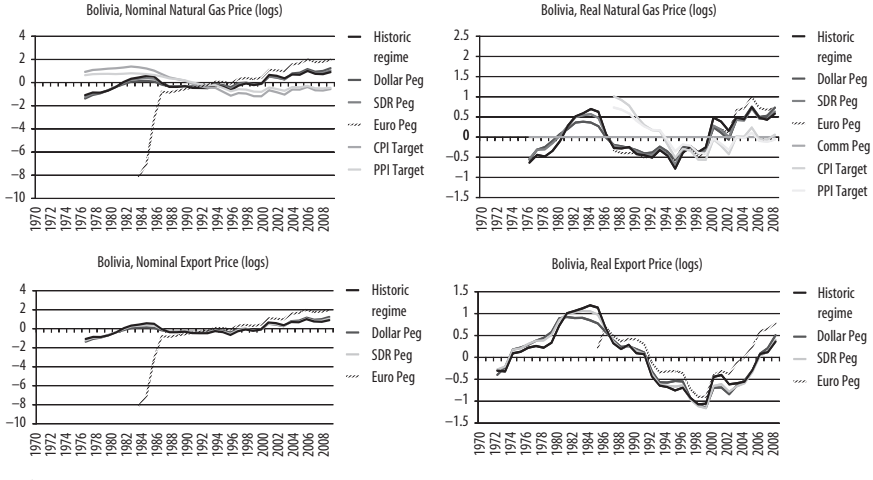
Appendix E. Nominal and Real Log Export Prices, Simulated under Alternative Regimes

Argentina

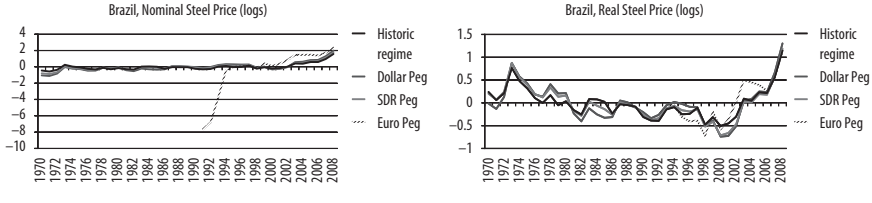


*Basket: Maize, soybeans, oil, and wheat.

Bolivia

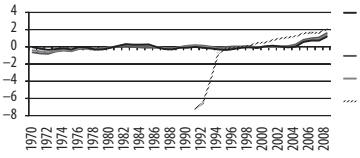


Brazil

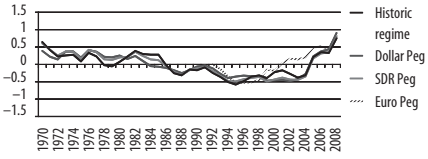


Appendix E. (*Continued*)

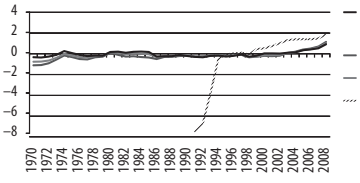
Brazil, Nominal Iron Ore Price (logs)



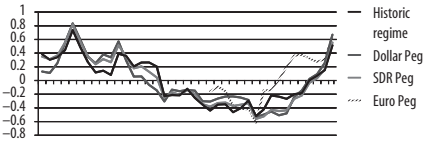
Brazil, Real Iron Ore Price (logs)



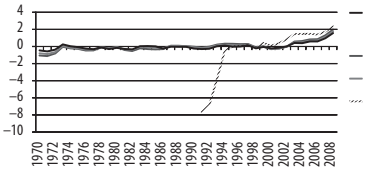
Brazil, Nominal Comm. Basket Price (logs)



Brazil, Real Comm. Basket Price (logs)



Brazil, Nominal Export Price (logs)



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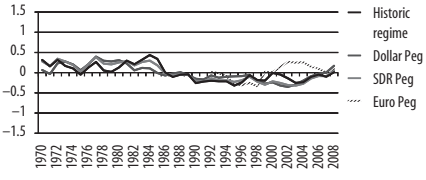
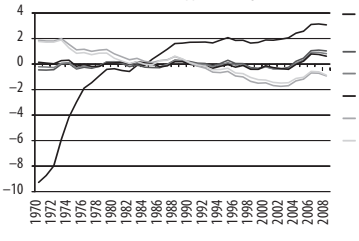
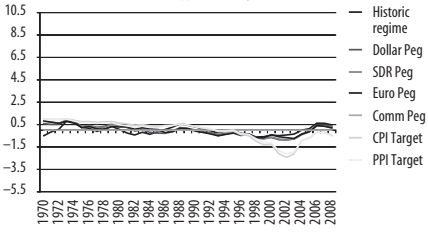


Chile

Chile, Nominal Copper Price (logs)

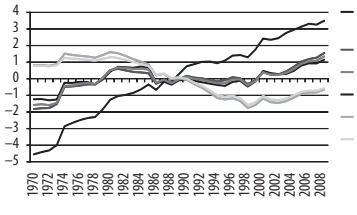


Chile, Real Copper Price (logs)

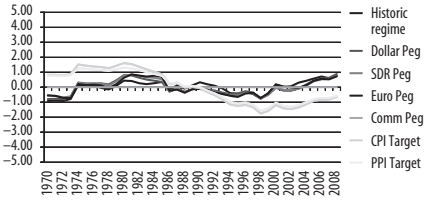


Columbia

Colombia, Nominal Oil Price (logs)



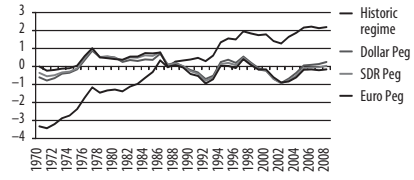
Colombia, Real Oil Price (logs)



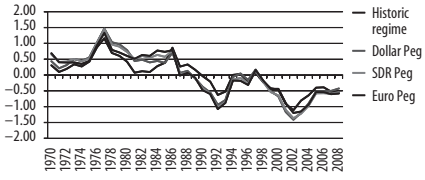
(*continued*)

Appendix E. (*Continued*)

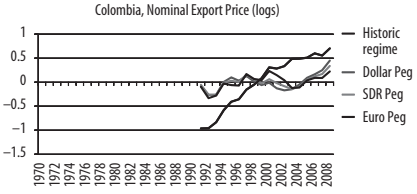
Colombia, Nominal Coffee Price (logs)



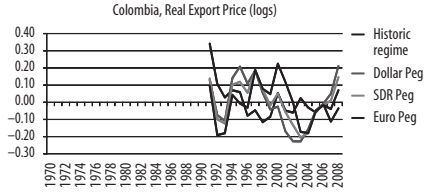
Colombia, Real Coffee Price (logs)



Colombia, Nominal Export Price (logs)

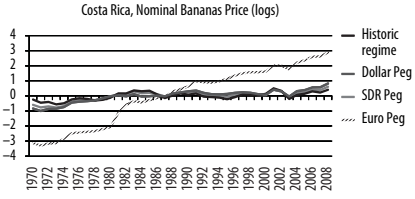


Colombia, Real Export Price (logs)

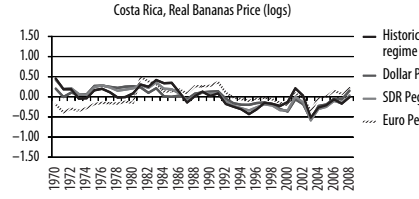


Costa Rica

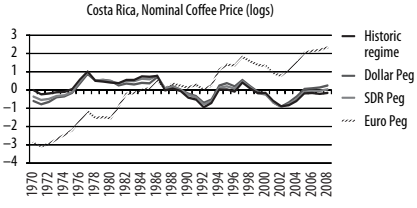
Costa Rica, Nominal Bananas Price (logs)



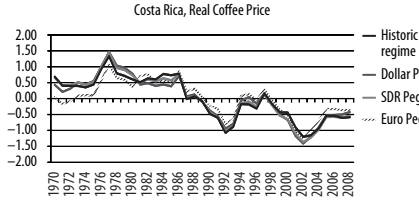
Costa Rica, Real Bananas Price (logs)



Costa Rica, Nominal Coffee Price (logs)

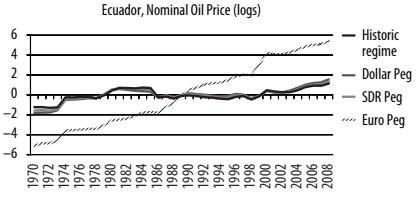


Costa Rica, Real Coffee Price

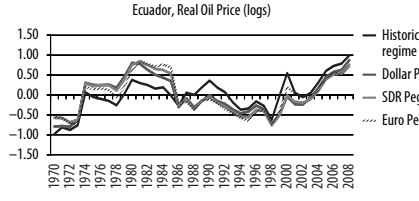


Ecuador

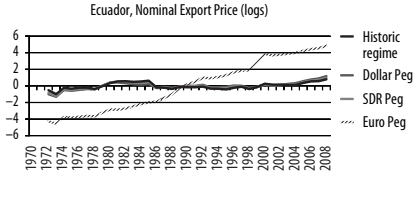
Ecuador, Nominal Oil Price (logs)



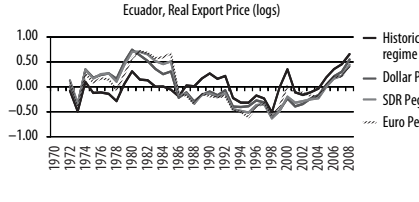
Ecuador, Real Oil Price (logs)



Ecuador, Nominal Export Price (logs)

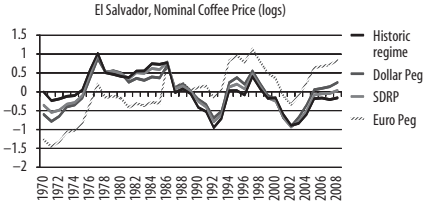


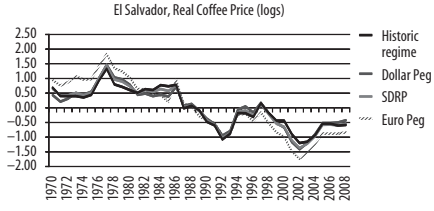
Ecuador, Real Export Price (logs)



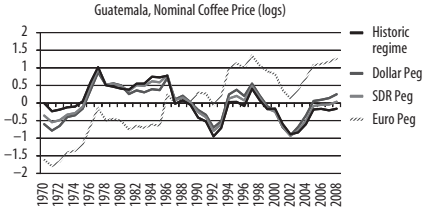
Appendix E. (*Continued*)

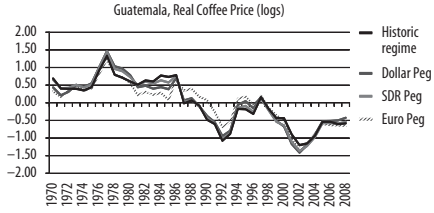
El Salvador





Guatemala





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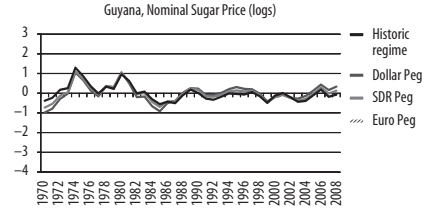

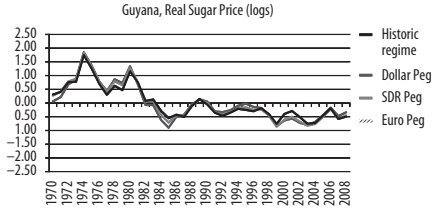

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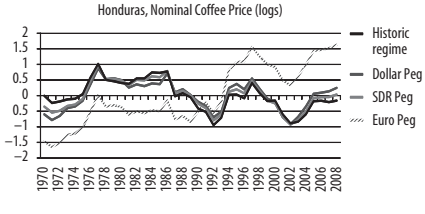

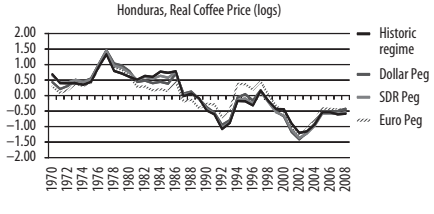

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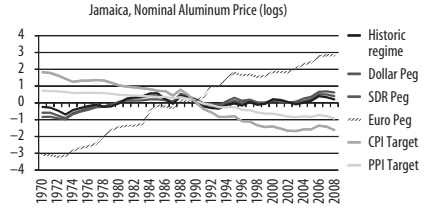

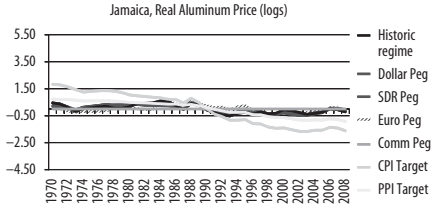

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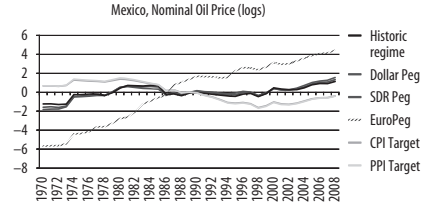
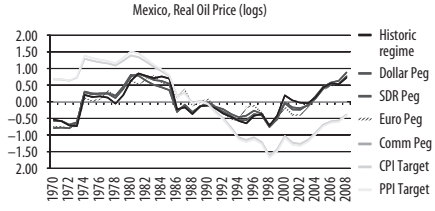
Appendix E. (*Continued*)

Mexico





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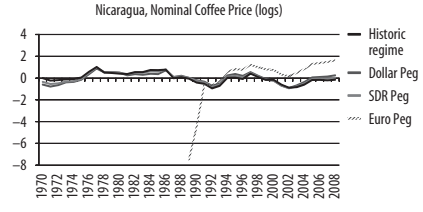
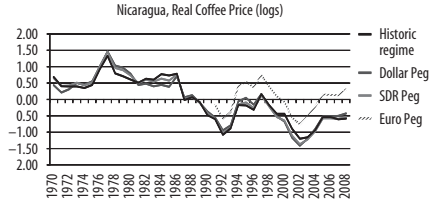
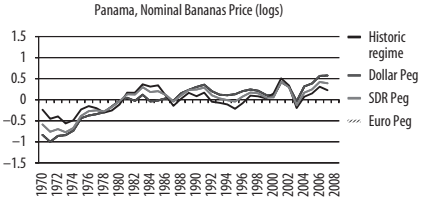
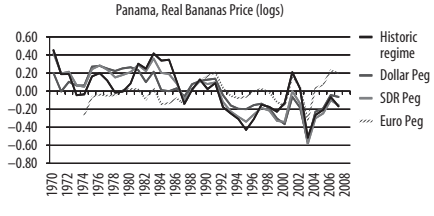


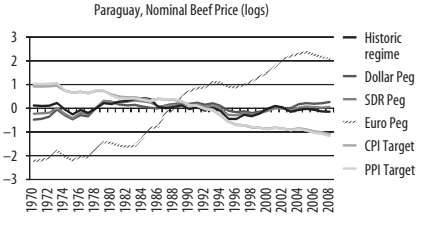


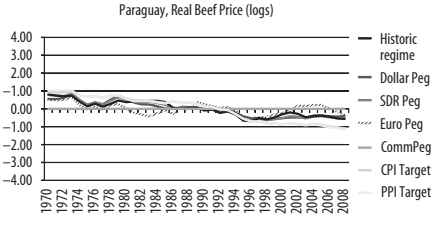
Panama



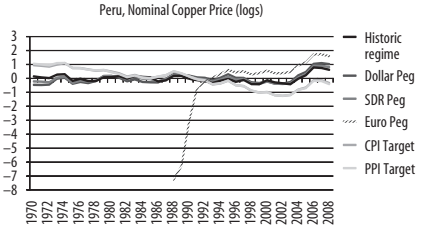


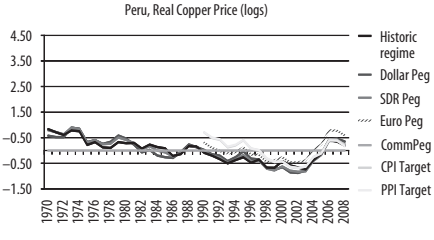
Paraguay





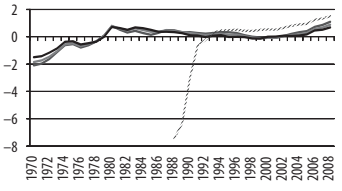
Peru



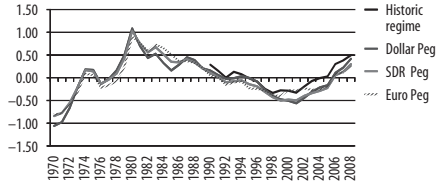


Appendix E. (*Continued*)

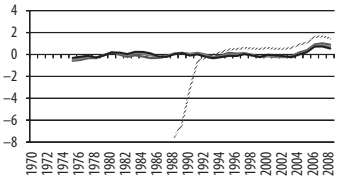
Peru, Nominal Gold Price (logs)



Peru, Real Gold Price (logs)



Peru, Nominal Export Price (logs)



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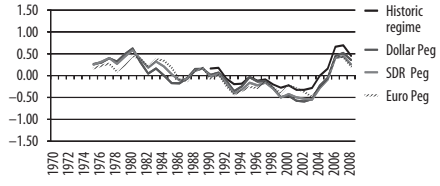
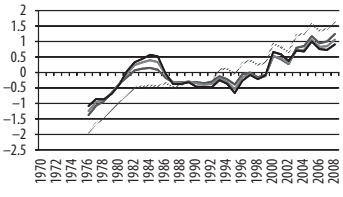
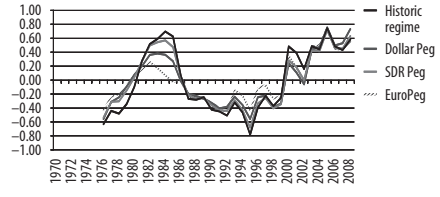


Trinidad and Tobago

Trinidad and Tobago, Nominal Natural Gas Price (logs)

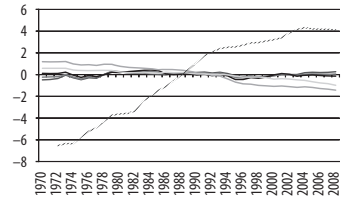


Trinidad and Tobago, Real Natural Gas Price (logs)

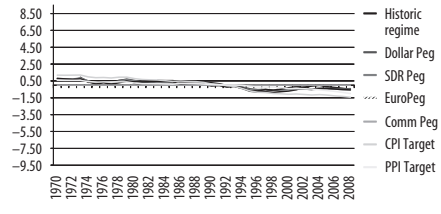


Uruguay

Uruguay, Nominal Beef Price (logs)

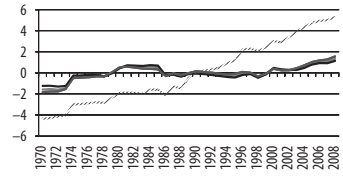


Uruguay, Real Beef Price (logs)

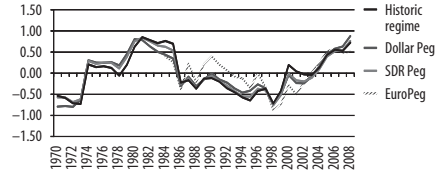


Venezuela

Venezuela, Nominal Oil Price (logs)



Venezuela, Real Oil Price (logs)



Sources: Authors calculations.

Comment

Luis A. V. Catão: Being a newcomer to the literature on monetary policy and commodity price shocks, it is both an honor and a hefty responsibility to comment on yet another thought-provoking, clearly written, and certainly very timely contribution by Jeffrey Frankel to this literature.

Having learned from Frankel's previous work how monetary policy in industrialized countries can greatly impact global commodity prices (Frankel 2008), this paper takes both global monetary policy and commodity price shocks as exogenous and asks, instead, which monetary policy regime is best equipped to manage such shocks. The context is that of a small open emerging market (SOEM) that specializes in the production and export of one or a handful of commodity goods of which it is a price-taker in world markets.

The Case against Standard Inflation Targeting and in Favor of the Producer Price Targeting Alternative

The main contention of the paper is twofold: that strict inflation targeting (IT)—based on an explicit and pre-announced quantitative annual target for CPI and low or null weight on the output gap—can be highly destabilizing for such a SOEM, and that product- or export-price targeting rules could do better. To see why, consider a SOEM that imports much of the food or oil it consumes, where that food or oil accounts for a substantial share of the consumer price index. This economy may be either a producer and net exporter of other commodities (like nonenergy minerals) or a producer and net exporter of services (for example, Caribbean tourism) and manufactured goods (like many countries in Asia, for instance). A rise in the world price of oil or food entails a terms-of-trade (TOT) deterioration, all else constant. As food and oil weigh heavily on the domestic consumption basket, CPI inflation will rise.

Suppose that the central bank adopts a strict Taylor rule on headline CPI. Higher CPI inflation would call for a rise in the policy-controlled short-term interest rate, lowering consumption and appreciating the nominal exchange rate (*E*). If the country is a price-taker in the world market for its exports, the appreciation would put a downward pressure on home goods' prices and hence on profit margins. Falling domestic consumption and squeezed profits would reinforce the contractionary impact of the TOT deterioration on output and employment—the converse would happen when global oil or food prices rise and this economy's TOT improves. In this sense, this Taylor rule would tend to exacerbate the procyclicality of this SOEM to TOT shocks.[1] Some support for the contention that IT regimes operate in this fashion is provided in table 1 of the paper: in economies that are officially under an IT regime, the correlation is negative. In other words, when TOT deteriorates (improves) the real effective exchange rate—REER—appreciates (depreciates). In short, the more volatile the world relative price of commodities, so goes the argument, the worse is the trade-off between output and inflation stabilization engendered by strict CPI IT.

Once exchange rate targeting and hard pegs are out of the way as viable alternatives for many countries for reasons thoroughly discussed in the paper, other alternative rules gain further luster. One alternative would be to target core CPI inflation, where "core" means that volatile flex-price goods like food and oil are typically purged from the index. While this is actually practiced by some SOEMs, like Korea and South Africa, it is not problem-free. For one thing, the purging may be construed by the public as nontransparent and thus detract from policy credibility, as noted in the paper. In addition, in countries where food (processed and unprocessed) accounts for 30 to 50 percent of CPI, one might wonder what such a "purged" CPI stands for.[2]

The focus of the paper is on three producer-based price targeting alternatives—namely, Peg the Export Price (PEP), Peg the Export Price Index (PEPI), and product price targeting (PPT). PEP amounts to stabilizing the domestic currency price of the country's main exporting commodity (for example, copper in Chile), whereas the PEPI would stabilize the export

1. A similar mechanism is applicable to the SOEM, which produces and exports commodities (including food and oil) but imports mainly manufactured goods, and where manufactured goods weigh heavily on CPI. When world manufacturing prices rise relative to commodity prices, TOT deteriorates and domestic CPI inflation rises—calling for a monetary tightening—which reinforces the negative impact of the TOT on output and employment.

2. See Catão and Chang (2010) for cross-country data on food weights in headline CPI.

price index (that is, not one but all commodities in the export basket). PPT is broader: the policy goal would essentially consist of stabilizing the domestic producer price index (PPI) once the latter is computed of value-added weights instead of gross sales weights, as in the old-fashioned PPI. It is straightforward to see that either of these alternatives could go some way toward mitigating the procyclical "bias" of CPI IT that Frankel cites: when TOT deteriorates, the exchange rate automatically depreciates to stabilize the domestic price of exports or output. If wages and nontradable prices are sticky, it follows that domestic relative prices and producers' profit margins are also stabilized. Hence the effects of TOT volatility on output and employment are offset via exchange rate fluctuations.

Another Look at Targeting Choice Criteria

What are the downsides of those producer price targeting rules? One is clearly practical implementation. To fully stabilize PEP or PEPI in domestic currency, the government has to be adjusting the nominal exchange rate to the short-term gyrations of those prices (or else intervening directly in the respective commodity markets). To the extent that such gyrations can be extreme—even on an intra-day basis—this would likely require rather frequent intervention and sizable buffer stocks (of foreign exchange rate reserves or of physical commodities); this could certainly be very expensive in a world of near-zero interest rates on "safe assets." In addition, in the case of PEPI, one would need to have real-time statistics on the index on a daily or weekly basis, which most countries do not typically produce.

But my main reservations are of a more conceptual nature. Specifically, it is not clear to me that any of those three price-level targeting rules would emerge as winner on the basis of broader standard criteria for choosing a targeting rule. In what follows, I elaborate on this point and conclude that, all in all, broad CPI inflation targeting still stands as the best compromise choice for many, if not most, SOEMs.

A first consideration in this connection is that any optimal targeting rule is bound to depend on the welfare objectives of the policymaker. Standard economic theory says that typically the benevolent policymaker should want to maximize the consumption of the representative citizen, reduce volatility of consumption, and minimize labor effort. Combining the first and last objective, and assuming that production is proportional to employment, implies that one really wants to maximize the ratio of consumption to domestic output (C/Y)

and reduce the variability of *C*. A lot of the discussion in the paper assumes that stabilizing the domestic relative price of commodities is the key, purportedly because it helps minimize output volatility, though this connection is not established in the numerical simulations across policy rules in the second part of the paper. At any rate, especially in a small open economy with nontrivial financial market integration with the rest of the world, consumption and output will not necessarily move one to one. Moreover, standard economic theory says that one typically wants to maximize the level of consumption and minimize its volatility, rather than minimize the volatility of relative prices and output per se.

Once this broad welfare objective is agreed upon, the follow-up question is: Which main imperfections stand in the way? The answer will depend on the type of economy. On this issue—as well as that of the policymaker's welfare function—I think that the paper would benefit from a less terse discussion. So I will try to fill in for some of that discussion here with a rather stylized typology.

Consider first the case of an economy that produces and exports sticky price–types of goods, like manufactures and services, and is a net importer of other commodities, notably food and oil, which have a high weight in its CPI basket relative to that of its (advanced) trading partners. Very small open economies that export mainly services like tourism as well as those that export mainly manufacturing (like China and much of Asia and some Eastern European countries) would readily fit into this category. These are the "worst-sufferer" cases modeled in Catão and Chang (2010): when primary commodity shocks hit, and imported food and oil prices rise by more than the export price, the country's TOT deteriorates, CPI inflation rises, and the REER tends to appreciate (since the rise in domestic inflation outstrips that of foreign inflation because of the higher weight of oil and food in CPI). So inflation and output (through the contractionary effects of falling TOT and an appreciating REER) are both badly hit. The key question in this context is: What are the main imperfections that would tip the balance away from CPI IT toward PPT, PPI, or PEPI?

For one thing, stabilizing PPI should clearly be important since this SOEM has a sticky price distortion, which lowers output under higher PPI inflation. This, however, would call for a monetary tightening, rather than the monetary loosening entailed by the PEP and PEPI rules advocated in the paper. Would output suffer much in the short run? This depends on the intratemporal substitution elasticities. If there is sufficient home bias, and the home good is relatively nonsubstitutable abroad, like a Caribbean Island or some specific

manufacture or service, then the attendant nominal exchange rate appreciation would not hit output too hard. In fact, a nominal appreciation would allow the country to better explore the so-called "TOT externality"—in the way that countries with some monopoly power over their exports impose "optimal tariffs." CPI-based IT would also call for tightening but just more aggressively since CPI inflation goes up by more than PPI inflation. If this economy is shut down from global financial markets, consumption is all the more protected by the TOT improvement associated with the currency appreciation since $C = (Ph/P) * Y$, where Ph/P is the relative price of the home good, which rises on TOT. By appreciating the REER and hence raising Ph/P, the policymaker lifts up C/Y, which is what standard economy theory tells us to maximize.

Conversely, assume instead that the economy is highly integrated with international capital markets. Then, a REER appreciation following the nominal appreciation would hurt consumption in the short run, but in the long run, simulations in Catão and Chang (2010) find that CPI targeting in fact does slightly better than PPI in lowering REER volatility. Since under (near) complete markets stabilizing the REER is tantamount to stabilizing consumption, CPI-based IT would have an edge through this mechanism. In contrast, PEP and PEPI would exacerbate REER volatility: by stabilizing export and producer prices in domestic currency, the price of food and oil (which weigh high in the consumption basket) would tend to soar, destabilizing consumption. Moreover, if the economy is sufficiently integrated within world capital markets and is also a price-taker in world commodity markets, its producers should be able to hedge themselves against commodity price shocks, rather than relying on monetary policy to do the job (at the expense of other objectives and of shifting volatility elsewhere in the economy). Diversifying such a country-specific TOT risk in world capital markets is simply likely to be cheaper.

Last but not least, if the food and oil price shock is persistent enough, and the central bank's credibility is low, such a credibility "distortion" would only reinforce this point: depreciating the currency in response to the negative TOT shock, as entailed by the Frankel PEP rule, could result in a potentially costly loss of credibility. The upshot is that, judged by a broader set of criteria beyond mere stabilization of output in the short run, the trade-offs between PPI and CPI IT are complex; but the shortcomings of PEP and PEPI are also quite apparent.

Let me now briefly consider two final cases in my typology of SOEMs. One is the country that basically produces and exports key staples, like meat, wheat, or soybeans—in short, a country that "produces what it eats" (to use the famous phrase of Diaz-Alejandro referring to early twentieth-century

Argentina). In this case, the domestic fix-price distortion is absent (since all commodities are essentially flex-price goods), so stabilizing PPI is no longer as attractive. But also note that in this economy PPI and CPI will tend to co-move tightly since much of what average citizens consume (food) is what they also produce. In this case, the Taylor rule on either PPI or CPI targeting will not deliver markedly distinct outcomes. In particular, the standard Taylor rule on CPI inflation goes in the countercyclical direction advocated by Frankel: as world food prices go up and TOT improves, CPI inflation also rises, calling for a monetary tightening and a currency appreciation. This will help stabilize both domestic producer prices and CPI inflation, thereby mitigating cyclical overheating. But, again, one may still argue that CPI may in fact have an edge over PPI inflation targeting insofar as it helps stabilize the price of the overall consumer basket (which includes imported manufactured goods), and not just the producer basket. To the extent that the welfare objective of the policymaker is to minimize volatility of overall consumption, stabilizing the whole basket—rather than just part of it—would be preferable.

Finally, there is the case of a country that produces and exports nonfood, nonoil commodities and that imports the rest, including possibly oil. In this case as well, the fix-price distortion is no longer present, so stabilizing PPI is not particularly attractive from the view of mitigating that distortion. Yet, this seems to be the context in which the Frankel criticism of standard IT is most pertinent. Suppose that world price of manufactures or oil rise by more than the country's export price, so that its TOT deteriorates.[3] Because CPI inflation will rise, standard CPI IT will call for tightening, inducing a currency appreciation. In this case, the IT rule tends to exacerbate the contractionary impact of the TOT deterioration. PEP and PEPI, in contrast, tend to do a better job at shielding output but only insofar as domestic costs (notably wages) are sticky and do not respond to the rise in CPI inflation. But the PEP and PEPI will fail, once again, in terms of stabilizing the cost of overall CPI since the goods that this economy exports have limited weight in CPI. So, what PEP and PEPI are doing is basically shifting volatility across traded goods and, in particular, trading-off the volatility in producer prices versus the volatility in the price of consumption. If there are real rigidities of the type modeled in Blanchard and Gali (2007), real wages will respond to this rise in CPI, and rising wage costs will compress profits and production once PEP and PEPI

3. Although historically commodities' prices tend to co-move closely, the commodity lottery may play out so that if global commodity prices rise, the price of the country's main import commodity (say oil) rises by more than the country's export price. So, its TOT will deteriorate.

stabilize producer prices. In this case, one might do much better by sticking to CPI IT and placing not too low a weight on the output gap. In short, when advocating the superiority of PEP and PEPI, even in this more favorable case, care must be taken to focus on the main distortion(s) that policy aims to mitigate.

Further Pros of CPI Inflation Targeting

In addition to transparency, I would like to round up my defense of CPI IT with three other pluses that are worth restating here.

One is that, unlike price level targeting, standard IT does not require one to take a stand on what is trend versus what is cycle: CPI inflation is typically stationary. This is a nontrivial problem with PEP and PPT *level* targeting that I found missing in the paper's discussion. Supposedly, a SOEM policymaker would like to stabilize domestic commodity prices around fundamental or trend levels so as to avoid wild and potentially very disruptive corrections in producer prices and in the nominal exchange rate down the line. Implicit in Frankel's discussion, it seems to me, is the assumption that the U.S. dollar spot commodity price is close to that fundamental value, but his own early work indicates that this is not always the case. At any rate, I believe the paper would benefit from a more upfront discussion of the trade-offs between inflation versus price *level* targeting.

Second, history teaches us that the political economy of stabilizing export prices is a tricky one. Doing away with price shocks to exporters would mitigate the risk of their going out of business, but such a policy rule may detract from needed structural change, which may be painful in the short run but beneficial in the longer run. It may create political distortions via the consolidation of powerful export lobbies. Brazil's pre–World War II experience with coffee provides an illustration (Furtado 1963): coffee producers tilted policy so as to favor a depreciation during falling world coffee prices (largely resulting from their own overproduction), thus "socializing the losses" among urban consumers. In contrast, during rising coffee prices and improved TOT, they would lobby for pegging the currency, thus "privatizing" the benefits of the bonanza. This arguably protracted structural adjustment and diversification away from coffee. Besides, such a policy was clearly regressive insofar as poorer urban classes were the ones hit the hardest by the rising prices of tradable staples other than coffee, following the devaluation bouts. While the political mileage of countries in this day and age of mass democracy

and greater institutional transparency may vary in this regard, one should perhaps be mindful of such political economy pitfalls.

To conclude, I ask permission to put on my multilateral IMF hat and highlight another nontrivial benefit of broad CPI inflation targeting—namely that of mitigating the externality problem—that, if all IT central banks were to take imported inflation as given and accommodate it as implied by PPI or some "commodity purged" CPI IT, global commodity prices would be less anchored; this would be less conducive to keeping global inflationary pressures at bay. Conversely, if there is a worldwide food undersupply, and all food exporters stabilize food prices rather than allowing them to rise relative to the prices of other goods as entailed by PEP and PEPI type rules, this may curb the needed expansion of global food supply.

All in all, I am inclined to think that many SOEMs and the world at large are better off by sticking to an old wisdom, "If it ain't broken, don't fix it." Broad CPI inflation targeting may perhaps be dented here and there, but it is not yet broken.

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