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THE PERFORMANCE OF ALTERNATIVE MONETARY REGIMES

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I. INTRODUCTION

The choice of monetary regime is a perennial issue in economics. For decades, advocates of discretionary or "just do it" monetary policy have debated supporters of regimes that constrain policymakers. Such regimes range from money targeting, advocated by Milton Friedman in the 1960s, to the inflation targeting practiced by many countries today.

This paper compares the monetary regimes that have been most popular in the last 25 years. I examine countries with discretionary policy, such as the United States, and countries with inflation targets. I also examine countries that have given up national monetary policy, either by forming a currency union or through a hard peg to another currency. Finally, I examine the main remnant of money targeting: the ECB's use of "monetary analysis" in setting interest rates.

Other chapters in this Handbook examine the theoretical arguments for alternative policies (e.g. Svensson on inflation targets). This chapter deemphasizes theory and examines the actual economic performance of countries that have adopted alternative regimes. I focus on the behavior of core macroeconomic variables: output, inflation, and interest rates.

Section II of this chapter presents evidence on the economic performance of countries with three policy choices: discretion,

inflation targeting, and euro membership. I focus on the period 1985-2006 –- the Great Moderation. Simple statistical tests suggest that, during this period, the choice among the three regimes had modest if any effects on advanced economies. However, the adoption of inflation targets helped emerging economies stabilize output.

Section III reviews the previous literature on inflation targeting. A number of papers report findings at odds with my evidence: they find that IT benefits advanced economies. However, a variety of problems with this work leave me unpersuaded.

Section IV compares IT to discretionary policy over the period since August 2007 –- the world financial and economic crisis. I focus on discretionary policy in the United States and IT in the United Kingdom and Sweden. In responding to the crisis, the Federal Reserve started cutting interest rates aggressively in September 2007. In contrast, the Bank of England and the Riksbank did not cut rates sharply until October 2008. My reading of history suggests that the difference in monetary regimes helps explain the difference in policy actions. This is a strike against IT, as a faster monetary easing would have dampened the British and Swedish recessions that began in 2008.

Section V examines the effects of the euro on countries that have adopted it. The evidence to date suggests that the currency

union has produced a moderate increase in intra-European trade and a larger increase in capital-market integration. On the downside, price levels in different countries have diverged, causing changes in competitiveness. This problem could destabilize output in the future.

Section VI turns to the role of money in ECB policy. On its face, the ECB's attention to monetary aggregates differs from policymaking at most central bank. However, a review of history suggests that this difference is largely an illusion. The behavior of monetary aggregates rarely if ever influences the ECB's setting of interest rates.

Finally, Section VII discusses hard exchange-rate pegs, including currency boards and dollarization. History suggests that such policies are dangerous, as they have led to severe recessions in several countries.

Section VIII concludes.

II. SOME SIMPLE EVIDENCE

New Zealand and Canada pioneered inflation targeting in the early 1990s. Under this regime, the central bank's primary goal is keeping inflation near an announced target or within a target range. This policy quickly became popular, and approximately 30 central banks are inflation targeters today. Other central banks, notably the Federal Reserve, have resisted this trend and

have no explicit policy rule. This regime is traditionally called “discretion,” and lately has been called the “just do it” approach to policy.

In 1999, 11 European countries abolished their national currencies and adopted the euro; 15 countries used the euro in 2008. This currency union dwarfs all others in the world. I will interpret euro adoption as a choice of monetary regime: rather than choose inflation targeting or discretion, a country cedes control of its monetary policy to the ECB.

Economists have made many arguments about the effects of inflation targeting and the euro. For example, some opponents of IT argue that an emphasis on inflation stability decreases output stability. Supporters of IT argue that the policy anchors inflation expectations, stabilizing both output and inflation. Opponents of the euro suggest that the elimination of national monetary policy reduces output stability. Supporters argue that a common currency increases the integration of European economies, benefitting economic growth.

Here I seek to measure the effects of IT and the euro in simple ways. I focus on basic measures of economic performance: the means and standard deviations of output growth, inflation, and long-term interest rates. For 20 industrial countries, I measure the effects of IT and euro adoption relative to discretionary policy. For 22 emerging market economies, none of

which uses the euro, I compare IT to discretion.

I measure the effects of alternative regimes by comparing different countries and time periods. The basic approach is "differences in differences": I compare changes in performance in countries that adopted a new policy and countries that did not. An important detail is controlling for the initial level of performance; this addresses the problem that changes in policy regime are endogenous (Ball and Sheridan, 2005).

The results suggest that neither inflation targeting nor euro adoption has had major effects on the performance of advanced economies. In emerging markets, however, IT has substantially reduced output volatility.

Methodology

For advanced economies, I examine economic performance over three time periods. The first runs from 1985 to the early 1990s, when many countries adopted IT, and the second runs from the early 90s to the late 90s. Ball and Sheridan examine roughly these periods in measuring the effects of IT. The third time period begins in the late 90s, when additional countries adopted IT and the euro was created. I end this period in mid-2007 to avoid the financial crisis that started the next year.

For emerging market economies, I compare two time periods. One runs from 1985 to the late 1990s, when a group of EMEs adopted inflation targeting, and the other runs from the late 90s

to 2006. This choice of periods follows Goncalves and Salles (2008).

Here I describe how I measure the effects of IT and euro adoption in advanced economies. As detailed below, the analysis of EMEs is a simplified version of this approach, as there are only two time periods and two choices of policy.

Let X_{it} be some measure of economic performance –- say the average rate of inflation –- in country i over period t. There are three time periods: t=1, 2, 3. My basic regression is

(1) $X_{it} - X_{it-1}$

$= aD^2_t + bD^3_t + cI_{it} + dE_{it} + eX_{it-1}(D^2_t) + fX_{it-1}(D^3_t)$.

In this regression, there is an observation for each country in periods t=2,3. D^2_t and D^3_t are dummy variables for the two periods.

The variables of interest are I_{it} and $E_{it,}$ which indicate changes in monetary regime between periods t-1 and t. These variables are defined by

I_{it} = 1 if country i switched from discretion in period t-1 to IT or the euro in period t;

= 0 otherwise .

E_{it} = 1 if country i switched from discretion or IT in period t-1 to the euro in period t;

= 0 otherwise .

To interpret I and E, think of ordering monetary regimes

from the oldest to the most recent: discretion, then inflation targeting, then euro adoption. The variable I captures a switch from discretion to inflation targeting, and E captures a switch from inflation targeting to the euro. If a country switches from discretion to the euro, it makes the discretion-IT and IT-euro transitions at the same time. In this case, both I and E equal one.

The time dummies, D^2_t and D^3_t, capture international trends in economic performance. For example, when X_{it} is average inflation, the coefficient on D^2_t is negative, reflecting the fact that inflation fell in many countries from period 1 to period 2. The coefficient on D^3_t is close to zero, as inflation generally did not change much from period 2 to period 3.

X_{it-1} is the initial value of X in country i before the change measured on the left side of the equation. As stressed by Ball and Sheridan, a pure difs in difs regression is likely to produce biased estimates of policy effects because changes in policy are endogenous. Controlling for the initial X eliminates this problem. Notice that I let the coefficient on X_{it-1} differ across periods 2 and 3. Theoretically, this coefficient depends on the relative sizes of permanent and transitory shocks to X, which may differ across periods. (See the Appendix to Ball and Sheridan for details.)

Industrial Countries

I estimate equation (1) for the 20 advanced economies examined by Ball and Sheridan. The precise dating of the three time periods differs across countries. When I use quarterly data, the first period begins in 1985:1 for all countries. For countries that adopted IT in the early 90s, the second period begins in the first quarter of the new policy. For countries that did not adopt IT, the second period begins at the average of adoption dates for IT countries.

I date the start of the third period between 1999 and 2001. For countries that changed regimes during those years –- by adopting the euro or by late adoption of IT –- the third period starts in the quarter of the change. Once again, the start date for non-changers is the average for changers. The third period ends in 2007:2 for all countries. (See the Appendix to this chapter for details on the countries in the sample, the dating of periods, and other aspects of the analysis).

I estimate equation (1) for six versions of the variable X: the means and standard deviations of consumer price inflation; real output growth; and nominal interest rates on long-term government bonds. All data are from the OECD. Inflation data are quarterly; output and interest rate data are annual.

Table 1 summarizes the key coefficient estimates: the coefficients on I and E for the six measures of performance.

Table 1 is generally uninteresting: of the 12 coefficients, 11 are insignificant at the 10% level. Generally, the data do not indicate effects of either inflation targeting or the euro.

The only significant coefficient is the effect of IT on average inflation: -0.6 percentage points with a t-statistic of 2.5. To interpret this coefficient, note that average inflation for IT countries is 1.7% in period 2 and 2.1% in period 3. The coefficient estimate implies that these numbers would be 2.3% and 2.7% in the absence of IT. This effect is not negligible but not dramatic either.

Emerging Market Economies

Some economists argue that IT has had modest effects in advanced countries but larger effects in emerging markets. Here I examine this idea. Research on the euro in emerging markets will have to wait for euro accession by more Eastern European countries.

My analysis largely follows Goncalvez and Salles (2008), who extend Ball and Sheridan's work to emerging markets. There are only two time periods and no euro, so equation (1) simplifies to

(2) $X_{i2} - X_{i1} = a + bI_i + cX_{i1}$,

where I is a dummy indicating whether a country adopted IT in period 2. This regression measures the effect of IT adoption on performance, controlling for initial performance.

It is not obvious what countries to count as "emerging

markets." Here I use the 22 countries monitored by the Emerging Market Economies Section of the Federal Reserve. The results are similar for larger groups of countries, including the 36 examined by Goncalves and Salles and lists of emerging markets from the Economist Intelligence Unit and JP Morgan Chase.

All data are annual, from the International Financial Statistics. The first time period begins in 1985 and the second in the year of IT adoption –- or for non-adopters, the average adoption year (1998). The second period ends in 2006. Following Goncalvez and Salles, for each country I exclude years with inflation above 50%.

Table 2 reports the coefficients on the IT dummy for four performance measures: the means and standard deviations of inflation and output. The strongest effect is on the standard deviation of output: -2.1 percentage points with a t-statistic of 2.7. This effect is large relative to cross-country differences in the standard deviation of output. Thus IT appears to have an important stabilizing effect in emerging markets.

The estimated effect on average inflation is also sizable, although the statistical significance is borderline: -3.6 percentage points with t=1.9. Overall, the results support the view that IT has larger effects in emerging markets than in advanced economies.

III. PREVIOUS WORK ON INFLATION TARGETING

A large literature estimates the effects of inflation targeting. Many papers find, as I do, that IT has substantial benefits for emerging markets but not advanced economies. This is the conclusion of Walsh's (2009) literature review.[1]

The results of IT studies are not uniform, however. Some well-known papers claim that IT has significant effects in advanced economies. Here, I examine some of these studies critically.

To find influential papers, I searched Google Scholar in October 2009 for papers with "Inflation Targeting" in the title. I examined all empirical papers written since 2000 with at least 20 citations. Of these, six report evidence that IT has significant effects in advanced economies.

These papers report two kinds of findings. One is effects of IT on the behavior of output and inflation, which appear to contradict the results above. The other is evidence that IT affects the behavior of inflation expectations, as opposed to inflation itself. In my view, the second set of findings is more credible than the first.

Effects on Output and Inflation?

Four highly-cited papers report that IT affects the behavior

[1] A non-exhaustive list of supportive papers includes Ball and Sheridan, Goncalvez and Salles, Dueker and Fischer (2006), Mishkin and Schmidt-Hebbel (2007), and Lin and Ye (2007, 2009).

of inflation and output in advanced economies. In each case, there are reasons to doubt the results.

Cecchetti and Ehrmann (2000) and Neumann and von Hagen (2002) These papers are among the first to compare countries with and without inflation targets. Neumann and von Hagen find that IT substantially reduces both the mean and variance of inflation. Cecchetti and Ehrmann also find that IT reduces the variance of inflation, but they report that it raises the variance of output.

The main problem with these papers is they use a pure difference-in-differences approach, without controlling for initial conditions. Ball and Sheridan find that effects of IT often appear in such specifications but disappear when initial conditions are included. If the decision to adopt targets is endogenous and correlated with initial conditions, the pure difs-in-difs results are biased.

Vega and Winkelreid (2005) This paper seeks to control for the endogeneity of IT with a sophisticated econometric technique, propensity score matching. The authors report that IT reduces the mean and variance of inflation in advanced as well as emerging economies.

There are two reasons to question these results. One is the work of Lin and Ye (2007), who also use propensity score matching. That paper finds no significant effects of IT. The sets of advanced economies and the time periods in the two

studies appear similar. The different conclusions suggest that propensity score matching does not produce robust results in this application.

Second, some of Vega and Winkelreid's findings are simply implausible. They estimate that IT reduces average inflation in advanced economies by 3.3 percentage points. In the empirical work of Section II, average inflation for all non-targeters outside the euro area was 1.9% in period 2 (early to late 1990s) and 1.6% in period 3 (late 90s to 2006). Vega and Winkelreid's results imply that, had these countries adopted IT, average inflation would have been -1.4% and -1.7% in the two periods. In reality, it seems unlikely that inflation targeting would have produced deflation. Vega and Winkelreid's estimated effect is too large to believe.

Levin et al. (2004): This paper reports a strong effect of inflation targeting on the persistence of inflation. Inflation becomes more anchored in the sense that shocks die out more quickly. Specifically, impulse responses of inflation in a univariate AR model go to zero more quickly.

This result appears to be an artifact of choices of lag lengths. For all IT countries, Levin et al. assume that quarterly inflation follows an AR-1 process. For most non-IT countries, they assume an AR-3 or AR-4. If instead one estimates AR models of the same order for targeters and non-targeters,

measured inflation persistence is similar.

Levin et al. base their choices of lags on the AIC criterion. However, Faust (2009) uses Monte Carlo analysis to show that this criterion is unreliable in applications similar to Levin's. The AIC is likely to select a single lag even if the truth is several lags.

Inflation Expectations

Three papers focus on the behavior of expected inflation, as measured by either professional forecasts or comparisons of nominal and indexed bonds. This work finds that inflation targeting reduces short-term inflation expectations when targets are announced, and reduces the sensitivity of long-term expectations to economic news.

In this author's judgment, the evidence for these effects is stronger than for effects on actual inflation or output, but not overwhelming. Any effects that exist are subtle and raise puzzles.

Johnson (2002): This paper examines countries that reduced the level of inflation in the early 1990s. It compares countries that did and did not adopt inflation targets near the start of disinflation. It measures expected inflation with the average one-year-ahead forecast from Consensus Forecasts. Johnson finds that expected inflation fell more quickly for inflation targeters than for non-targeters.

There are no obvious flaws in Johnson's analysis, but it does raise a puzzle. As Johnson points out, a faster fall in expected inflation should allow targeters to achieve greater disinflation for a given path of output. Yet other work, including that of IT advocates, finds that IT does not change the output-inflation tradeoff during disinflation. For example, Bernanke et al. (1999) find no effect of IT on sacrifice ratios.

Levin et al., again: The Levin et al. paper that examines inflation persistence also examines expectations from Consensus Forecasts. It focuses on long-term expectations -- forecasts at horizons of three to ten years. The approach is straightforward: for a given country, the authors regress long-term expected inflation on average inflation over the previous three years. The estimated effects are close to zero for inflation targeters but significant for non-targeters. Levin et al. conclude that IT helps anchor inflation expectations.

Once again, there is a puzzle. The unconditional variance of long-term inflation expectations does not differ significantly between targeters and non-targeters. If inflation movements cause smaller shifts in expectations in targeting countries, something else must cause larger shifts to offset this effect. Levin et al. do not identify this offsetting factor. In any case, expectations are not more anchored unconditionally under inflation targeting.

Gurkaynak et al. (2006): This paper uses daily data to measure the effects of economic news and monetary policy on long-term inflation expectations. It measures these expectations with spreads between nominal and indexed government bonds. It finds significant effects in the United States, a non-inflation targeter, but not in Sweden, a targeter. It finds effects in the U.K. during part of its inflation targeting regime, before the Bank of England became independent in 1997, but not after. The authors conclude that "a well-known and credible inflation target" helps anchor expectations.

This evidence is suggestive but somewhat thin. Financial markets may respond differently to news in the U.S. and Sweden for reasons other than inflation targeting. The U.S. evidence comes from the first few years of the TIPS market, when interest-rate spreads may not have been good measures of expected inflation. The U.K. evidence suggests that central bank independence rather than inflation targeting is critical to expectations.

IV. INFLATION TARGETING AND THE CRISIS OF 2007-08

It is not surprising that researchers have found it difficult to detect effects of inflation targeting. The period from IT's inception in the early 1990s through 2006 was a tranquil one for advanced economies –- the "Great Moderation."

Facing few adverse shocks, central banks found it relatively easy to keep economies stable, with or without inflation targets.

During the Great Moderation, many economists suggested that IT would be tested when a major shock hit the world economy. Much speculation concerned IT's usefulness in containing an inflationary shock. As it turns out, the first test of IT was the financial crisis that began in 2007. Here I ask whether IT helped or hurt central banks in responding to this shock.

I focus on the speed with which central banks lowered interest rates during the crisis. The Fed began to lower rates in September 2007 after interbank loan markets froze. Most other central banks did little until October 2008, when the post-Lehman crisis made it obvious that looser policy was needed. We cannot draw firm conclusions from this episode. However, the absence of inflation targets was probably one factor explaining the Fed's faster response to the crisis.

Policy Rates

I examine central banks in the advanced economies studied in Section II, excluding the ECB which is discussed below. This group includes nine inflation targeters. Unfortunately, there is a shortage of non-targeters for comparison. The sample of countries includes three non-targeters. However, one of the three, Denmark, pegs its currency to the euro and thus lacks an independent monetary policy. Another, Japan, entered the

financial crisis with a policy interest rate of 0.50, making significant easing impossible. This leaves the U.S. as the only clean example of how a non-targeter responded to the crisis. Nonetheless, comparing the U.S. to the nine inflation targeters is instructive.

Figure 1 shows the interest rate targets of the ten central banks over 2007 and 2008. I adjust the scale for each country so the lines start at the same point in June 2007. The graph shows how quickly each central bank reduced interest rates relative to their pre-crisis levels.

The United States is an outlier in Figure 1. The Fed started easing rapidly in September 2007. Its target fell from 5.25% to 2.0% in May 2008. In contrast, most of the inflation targeting central banks held rates steady or even raised them until October 2008.

The inflation targeter that eased most quickly was Canada. A likely explanation is that Canada partially mimics U.S. policy to stabilize the U.S.-Canadian exchange rate.

While the U.S. experience is only one observation, it is prima facie evidence that discretionary policy produced a quicker response to the crisis than inflation targeting. Of course other factors could also explain U.S. policy. It could be that the perceived risks to inflation and output over 2007-08 were different than in other countries. To explore this issue, I

examine U.S. policy more closely and compare it to policy in two IT countries, the U.K. and Sweden.

The U.S. vs. the U.K. and Sweden

Between September 2007 and October 2008, while the Federal Reserve lowered interest rates rapidly, the Bank of England kept rates almost constant. The Riksbank raised rates. What explains these different policies?

The answer does not appear to lie in the behavior of output and inflation. Figure 2 shows the paths of these variables starting in January 2007. During the period of the Fed's idiosyncratic easing, inflation was slightly higher in the U.S. than in the other countries. Output growth was similar in the three countries through 2007Q4. A recession started in 2008Q1 in the United States, a quarter before the U.K. and Sweden. However, much of the Fed's easing occurred before the end of 2007.

Figure 3 shows forecasts of future growth and inflation in the U.S. and Sweden. Specifically, it shows forecasts for 2009 produced by the central bank at different points in time. (Forecasts are not available with the same timing in the U.K., but generally U.K. forecasts were similar to Swedish forecasts.) Forecasted growth is consistently higher in the U.S. than in Sweden. Forecasted inflation is higher in Sweden through October 2008, but only by amounts ranging from 0.4 to 0.7 percentage

points (except for June 2008). These differences do not explain the major divergence in policy.

Notice that, until Fall 2008, both Sweden and the U.S. were forecasting respectable growth rates and inflation at or above desired levels. These forecasts and similar ones for the U.K. suggest that policy in all three countries should have remained steady or tightened. The puzzle is not why the European countries failed to ease policy, but why the U.S. did ease.

Evidently, the U.S. responded to the financial crisis even though it did not influence policymakers' forecasts of output and inflation. It could be that policymakers perceived a risk of a major recession even though the most likely outcomes were benign. That is, the easing could be insurance against tail events. The Fed might also care about financial stability for its own sake, even holding constant future output.

The absence of inflation targeting probably made it easier for the Fed to loosen policy. In IT regimes such as the U.K.'s and Sweden's, the central bank must justify a shift in policy based on inflation forecasts. There was nothing in U.S. inflation forecasts to justify a rapid decrease in interest rates.

A possible explanation for divergent policies is that a financial crisis was more evident in the U.S. than elsewhere. However, the U.K.'s financial crisis was in many ways similar to

or worse than the U.S. crisis. The Fed started easing in September 2007 when interbank lending froze; this happened for U.K. banks as well as U.S. banks. The Northern Rock bank run in the U.K. also occurred in September 2007; comparable U.S. institutions did not seem endangered until the Bear Stearns takeover in March 2008.

More generally, most observers of the U.K. economy perceived a major credit crunch by early 2008. In May 2008 the Financial Times reported on a speech by the chief executive of HBOS, the U.K.'s largest mortgage lender. The article was headlined "HBOS sees no early end to crisis." At this point the Bank of England's interest rate target was 5.0%, the same level as in early 2007. The Fed had cut its target from 5.25% to 2.0%.

V. THE EURO

Before the euro was created, economists predicted many effects, both positive and negative. We saw earlier that, for the period 1999-2006, euro adoption had no detectable effects on the level or volatility of output, inflation, or interest rates. Clearly, the euro produced neither an economic miracle nor a disaster.

The ECB responded slowly to the financial crisis of 2007-08: like many inflation targeting central banks, it did not ease until October 2008. A possible explanation is that the ECB's

price stability goal caused it to act like an inflation targeter. In any case, there is no reason to think that monetary union per se was responsible for ECB policy.

While macro data do not yet show clear effects of the euro, we can look more closely to see whether potential benefits and costs are starting to appear. Advocates of the currency union stress the potential for greater economic integration, while skeptics suggest that a "one size fits all" monetary policy exacerbates output fluctuations in euro countries. Here I examine the evidence for these effects.

Economic Integration

Euro proponents argue that a common currency promotes trade and capital flows within the euro area. These effects follow from lower transaction costs, more transparent price comparisons, and the elimination of any risk of speculative attacks. Greater integration should increase competition and the efficiency of resource allocation, raising economic growth.

Trade: A large literature estimates the deteminants of trade with "gravity equations," in which trade between two countries depends on their size, distance from each other, income, and so on –- and whether the countries use a common currency. Using this approach, Rose (2000) famously estimated that a currency union increases trade among its members by 200%. This finding was based on data for small currency unions that predate the

euro; some used it to predict the effects of euro adoption.

In recent years, researchers have had enough data to estimate the actual effects of the euro. They report effects that are much smaller than those found by Rose, but non-negligible. A survey by Baldwin (2006) concludes that the euro has raised trade among members by 5-15%. A survey by Frankel (2008) says 10-20%.

One might think the effects of a currency union grow over time. But Frankel finds that the effects on trade stop growing after five years or so, based on data for both the euro and other currency unions.

I supplement this research with some simple new evidence. If a common currency promotes trade within the euro area, this trade should increase relative to trade between euro countries and other parts of the world. Figure 4 looks for this effect in the DOTS data on bilateral trade from the IMF. Trade within the euro area is measured by all exports from one euro country to another, as a percent of euro area GDP. Trade with another group of countries is measured by exports from the euro area to the other countries plus imports from the other countries, again as a percent of euro area GDP. All variables are normalized to 100 in 1998, the year before the euro was created.

In Figure 4, one group of non-euro countries has just one member, the United Kingdom. The U.K. is the European Union's

most prominent non-adopter of the euro. Another group of countries includes 11 advanced economies, specifically non-euro countries that were members of the OECD in 1985. The final group is all 183 non-euro countries in the DOTS data set.

The Figure suggests that the euro has boosted trade among euro countries. Trade with other regions rose more rapidly than intra-euro trade from 1993 through 1998. But then intra-euro trade started rising relative to trade with the U.K. and other advanced economies, especially after 2002. The Figure suggests a larger impact of the euro on trade than the 5-20% reported in the literature.

Notice that trade among euro countries has not risen more than trade with all DOTS countries. This reflects rising trade with emerging economies such as India and China, which have become larger parts of the world economy. One way to interpret the euro's influence is that it has helped intra-European trade keep pace with trade between Europe and emerging markets.

Capital Markets: Lane (2009) surveys the effects of the euro on capital market integration. These effects have been strong. One effect is an increase in cross-border holdings of bonds, which in turn has stimulated bond issuance by corporations. Outstanding debt securities issued by non-MFI corporations in the euro area tripled between 1998 and 2007.

According to the research surveyed by Lane, the euro has

also increased cross-border holdings of equities by about two thirds. It has increased flows of foreign direct investment and cross-border lending between banks.

Does One Size Fit All?

When a country adopts the euro, it gives up independent monetary policy. It can no longer adjust interest rates to offset country-specific shocks. Critics of monetary union suggest that the reduced scope for policy leads to greater output volatility.

A related problem involves divergence in national price levels. A country in an economic boom is likely to experience inflation above the euro average. Higher prices make the economy less competitive; in effect, it experiences a real appreciation of its currency. The loss of competitiveness is likely to reduce output eventually. Indeed, to reverse the divergence of price levels, the economy needs a sufficiently large slump to push inflation below the euro average temporarily.

This effect is emphasized by Blanchard (2006, 2007). He calls the euro a “suboptimal currency area” and predicts “long, rotating slumps” as price levels in different countries diverge and then are brought back in line.

Evidence on Output Fluctuations Is there evidence of these effects? So far, there is no clear effect of the euro on output volatility. Recall the finding in Section II that euro adoption

does not have a significant effect on the standard deviation of output.

We can examine this issue another way. Currency union means that monetary policy cannot be tailored to the circumstances of individual countries. In a given year, some countries will experience booms and recessions that could be smoothed out if the countries had separate monetary policies. If this phenomenon is important, currency union should create greater dispersion in output growth across countries.

There is no evidence of this effect. Figure 5 shows the standard deviation of output growth across euro members (all countries except Luxembourg that joined by 2000). There is no upward trend after the euro was created; the dispersion in growth rates appears stable back to 1980.

Evidence on Price Levels On the other hand, there may be reason to worry about larger output fluctuations in the future. The euro era has seen a significant divergence in price levels across countries, causing changes in competitiveness that eventually need to be reversed.

The dispersion in inflation rates across euro countries has fallen sharply since monetary union. In recent years, this dispersion has been comparable to inflation dispersion across regions in the United States –- where economists do not worry about rotating slumps caused by a common currency. Mongelli and

Wyploz (2009) call this phenomenon “price convergence.” However, as Lane (2006) points out, the serial correlation of relative inflation rates is higher in Europe than in the U.S. As a result, inflation differences cumulate to larger price-level differences in Europe.

Figures 6 and 7 illustrate this point. Figure 6 compares the 11 major euro economies to 27 metropolitan areas in the U.S. The Figure shows the standard deviation of inflation rates across countries or metro areas and the standard deviation of price levels. All price levels are normalized to 100 in 1998, so the standard deviation of price levels is zero in that year. The Figure confirms that inflation differences within Europe have fallen to U.S. levels. At the same time, price levels are diverging at a faster rate in Europe.

Figure 7 compares four broad regions of the United States to the four largest euro economies. Here, price level dispersion in 2008 is more than three times as large in Europe as in the U.S.

Europe’s price-level dispersion may partly reflect changes in equilibrium real exchange rates. However, much of the dispersion is likely due to demand-driven inflation differences. Lane reports a strong correlation between the cumulative change in a country’s price level and cumulative output growth, which he interprets as a “medium run Phillips curve.”

As of 2008, the spreading out of European price levels was

continuing. This fact suggests that countries are building up real exchange rate misalignments that must eventually be reversed. This process could involve the rotating slumps that Blanchard predicts.

VI. THE ROLE OF MONETARY AGGREGATES

A generation ago, any discussion of monetary regimes would emphasize targeting of a monetary aggregate. Versions of this policy, advocated by Milton Friedman in the 1960s, were practiced by the U.S. during the "monetarist experiment" of 1979-82 and by Germany and Switzerland during the 1980s and 90s. Today, however, most central banks pay little attention to monetary aggregates. They believe that instability in money demand makes the aggregates uninformative about economic activity and inflation. Policymakers rarely mention the behavior of money in explaining their interest-rate decisions.

The major exception is the European Central Bank, which says that monetary aggregates play a significant role in its policymaking. Here I ask how the ECB's attention to money has affected policy decisions and economic outcomes. The answer is anti-climactic: the ECB's attention to money does not matter. While policymakers discuss monetary aggregates extensively, these variables have rarely if ever influenced their choices of interest rates.

The Two Pillars

The primary goal of the ECB is price stability, defined as inflation "below but close to 2%." Policymakers adjust short-term interest rates to achieve this goal. The ECB says that "two pillars" underlie its choices of rates. One is "economic analysis," in which the ECB forecasts inflation based on real activity and supply shocks. This process is similar to inflation forecasting at inflation-targeting central banks. The second pillar is "monetary analysis," in which policymakers examine measures of money and credit. The primary focus is the growth rate of the M3 aggregate (roughly equivalent to M2 in the U.S.). The ECB compares M3 growth to a "reference value" of 4.5%. Policymakers say this comparison influences their choices of interest rates; everything else equal, higher M3 growth may lead to tighter policy.

The ECB argues that its monetary analysis helps it achieve price stability because money growth is a signal of inflation at medium to long horizons. Many outsiders criticize the ECB's logic and argue that it should switch to pure inflation targeting. The ECB volume edited by Beyer and Reichlen (2008) summarizes this debate.

I examine the roles of the ECB's two pillars over the history of its policymaking. I find that economic analysis and monetary analysis usually produce the same prescriptions for

policy. On the rare occasions when the two analyses conflict, economic analysis appears to determine policy. Therefore, the ECB's policy decisions have always been close to those it would have made if economic analysis were its only pillar.

Collinearity

I base my conclusions largely on editorials in the ECB Monthly Bulletin, which explain the interest-rate decisions of the Governing Council. A typical editorial describes the ECB's current economic analysis and what it suggests for the direction of policy. The editorial then "cross-checks" this prescription with monetary analysis. Usually the monetary analysis confirms the economic analysis.

As an example, consider the Monthly Bulletin of July 2008, which explains a decision to raise interest rates by a quarter point. The editorial summarizes the ECB's economic analysis, concluding that "risks to price stability at the policy-relevant medium horizon remain clearly on the upside." This judgment reflects current inflation above the 2% limit and fears about rising food and energy prices. The economic analysis implies that a policy tightening is warranted.

After reviewing the ECB's economic analysis, the editorial states that "the monetary analysis confirms the prevailing upside risks to price stability at medium-to-longer-term horizons." It notes that annual M3 growth exceeds 10%. This number "overstates

the underlying path of monetary expansion, owing to the impact of the flat yield curve and other temporary factors." Nonetheless, the monetary analysis "confirms that the underlying rate of money and credit growth remains strong." Thus the monetary analysis points to the same need for tightening as the economic analysis.

ECB economists acknowledge that situations like July 2008 are typical. At most policy meetings, the economic and monetary analyses point to the same action. Fischer et al (2008) is perhaps the ECB's most detailed review of the role of money in its policymaking. That paper concludes "there is a high degree of collinearity between the communication regarding the monetary and economic analyses." This collinearity makes the role of money "difficult to assess."

Exceptions to Collinearity

The ECB's economic and monetary analyses do not always point in the same direction. Fischer et al and Trichet (2008) cite two episodes in which the two pillars produced conflicting signals. In my reading of the record, in one case policy followed the prescription of the economic analysis; in the other, the two signals did not really differ by much. Since Fischer et al and Trichet wrote, there has been one clear case of conflicting signals, and again the economic analysis prevailed.

2001-2003: This period is one of the episodes identified by Fischer et al. and Trichet. Fischer et al report:

> Between mid-2001 and mid-2003, the monetary analysis... pointed to relatively balanced risks to price stability, whereas the economic analysis saw risks on the downside. Overall, the successive cuts of interest rates of this period suggest that the economic analysis played the decisive role in explaining monetary policy decisions.

Fischer et al explain why policymakers disregarded their monetary analysis. In 2001-03, M3 was growing rapidly, but this reflected unusual temporary factors. Savers were shifting to safe assets in the wake of the global stock market decline and the September 11 terrorist attacks. This shift did not necessarily indicate inflationary pressures.

Trichet (2008) interprets this episode differently than Fischer et al. He says "the underlying monetary expansion was rather sustained" and "monetary analysis had a particularly decisive influence" on policy. In Trichet's view, rapid money growth prevented the ECB from lowering interest rates more than it did. Yet the ECB reduced its interest rate target to 2.0%. We do not know what would have happened if money growth were lower. It seems dubious, however, that the young ECB, eager to establish its credibility as an inflation fighter, would have pushed interest rates much below 2%.

December 2005: In this month the ECB initiated a series of interest rate increases. Both Fischer et al. and Trichet say the ECB's monetary and economic analyses gave different signals at the time. In their view, the monetary analysis was decisive.

Trichet gives this account:

> In December 2005, when we first increased policy rates, many commentators judged our move as premature against the background of a seemingly fragile economic recovery. In fact, at that time the signals coming from the economic analysis were not yet so clear and strong. But the continued strong expansion of money and credit through the course of 2005 gave an intensifying indication of increasing risks to medium term price stability which played a decisive role in our decision to start increasing policy rates in late 2005.... Without our thorough monetary analysis, we probably would have been in danger of falling behind the curve...

Fischer et al. contrast the "degree of uncertainty" in the economic analysis to the "stark signal" provided by monetary analysis.

In my reading, the real-time policy record does not support this interpretation. It suggests a typical case of collinearity rather than a decisive role for money. In the Monthly Bulletin of December 2005, the editorial says the decision to raise rates reflected "risks to price stability identified in the economic analysis and confirmed by cross-checking with the monetary analysis." After that, the editorial devotes six paragraphs to summarizing the economic analysis, concluding that "the main scenario for price stability emerging from the economic analysis remains subject to upside risks." Then a single paragraph makes the point that "evidence pointing to increased upside risks to price stability over the medium to longer term comes from the monetary analysis." The editorial concludes by repeating that the economic analysis was "confirmed by cross-checking" with the monetary analysis.

Fall 2008 Like many central banks, the ECB lowered interest rates rapidly during the post-Lehman financial crisis. The ECB's actions were motivated by its economic analysis. Monetary analysis did not indicate a need for rapid easing, but it was disregarded.

The ECB first cut rates by half a percent on October 8, in between policy meetings. The press release explaining this action includes only economic analysis. It discusses the influence of lower growth and other non-monetary factors on inflation. The twelve-month growth rate of M3 was over 8%, far above the reference value of 4.5%, but the press release ignores this fact.

At its November meeting, the Governing Council cut rates by another half percent. In the Monthly Bulletin, this decision is explained by economic analysis: as the world economy slumped, "a number of downside risks to economic activity have materialized." The monetary analysis does not support a cut in interest rates. To the contrary, "taking the appropriate medium-term perspective, monetary data up to September confirm that upside risks to price stability are diminishing but that they have not disappeared completely." The growth rate of M3 was still far above the reference value. If policymakers put a significant weight on monetary analysis, it seems unlikely they would have cut interest rates as sharply as they did.

VII. HARD CURRENCY PEGS

The final monetary regime that I examine is a hard peg to a foreign currency. Under this policy, as in a currency union, a country gives up independent monetary policy. There are two basic versions of a hard peg: dollarization and a currency board. In the first, a country abolishes its national currency and uses a foreign one. In the second, the country maintains its currency but seeks a permanently fixed exchange rate against a foreign currency. It pledges not to adjust the exchange rate, and it maintains enough foreign-currency reserves to prevent a speculative attack from forcing devaluation.

Table 3 lists the largest economies to adopt hard pegs since 1980. These policies are still in effect everywhere but Argentina. In most cases, the initial purpose of the peg was to stop high inflation –- annual rates of three digits or more. Hong Kong and El Salvador are exceptions; their inflation rates were moderate when they adopted hard pegs. Their motivation was to eliminate exchange-rate fluctuations and increase integration with foreign economies.

Benefits of Hard Pegs

When governments have used hard pegs to stop inflation, they have always been successful. A hard peg reliably reduces inflation to single digits within a few years, and inflation stays low as long as the peg continues.

However, a hard peg is far from essential for conquering inflation. Many countries besides the hard peggers experienced high inflation in the 1980s or 1990s, and almost all have eliminated this problem. They used less drastic policies such as a temporary exchange rate peg or a monetary tightening under flexible exchange rates.

The effects of a hard peg on economic integration are potentially important. This is especially true for Hong Kong; that economy exports more than 100% of its GDP, making stable exchange rates more important than usual. However, research has not quantified the benefits of hard pegs for trade or capital flows.

Hard Pegs and Capital Flight

The primary disadvantage of a hard peg, like membership in a currency union, is the loss of national monetary policy. For the countries that have adopted hard pegs, this cost has been most pronounced during episodes of capital flight. Other countries use the exchange rate as a shock absorber: depreciation reduces the output losses following capital flight. Lacking this shock absorber, hard peggers experience deeper slumps.

This problem has arisen for most of the countries with hard pegs:

Argentina: This country experienced capital flight during the Tequila crisis of the mid-1990s and again when government

debt rose in the late 90s. The result was a deep recession, with the unemployment rate rising to nearly 20%. The slump produced a political crisis in 2001, with rioting, a series of interim governments, and finally the abandonment of the hard peg.

Hong Kong: The East Asian financial crisis hit Hong Kong harder than most of its neighbors, whose currencies depreciated. Cumulative output growth in Hong Kong was -3.5% over 1998-1999. Growth was positive over this period in the other Asian tigers: 2.6% in South Korea, 5.8% in Singapore, and 10.3% in Taiwan. One symptom of Hong Kong's slump was deflation: the price level fell 15% from 1998 to 2004.

Eastern Europe: Severe capital flight hit emerging Europe during the world financial crisis of 2008. By far the biggest losers were the Baltic countries with currency boards. For 2008-2010, the IMF forecasts cumulative output growth of -19% in Estonia, -26% in Latvia, and -16% in Lithuania. These output losses dwarf those of other European countries.

The other European country with a currency board is Bulgaria. Its slump has been less severe than those in the Baltics: forecasted growth for 2008-2010 is 1.7%, including -5% in 2009. However, leaving aside the Baltics, Bulgaria is one of the two European countries with the largest output losses following the financial crisis. (The other is Romania, where the central bank has pursued unusually tight policy during a

transition to inflation targeting.)

Overall, these experiences cast doubt on the wisdom of hard pegs. An economy with a hard peg is likely to suffer a severe recession at some point because of capital flight. (This has not happened yet in Ecuador or El Salvador, but observers worry about the future. Ecuador is losing competitiveness because its inflation rate has persistently exceeded the U.S. level.)

VIII. CONCLUSION

This chapter has reviewed the experiences of economies with alternative monetary regimes. The introduction lists the main findings. Here I summarize some lessons for different types of economies.

- *The United States*: The U.S. has not suffered from its failure to adopt inflation targets. During the Great Moderation, inflation targeting had little effect on the performance of advanced economies. During the financial crisis of 2007-08, the absence of targets probably made it easier for the Fed to ease policy aggressively.
- *The Euro Area*: The ECB's idiosyncratic emphasis on monetary analysis is neither good nor bad. Since the ECB's founding, its choices of interest-rate targets would not have differed much if it relied only on economic analysis.
- *A Potential Euro Adopter*: History suggests that adopting the

euro does not have dramatic effects on economic performance. There is solid evidence that the euro promotes integration among economies. On the other hand, euro countries have experienced changes in competitiveness arising from divergent price levels. It is not obvious whether the benefits of the euro are larger or smaller than the costs.

- *A Non-European Emerging Economy*: In contrast to advanced economies, emerging economies have benefitted significantly from inflation targeting. IT has reduced the volatility of output. The more rigid policy of a hard currency peg has proven dangerous: it leads to deep recessions when capital flight occurs.

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APPENDIX

This Appendix provides details of the empirical work in Section II on the effects of IT and the euro.

The samples are 20 advanced economies and 22 emerging economies. I measure the means and standard deviations of macro variables over three time periods for the advanced economies and two periods for the emerging economies. Tables A1 and A2 list the two sets of countries, the dating of the periods, and the country's regime during each period: D for discretion, IT for inflation targeting, and E for euro membership.

For advanced economies, the dating of periods is by quarter. I use Ball and Sheridan's dating of the start of IT regimes. The start of euro membership is 1999:1 for all countries in the sample. The quarterly dating is used in regressions for the mean and standard deviation of inflation, which are constructed from quarterly data.

The means and standard deviations of output growth and interest rates are constructed from annual data. In regressions for these variables, the dating of periods is annual. When a regime shift occurs in the first quarter of a year, that year is the start of the new sample period. If a shift occurs in quarters 2, 3, or 4 of a year, that year is left out of the analysis; one period ends in the previous year and the next begins in the year after.

For countries that did not switch regimes between period t-1 and t, the start of period t is the average of the start dates for countries that did switch. In quarterly data, this is 1993:3 for t=2 and 1999:1 for t=3.

For emerging economies, all data are annual. The dating of IT adoption follows Goncalves and Salles. Again, the start of the second period for non-targeters is the average date for targeters (1998).

For advanced economies, I estimate equation (1) for six measures of economic performance. For emerging economies, I estimate equation (2) for four measures of performance. Tables 1 and 2 summarize the key coefficient estimates. Tables A3 and A4 show the full regression results.

Table 1
Effects of Inflation Targeting and Euro Adoption
(Advanced Economies)

	Mean			Standard Deviation		
	Inflation	Output growth	Interest rate	Inflation	Output growth	Interest rate
Effect of Inflation Targeting	-0.62	0.15	0.40	0.00	0.18	0.12
	(0.25)	(0.49)	(0.27)	(0.22)	(0.17)	(0.15)
Effect of Euro Adoption	0.44	-0.44	-0.59	-0.42	0.09	0.07
	(0.34)	(0.64)	(0.38)	(0.30)	(0.22)	(0.22)

(Standard errors are in parentheses)

Table 2
Effects of Inflation Targeting
(Emerging Economies)

	Mean		Standard Deviation	
	Inflation	Output growth	Inflation	Output growth
Effect of Inflation Targeting	-3.58	-0.23	-1.24	-2.08
	(1.92)	(0.66)	(1.67)	(0.78)

(Standard errors are in parentheses)

Table 3

Largest Economies Adopting Hard Pegs, 1980-Present

Currency Boards

Argentina (ended 2001)

Hong Kong

Bulgaria

Estonia

Latvia

Lithuania

Dollarization

Ecuador

El Salvador

Table A1
Sample of Advanced Economies

Country	Period 1	Regime	Period 2	Regime	Period 3	Regime
Australia	1985:1-1994:2	D	1994:4-1998:4	IT	1999:1-2007:2	IT
Austria	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Belgium	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Canada	1985:1-1991:4	D	1992:1-1998:4	IT	1999:1-2007:2	IT
Denmark	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	D
Finland	1985:1-1993:4	D	1994:1-1998:4	IT	1999:1-2007:2	E
France	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Germany	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Ireland	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Italy	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Japan	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	D
Netherlands	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
New Zealand	1985:1-1990:1	D	1990:3-1998:4	IT	1999:1-2007:2	IT
Norway	1985:1-1993:2	D	1993:3-2000:4	D	2001:1-2007:2	IT
Portugal	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	E
Spain	1985:1-1995:1	D	1995:2-1998:4	IT	1999:1-2007:2	E
Sweden	1985:1-1994:4	D	1995:1-1998:4	IT	1999:1-2007:2	IT
Switzerland	1985:1-1993:2	D	1993:3-1999:4	D	2000:1-2007:2	IT
United Kingdom	1985:1-1992:3	D	1993:1-1998:4	IT	1999:1-2007:2	IT
United States	1985:1-1993:2	D	1993:3-1998:4	D	1999:1-2007:2	D

D = Discretion, IT = Inflation Targeting, E = Euro

Table A2
Sample of Emerging Economies

Country	Period 1	Regime	Period 2	Regime
Brazil	1985-1998	D	1999-2006	IT
Chile	1985-1990	D	1991-2006	IT
China	1985-1997	D	1998-2006	D
Colombia	1985-1999	D	2000-2006	IT
Czech Republic	1985-1997	D	1998-2006	IT
Hong Kong	1985-1997	D	1998-2006	D
Hungary	1985-2000	D	2001-2006	IT
India	1985-1997	D	1998-2006	D
Indonesia	1985-1997	D	1998-2006	D
Israel	1985-1991	D	1992-2006	IT
Malaysia	1985-1997	D	1998-2006	D
Mexico	1985-1998	D	1999-2006	IT
Peru	1985-1993	D	1994-2006	IT
Poland	1985-1998	D	1999-2006	IT
Russia	1985-1997	D	1998-2006	D
Saudi Arabia	1985-1997	D	1998-2006	D
South Africa	1985-1999	D	2000-2006	IT
South Korea	1985-1997	D	1998-2006	IT
Taiwan	1985-1997	D	1998-2006	D
Thailand	1985-1999	D	2000-2006	IT
Turkey	1985-1997	D	1998-2006	D
Venezuela	1985-1997	D	1998-2006	D

D= Discretion, IT = Inflation Targeting

Table A3
Regression Results- Advanced Economies (Equation 1)

Dependent vbl: change in	**Mean Inflation**	**Std Dev of Inflation**	**Mean Growth**	**Std Dev of Growth**	**Mean Interest rate**	**Std Dev of Interest rate**
D_t^2	1.12	1.15	2.28	1.03	3.58	0.68
	(0.32)	(0.31)	(1.03)	(0.27)	(0.53)	(0.19)
D_t^3	-0.34	1.52	-1.47	-0.17	-3.14	-0.13
	(0.50)	(0.57)	(1.17)	(0.39)	(1.03)	(0.30)
I_{it}	-0.62	0.00	0.15	0.18	0.4	0.12
	(0.25)	(0.23)	(0.49)	(0.17)	(0.28)	(0.15)
E_{it}	0.44	-0.42	-0.44	0.09	-0.59	0.07
	(0.34)	(0.30)	(0.64)	(0.22)	(0.38)	(0.22)
$X_{i,t-1}\left(D_t^2\right)$	-0.80	-0.83	-0.67	-0.98	-0.72	-0.48
	(0.07)	(0.10)	(0.34)	(0.14)	(0.05)	(0.13)
$X_{i,t-1}\left(D_t^3\right)$	-0.18	-1.28	-0.41	-0.86	-0.38	-0.97
	(0.21)	(0.25)	(0.18)	(0.19)	(0.13)	(0.16)

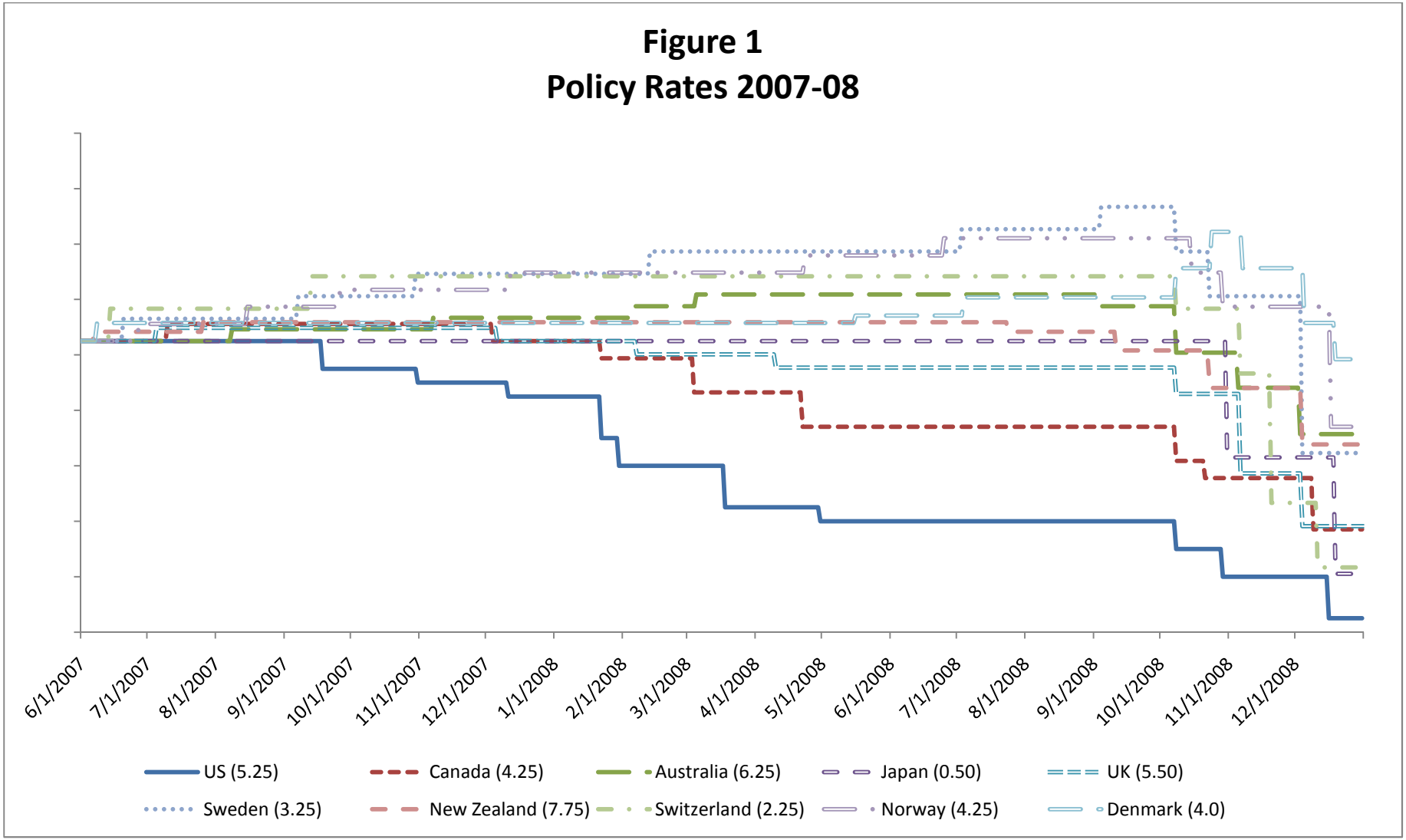
(Standard errors are in parentheses)

Table A4
Regression Results- Emerging Economies (Equation 2)

Dependent vbl: change in	**Mean Inflation**	**Std Dev of Inflation**	**Mean Growth**	**Std Dev of Growth**
Constant	3.21	2.54	4.02	3.58
	(1.76)	(1.51)	(0.67)	(1.04)
I_i	-3.58	-1.24	-0.22	-2.08
	(1.92)	(1.67)	(0.66)	(0.78)
X_{i1}	-0.68	-0.56	-0.88	-0.79
	(0.08)	(0.08)	(0.10)	(0.25)

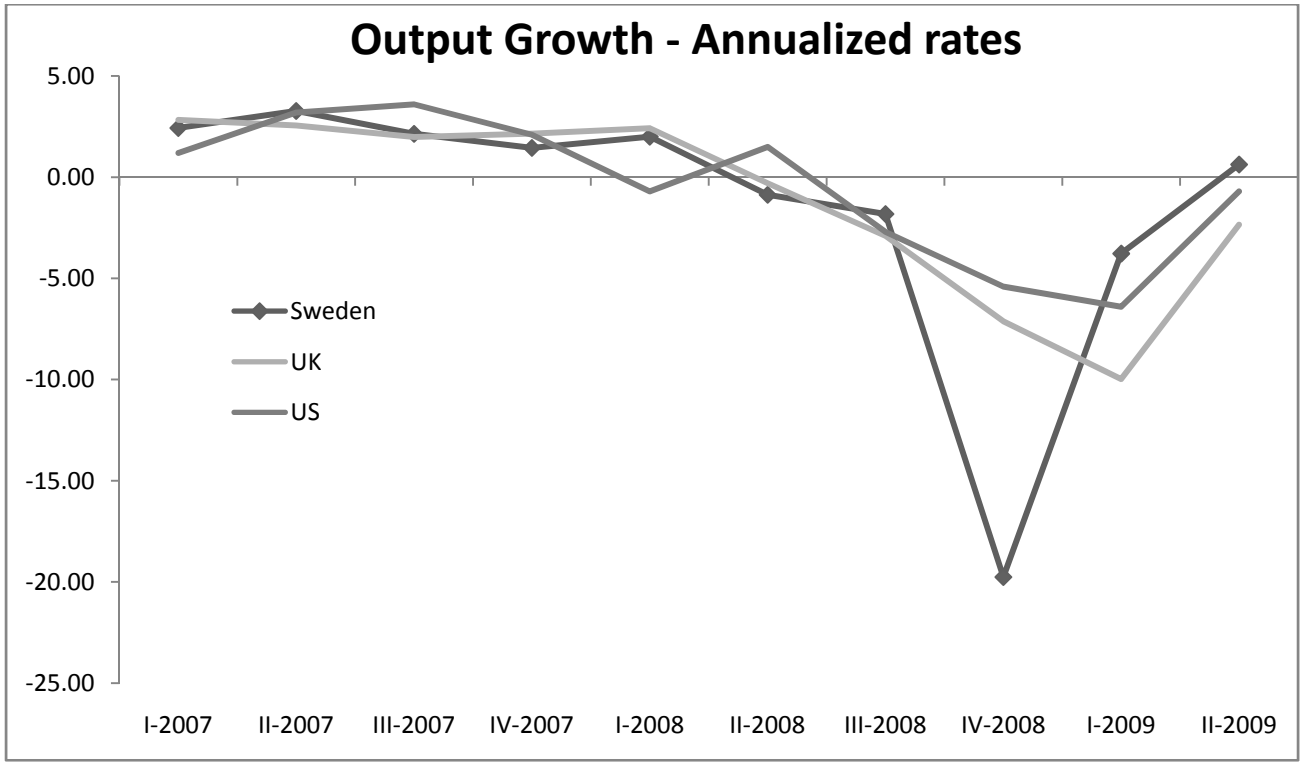
(Standard errors are in parentheses)

Figure 1
Policy Rates 2007-08



(Numbers in parentheses are policy rates on 6/1/07)

Figure 2


Output Growth - Annualized rates
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
Sweden
UK
US
I-2007
II-2007
III-2007
IV-2007
I-2008
II-2008
III-2008
IV-2008
I-2009
II-2009

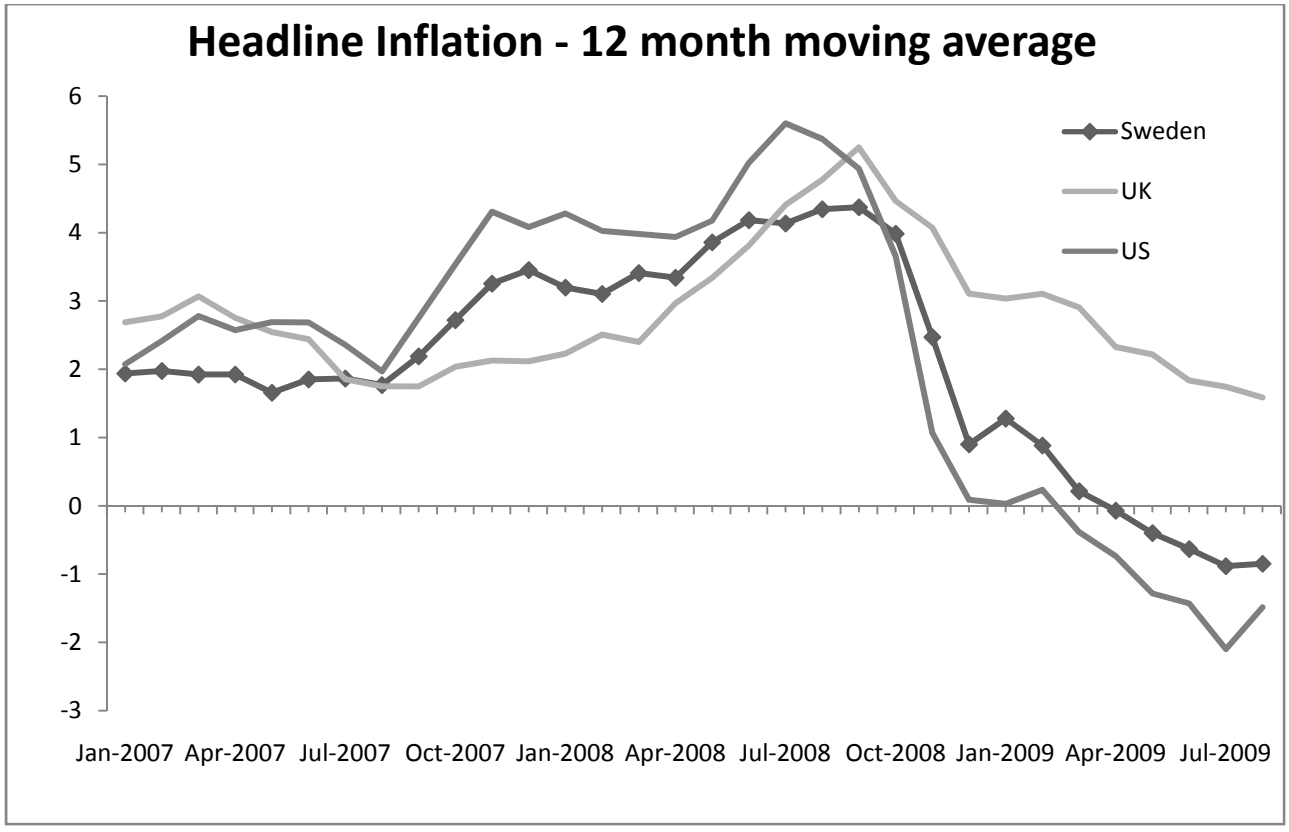
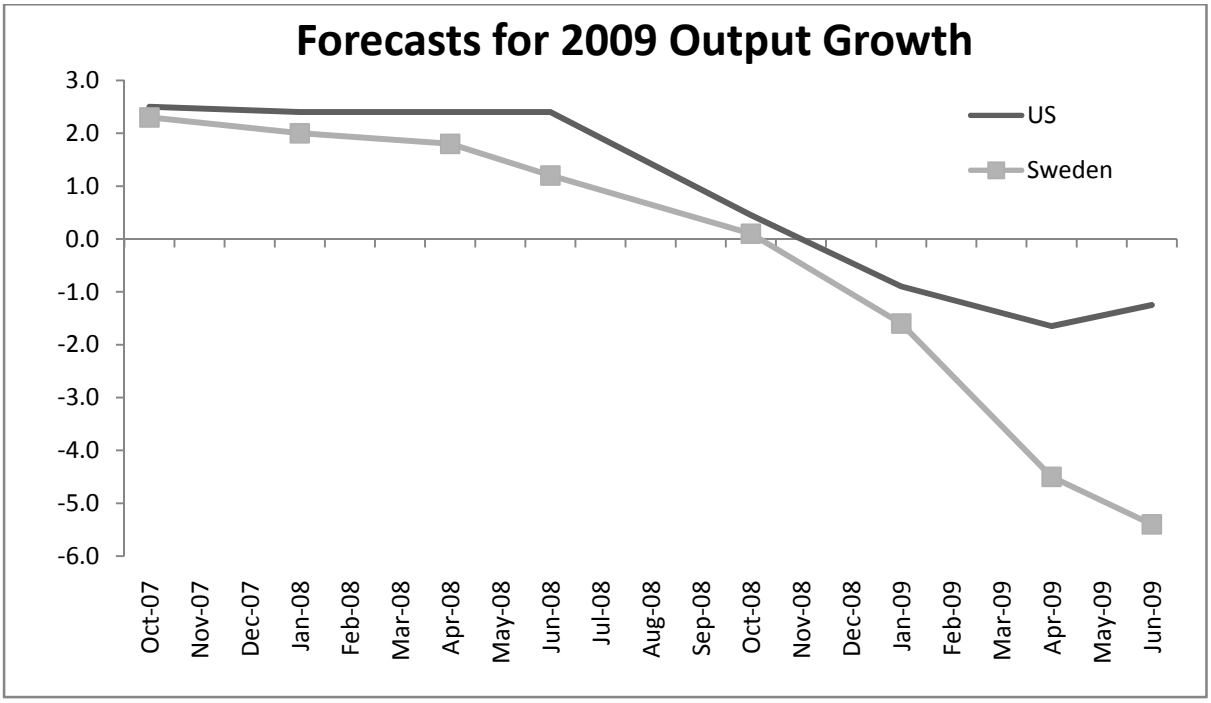

Headline Inflation - 12 month moving average
6
5
4
3
2
1
0
-1
-2
-3
Sweden
UK
US
Jan-2007
Apr-2007
Jul-2007
Oct-2007
Jan-2008
Apr-2008
Jul-2008
Oct-2008
Jan-2009
Apr-2009
Jul-2009

Figure 3


Forecasts for 2009 Output Growth
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
US
Sweden
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
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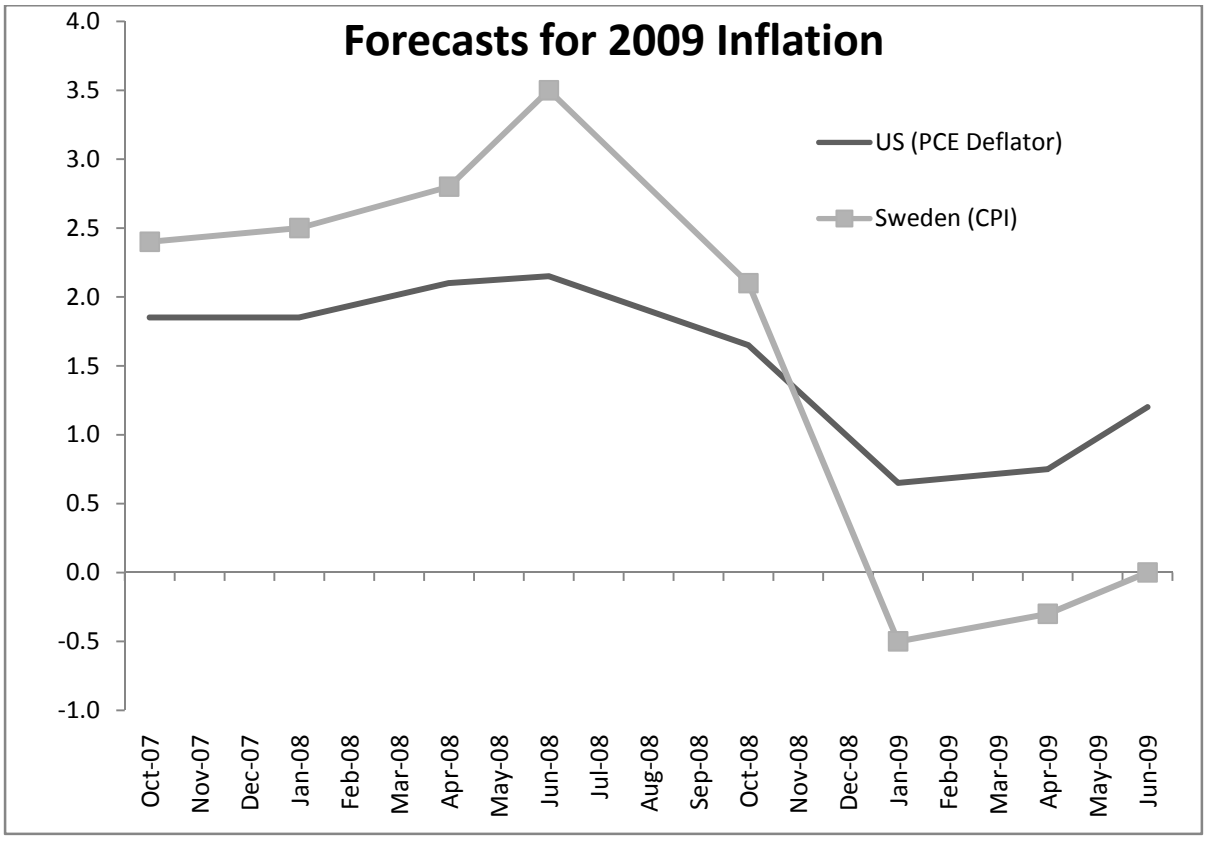
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09


Forecasts for 2009 Inflation
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
US (PCE Deflator)
Sweden (CPI)
Oct-07
Nov-07
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
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Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09

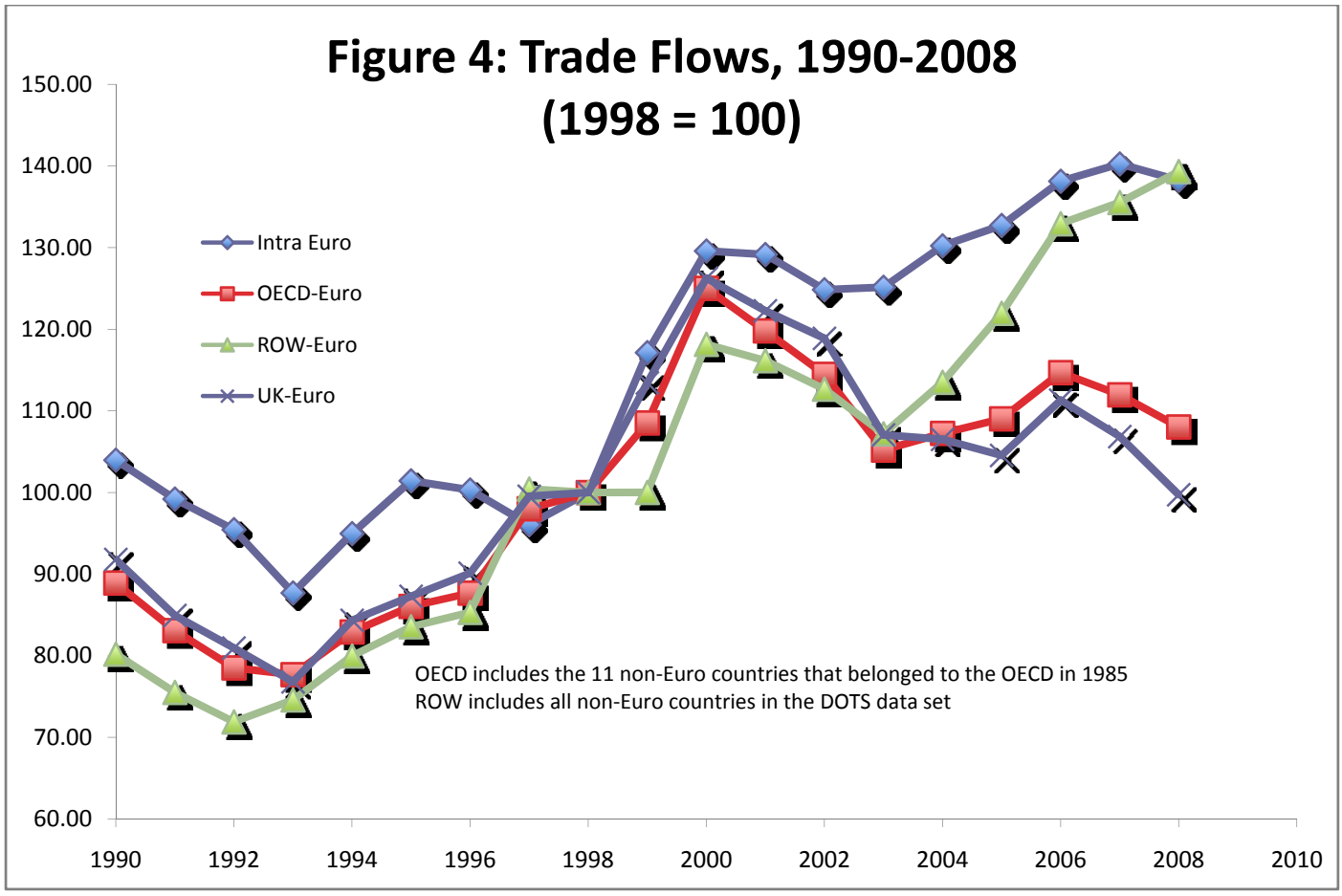


Figure 4: Trade Flows, 1990-2008
(1998 = 100)
150.00
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Intra Euro
OECD-Euro
ROW-Euro
UK-Euro
OECD includes the 11 non-Euro countries that belonged to the OECD in 1985
ROW includes all non-Euro countries in the DOTS data set

Figure 5

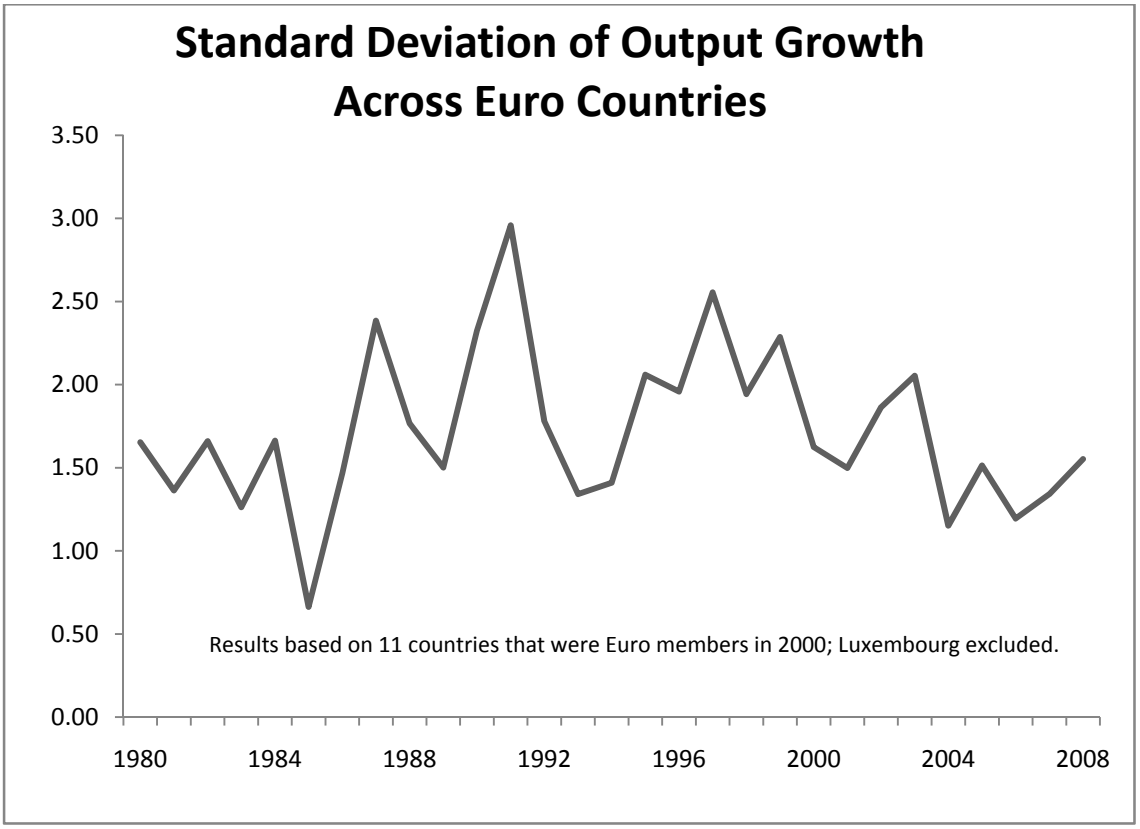
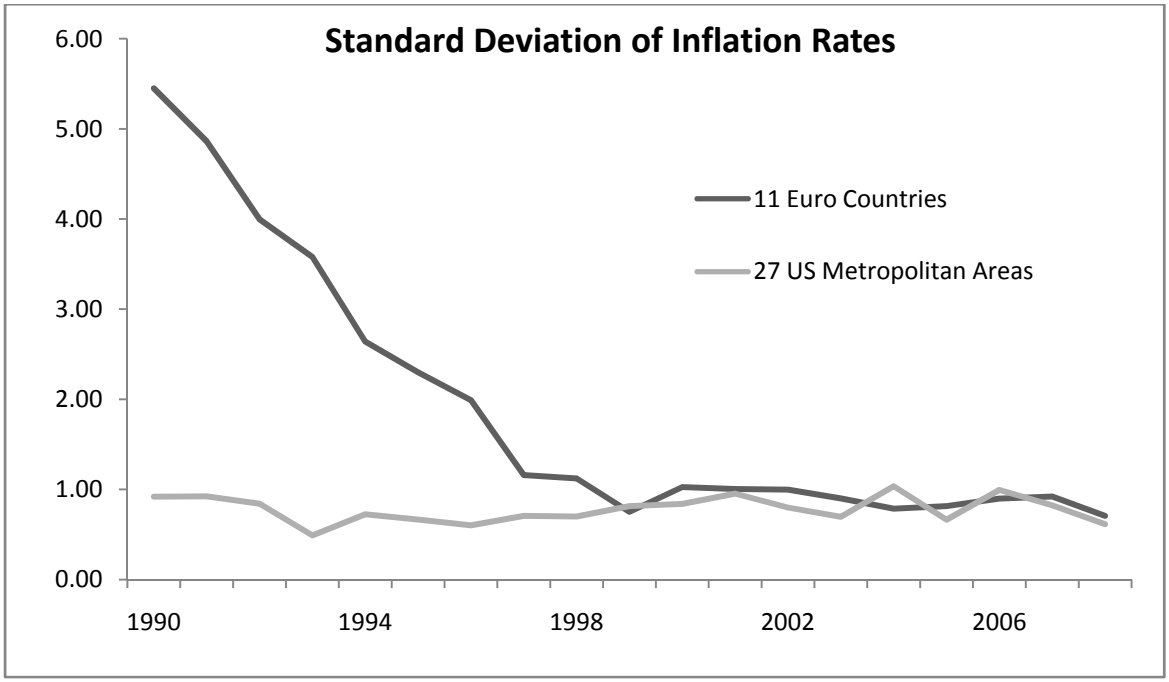

Standard Deviation of Output Growth
Across Euro Countries
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1980
1984
1988
1992
1996
2000
2004
2008
Results based on 11 countries that were Euro members in 2000; Luxembourg excluded.

Figure 6


Standard Deviation of Inflation Rates
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990
1994
1998
2002
2006
11 Euro Countries
27 US Metropolitan Areas

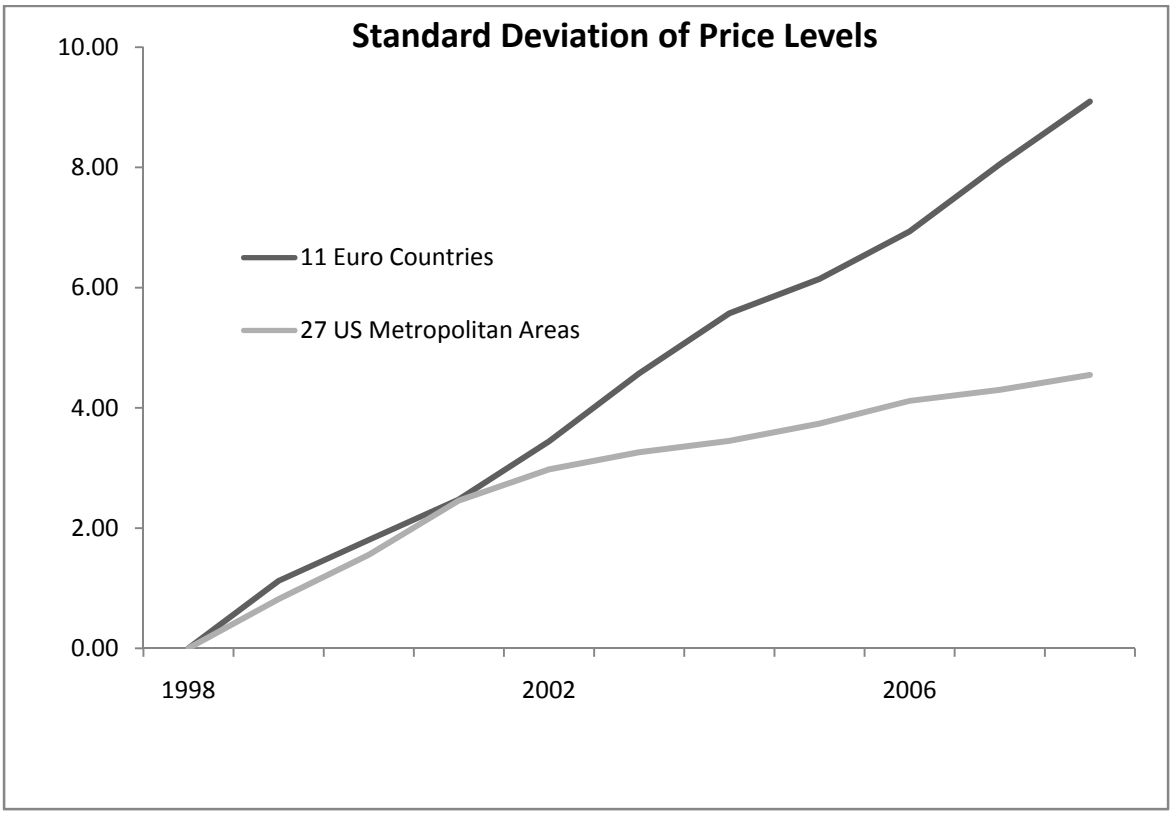
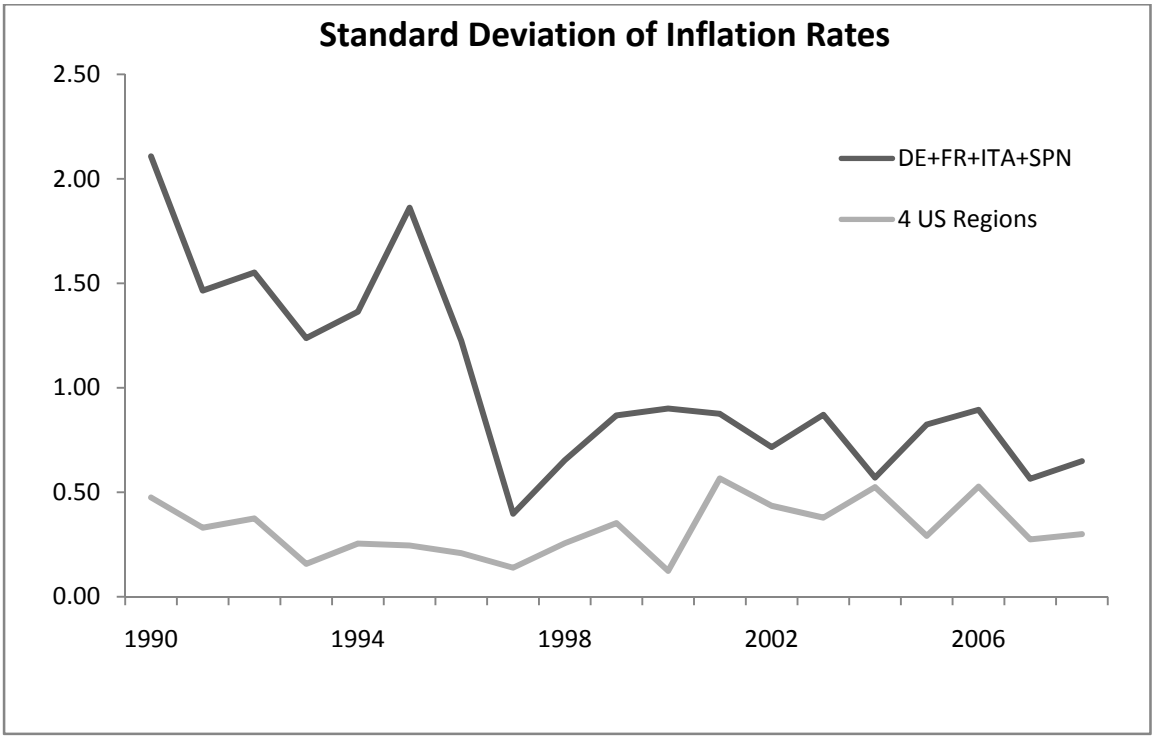
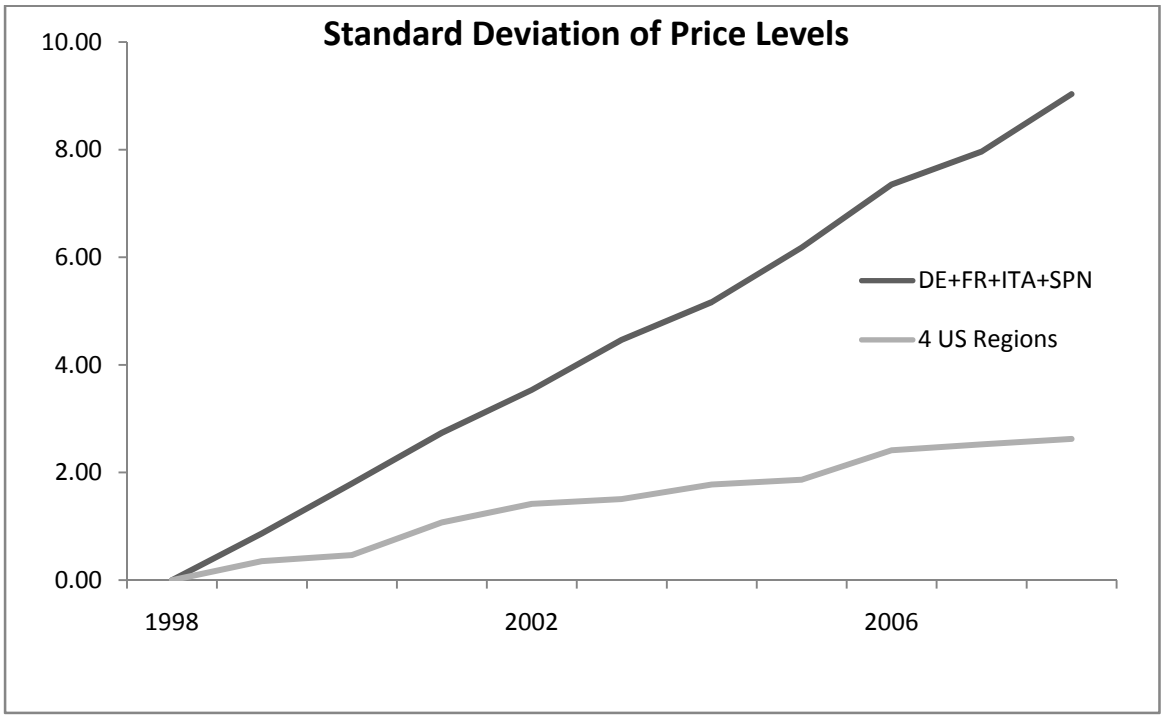

Standard Deviation of Price Levels
10.00
8.00
6.00
4.00
2.00
0.00
1998
2002
2006
11 Euro Countries
27 US Metropolitan Areas

Figure 7


Standard Deviation of Inflation Rates
2.50
2.00
1.50
1.00
0.50
0.00
1990
1994
1998
2002
2006
DE+FR+ITA+SPN
4 US Regions


Standard Deviation of Price Levels
10.00
8.00
6.00
4.00
2.00
0.00
1998
2002
2006
DE+FR+ITA+SPN
4 US Regions