HAS GLOBALIZATION CHANGED INFLATION?

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ABSTRACT

Many observers suggest that the "globalization" of the U.S. economy has changed the behavior of inflation. This essay examines this idea, focusing on several questions: (1) Has globalization reduced the long-run level of inflation? (2) Has it affected the structure of inflation dynamics, as captured by the Phillips curve? (3) Has it contributed substantial negative shocks to the inflation process? The answers to these questions are no, no, and no.

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In recent years the United States has increased trade with other countries, notably China and India. Many observers suggest that this "globalization" of the economy has changed the behavior of inflation. For example, Greenspan (2005) says that globalization "would appear to be [an] essential element of any paradigm capable of explaining the events of the past ten years," including low inflation. <u>The Economist</u> (2005) says that increased trade "makes a mockery of traditional economic models of inflation, which generally ignore globalization."

A number of recent studies, including several from the Fed system, seek to measure the effects of globalization. Conclusions vary, but there is a trend toward skepticism about effects on inflation. Summaries of such effects typically include phrases such as "modest" (Yellen, 2006) or "gradual and limited" (Kohn, 2006).

I applaud this trend and would like to see it accelerate. In my view, there is little reason to think that globalization has influenced inflation significantly. "Modest" and "limited" probably overstate the effects.

This essay addresses several questions raised by economists and policymakers:

- Has globalization reduced the long-run level of inflation?
- Has it affected the structure of inflation dynamics, as

summarized by the Phillips curve?

• Has it contributed substantial negative shocks to the inflation process?

A short summary of the answers is no, no, and no.

But first let's ask a more basic question: has the U.S. economy really been globalized?

1. What Globalization?

Many discussions take it as given that globalization has occurred. But what does this term mean? The most natural definition is a rise in international trade. By this definition, nothing remarkable has happened to the United States in recent years.

Figure 1 shows a measure of trade from the IMF: non-oil imports and exports as a share of GDP. We see that trade has indeed risen for the United States. But this rise has been a gradual process, one that started long before the changes in inflation behavior attributed to globalization.

U.S. trade has risen more quickly since 1990 than it did during the 1980s. But the greatest increases occurred in the 1970s -- a decade notable for the absence of disinflationary forces.

Figure 1 also reminds us that, by world standards, the United States is still a non-globalized economy. U.S. trade is

far below the levels for open economies such as the United
Kingdom -- their levels today or 40 years ago. If globalization
has reduced U.S. inflation, it should have wiped out U.K.
inflation before Margaret Thatcher had to worry about it.

While U.S. trade has not changed remarkably in recent years,
the economy <u>has</u> globalized rapidly along another dimension:
financial integration. Figure 2 shows an IMF measure of
"financial openness," the ratio of foreign assets and liabilities
to GDP. Since 1990 this variable has risen at an unprecedented
rate.

This aspect of globalization is relevant to monetary policy
because it affects the behavior of interest rates and asset
prices. However, financial integration does not directly
influence inflation. To the extent there are coherent theories
of globalization and inflation, they involve effects of trade in
goods and services. Trade hasn't changed enough to produce big
effects.

2. Long-Run Inflation

Since the 1980s, trade has increased somewhat for many
countries, including the United States. Over the same period,
inflation rates have generally fallen. Some economists suggest a
link between these two phenomena, notably Rogoff at the 2003 and
2006 Jackson Hole conferences.

We all know that long-run inflation levels are determined by central banks. For some reason, central banks have produced less inflation recently than they did in the 1970s and 80s. In analyzing why, many economists use the Barro-Gordon (1983) model of monetary policy, in which inflation is the outcome of a dynamic consistency problem. Rogoff uses this model to analyze the effects of globalization.

A key parameter in the Barro-Gordon model is the slope of the short-run Phillips curve. This parameter helps determine the severity of the dynamic consistency problem facing a central bank. Rogoff suggests that globalization makes the Phillips curve steeper: inflation rises more for a given rise in output. The reason is that global competition makes wages and prices more flexible. A steeper Phillips curve makes expansionary policy less tempting for the central bank, reducing equilibrium inflation.

As an interpretation of recent history, this story has a fatal flaw. A sizable literature has measured Phillips curve slopes in the United States and elsewhere. There is robust evidence that these slopes have changed in recent decades -- but in the wrong direction. Throughout the industrial world, Phillips curves have become flatter: a given rise in output has

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less effect on inflation.[1]

Later I'll discuss why the Phillips curve may have flattened. The point here is that this development contradicts Rogoff's story. If the Phillips-curve slope really affected inflation as predicted by the Barro-Gordon model, worldwide inflation would have risen since 1980.

3. Short-Run Dynamics

Even if globalization doesn't affect long-run inflation, it could change short-run dynamics. Applied economists typically analyze short-run inflation behavior with a Phillips curve; a simple version is

$$\pi = \pi(-1) + \alpha(Y-Y^*) + \epsilon,$$

where π is inflation, $\pi(-1)$ is lagged inflation, Y is output, Y^* is potential output, and ϵ captures shocks to the inflation process. $Y-Y^*$ is the "output gap."

Some people suggest that globalization has made the traditional Phillips curve obsolete. For example, President Fisher of the Dallas Fed (2005) asks rhetorically

How can we calculate an "output gap" without knowing the present capacity of, say, the Chinese and Indian economies? How can we fashion a Phillips curve without imputing the behavioral patterns of foreign labor pools? How can we formulate a regression analysis to capture what competition from all these new sources does to incentivize American management?

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[1] See for example IMF (2006) and the Fed research discussed by Yellen (2006) and Kohn (2006).

In my view, we can still measure output gaps and fashion Phillips curves pretty well -- or at least, as well as we did before the growth of trade with China and India. There are several stories about how trade has changed the Phillips curve, but none withstands scrutiny.

Foreign vs. Domestic Output Gaps

One idea suggested by Fisher is that a country's inflation depends on output in its trading partners, not its own output. This idea was proposed in a BIS study (Borio and Filardo, 2005), which gained prominence with the help of The Economist. The BIS paper argues that foreign output matters because firms compete in global markets. It estimates Phillips curves with both foreign and domestic output gaps, and reports that foreign gaps have larger effects on inflation for the period 1985-2005.

This story is dubious on both theoretical and empirical grounds. In mainstream theories, output affects inflation because it affects firms' marginal costs. Rises in marginal cost are passed through into higher prices. Marginal costs for a country's firms depend on their own output levels, not foreign output.

Perhaps globalization makes markets more competitive, reducing firms' average markups. However, average markups are irrelevant to the cyclical behavior of inflation. Higher domestic output still raises marginal cost and hence prices. For

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globalization to dampen this effect, it would have to somehow cause countercyclical movements in markups. I don't see a reason to expect this outcome.

Empirically, the BIS results are not robust, as demonstrated by recent work at the Board. Ihrig et al. (2006) make reasonable changes in the country weights used by the BIS to construct foreign output gaps. They also modify the BIS's idiosyncratic approach to modeling inflation expectations. With either change in specification, the effects of foreign gaps disappear for most countries.

As a quick check on this issue, I estimated Phillips curves with the data from Ihrig et al., which cover 14 industrial countries. For the period 1985-2005, I pooled annual data for all the countries (294 total observations). I regressed the change in inflation on the domestic output gap, the foreign gap, and both gaps. Table 1 presents the results.

When both output gaps are included in the Phillips curve, the domestic gap is highly significant (t=5.1) and the foreign gap is barely significant (t=2.1). When the domestic gap is included, adding the foreign gap raises the adjusted R^2 by only 0.01. The results suggest that foreign gaps are at most a secondary influence on inflation.

The Slope of the Phillips Curve

Perhaps the domestic output gap is still the key variable in

the Phillips curve, but globalization has changed the coefficient on this variable. Such an effect is suggested by Rogoff and by the IMF's World Economic Outlook (2006).

These sources disagree about the direction of the effect. As discussed earlier, Rogoff says that globalization increases competition, which makes prices more flexible, which steepens the Phillips curve. The IMF says that globalization increases competition, which makes it hard to raise prices, which flattens the Phillips curve.

While theoretically questionable, the IMF view has some appeal because it fits the trends in the data. Output coefficients in the Phillips curve have fallen in recent decades as trade has risen. In its study, the IMF estimates the average output coefficient for industrial countries was 0.27 in 1983 and 0.17 in 2004.

Is globalization the right explanation for flatter Phillips curves? Two other explanations are common. First, lower trend inflation has reduced the frequency of nominal price adjustment, which flattens the Phillips curve in sticky-price models. Second, the rising credibility of central banks has anchored inflation expectations, which dampens movements in actual inflation.

Both of these explanations are more appealing than the globalization story. Each is solid theoretically. And the last

two decades really have seen big changes in trend inflation, and possibly in central bank credibility, while changes in trade have been modest.

To check the role of trade, I estimate a Phillips curve of the form

$$\pi = \pi(-1) + [\alpha_0 + \alpha_1 T](Y - Y^*) + \epsilon,$$

where T is the level of trade as measured by the IMF (see Figure 1). This equation allows the output coefficient to depend on trade. The data cover the G7 for the period 1971-2005 (245 total observations).

The results suggest that trade has at most a small effect. The point estimate of α_1 is -0.008. This means a trade increase of 6% of GDP (the change in the U.S. from 1990 to 2005) reduces the output coefficient in the Phillips curve by 0.05. If the coefficient is initially 0.5 (approximately the fitted value for the average T), then US-style globalization reduces the coefficient to 0.45. The t-statistic for α_1 is 1.6. Probably the results would be even weaker if we controlled for average inflation and credibility.

Potential Output

A final parameter that globalization might affect is Y^*. As Rogoff (2006) points out, globalization can improve the terms of trade, which is equivalent to a rise in potential output. This effect means that higher economic growth is possible without

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raising inflation, at least temporarily.

I won't dwell on this idea because it's clear the effect is minor. Estimates of the gains from trade are small compared to aggregate output (e.g. Kamin et al., 2004). In the last decade, U.S. productivity growth has been concentrated in industries that use domestically-produced computers. The 1970s remind me us that rising trade may have little benefit for aggregate productivity.

4. Import Prices and Inflation

Even if globalization hasn't changed the parameters of the Phillips curve, it could affect the path of inflation. Many observers suggest that trade has produced negative shocks to U.S. inflation -- negative values of the error ϵ in the Phillips curve. These shocks are caused by declines in import prices and/or increased imports of inexpensive goods.

Many economists presume that such an effect exists. Rogoff says that "*obviously*, since competition tends to drive down prices, [globalization] should have some direct impact on inflation." Kohn (2006) says "*it seems natural to expect* that [trade with China and India] would have exerted some downward pressure on inflation in the United States" (emphasis added).

Real vs. Nominal Variables

These statements may sound like common sense, but in fact Rogoff and Kohn are expressing a fallacy. Stephen Cecchetti has

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called this fallacy the "accounting" theory of inflation. In
this theory, one examines the determinants of individual prices,
such as trade, and then aggregates to find the effects on
inflation.[2]

The problem is that the prices affected by trade are
<u>relative</u> prices. Imports of Chinese shirts make shirts cheaper
compared to other goods and services. Inflation is the aggregate
change in <u>nominal</u> prices. There is no "natural" or "obvious"
connection between inflation and relative prices, as any pattern
of relative-price changes is consistent with any inflation rate.

One way to appreciate this point is to remember that, for
every relative-price decline, there is by definition a relative-
price increase. Instead of focusing on declines in the relative
prices of imports, we could note the rising relative prices of
domestically-produced goods. Should we worry that these price
changes put <u>upward</u> pressure on inflation?

Confusion about nominal and real variables is rife in
analyses of inflation. Milton Friedman (1975) pointed out this
problem in the context of oil shocks. It arises whenever an
economist says that rising medical costs have raised inflation,
or that falling computer prices have reduced inflation (e.g.
Gordon, 2001).

Discussions of globalization often acknowledge that monetary

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[2] Cecchetti suggested this term in a conversation with me around 1987.

factors determine inflation in the long run. For example, Kohn prefaces his objectionable comment with "although inflation is ultimately a monetary phenomenon...." My point is that basic economics gives us no reason to expect any link between relative prices and inflation, even in the short run. The accounting theory of inflation is always and everywhere a fallacy.

Some Fallacious Calculations

The accounting fallacy has distorted calculations of the effects of globalization. One example is a well-known study from the Board: Kamin et al.'s (2004) analysis of trade with China. This paper starts with a sound theoretical model, in which inflation is determined by the quantity equation for money. But the empirical work confuses nominal and relative prices.

Kamin et al. regress changes in nominal import prices on measures of trade with China. The regressions are cross-sectional: each observation covers a sector of the economy for the period 1993-2002. Therefore, the results capture effects on relative prices. Note the results would be the same, except for the constant term, if aggregate inflation were subtracted from the dependent variable, making it explicitly a relative-price change.

Kamin et al. incorrectly interpret their coefficients as effects on nominal prices. They multiply the coefficients by changes in trade levels over time to estimate the effects of

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Chinese trade on aggregate import prices. Then they multiply by the import-GDP ratio to estimate the effect on inflation.

Implicitly, the study assumes that the effect of trade on a sector's nominal price equals the effect on its relative price. Equivalently, a change in one sector's trade has no effect on nominal prices in other sectors. This assumption is arbitrary.

Kamin et al. conclude that Chinese trade has had a small but statistically significant effect on U.S. inflation. Some commentators suggest the effects might be larger if the data were extended to the present, or trade with other countries were accounted for. In my view, however, the Kamin et al. calculations should <u>not</u> be extended in these directions.[3]

Is There Any Effect?

Do relative prices ever influence inflation? Historically it seems they do in some circumstances, whether monetary economists like it or not. Friedman used the relative/nominal distinction to argue that OPEC shocks were not inflationary in the 1970s. Friedman was right in theory, but appears to have been wrong in practice.

Through what channels might relative prices affect inflation? We don't know. In a somewhat obscure paper, Ball and Mankiw (1995) present one story. In their theory, relative-price

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[3] IMF (2006) also presents cross-sectional regressions of price changes on measures of trade. This study hedges on the real-nominal distinction by calling the dependent variable "relative price inflation."

changes matter if they are unusually large. The explanation involves the interaction of relative shocks with stickiness in nominal adjustment.

According to Ball and Mankiw, OPEC affected inflation because it caused large year-to-year changes in relative prices. In contrast, inflation is not influenced by smooth trends in prices, such as steady changes in medical or computer prices.

Do import prices influence inflation? Like other relative prices, they matter only if they change sharply. Big short-run changes in import prices result mainly from changes in exchange rates. Rising trade with China and India is a smooth process that shouldn't affect inflation.

Research is needed on how and why relative prices influence inflation. And this work must improve on current techniques for estimating these effects. Researchers often add changes in relative food and energy prices to Phillips curves, and some include changes in relative import prices. This approach assumes that relative-price changes have linear effects on inflation, which is wrong if only large changes matter.

5. Conclusion

Inflation behavior is and should be a perennial topic at central banks. However, it can get tedious to measure output gaps and quibble over the structure of inflation lags. It is

natural to look for new ideas about inflation, such as effects of
globalization.

But the leading stories don't hold water. Changes in import
prices may have some effect on inflation, but maybe not if they
reflect smooth changes in trade. And there is little reason to
think that globalization has changed the structure of the
Phillips curve or the long-run level of inflation.

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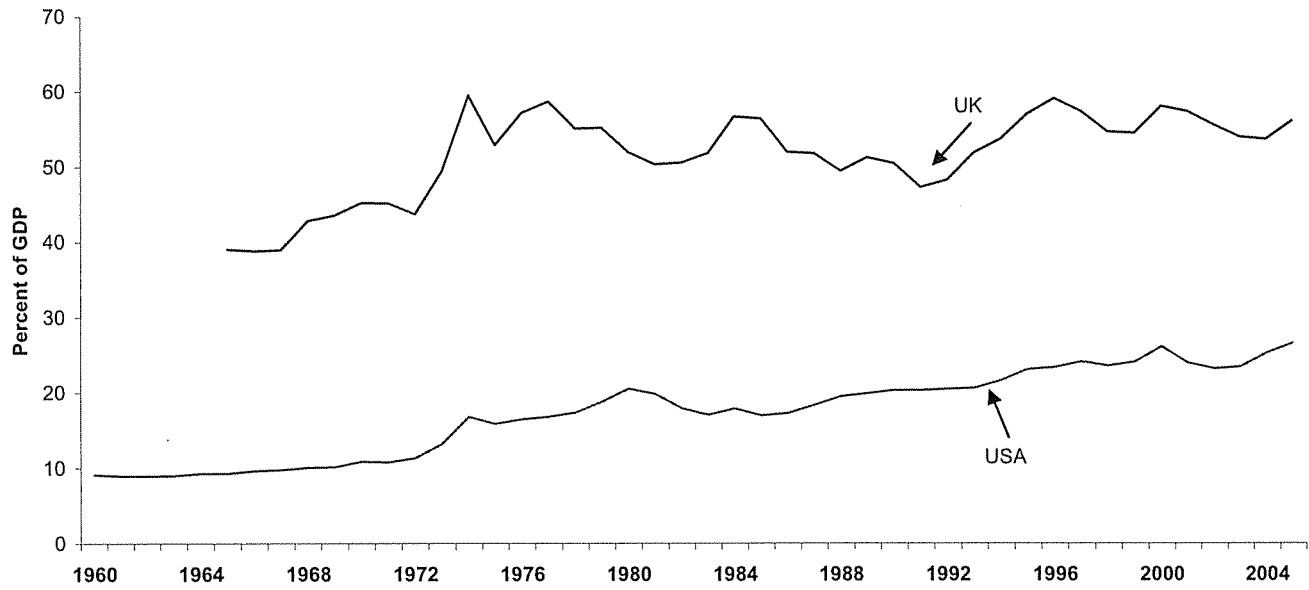
Table 1

Foreign vs. Domestic Output Gaps

Dependent Variable: Change in Inflation

Domestic Gap	Foreign Gap	Adj. R^2
0.224 (0.037)		0.110
	0.286 (0.074)	0.046
0.197 (0.039)	0.157 (0.075)	0.120

Figure 1
Total Trade for USA and UK

Total trade = Non-oil imports and exports (Source: IMF)

Figure 2
Financial Globalization