Global slack as a determinant of US inflation[1]

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Abstract

Resource utilisation, or "slack", is widely held to be an important determinant of inflation dynamics. As the world has become more globalised in recent decades, some have argued that the relevant concept of slack should be global rather than domestic (the "global slack hypothesis"). This line of argument is consistent with standard New Keynesian theory. However, the empirical evidence is, at best, fragile possibly because of a disconnect between empirical and theory-consistent measures of output gaps.

Keywords: Global slack, open-economy Phillips curve, inflation

JEL classification: E3, F4

Introduction

The idea that resource utilisation or slack plays an important role as a determinant of inflation has a long and disputed history in economics. The empirical relationship was first documented by Phillips (1958) (although Irving Fisher (1926) has some claim to priority) and has been a staple of macroeconomic analysis for the better part of the last half-century. Mankiw (2001) includes the short-run relationship between inflation and unemployment as one of the 10 basic principles of economics. The stability of the relationship has been called into question for a number of reasons, and so in recent years there has been a major attempt to put the relationship on a firmer theoretical footing.

Traditionally the Phillips Curve relationship has been specified as a relationship between some measure of domestic resource utilisation and domestic inflation. However a number of researchers have argued that with greater integration of the global economy ("globalisation") the concept of resource utilisation that is relevant for short run inflation dynamics is some measure of global resource utilisation rather than domestic. Borio and Filardo (2007) is a widely cited early contribution to the empirical literature exploring this idea. See also the works of Orr (1994), Tootell (1998) and Gamber and Hung (2001), and the more sceptical findings of Ihrig, Kamin, Lindner and Marquez (2007). In an earlier paper (Martínez-García and Wynne (2010)), we sketched out the analytical content of the global slack hypothesis in a simple open-economy extension of a standard New Keynesian model.

In what follows we provide some illustrative evidence on how well the global slack hypothesis holds for the United States, and then discuss the puzzle posed by the evidence. We then highlight four important results from our earlier paper that have important implications for empirical tests of the global slack hypothesis. First, as long as the consumption basket that is priced to derive the consumer price index includes foreign goods, then foreign output gaps should have a direct effect on domestic inflation. An indirect effect is also to be expected as foreign demand of domestically-produced goods affects the marginal cost and prices of the domestic goods too. The extent to which these effects matter will depend on the importance of foreign goods in the domestic consumption basket and domestic goods in the foreign consumption basket. Second, the effects of foreign output gaps on domestic inflation can be captured by the information contained in terms of trade (or, to be more precise, on the deviations of terms of trade from their relative abundance given the potential of the domestic and foreign economies). Third, these results hold under alternative assumptions on international price-setting behaviour—both producer and local currency pricing—although the exact form of the Phillips Curve will differ somewhat. And fourth, the concept of the output gap that is consistent with this particular theory of output and inflation determination in an open economy could bear little relationship to the output gap as conventionally measured. We conclude with some suggestions for further research.

Aggregate US data

Let's start with the aggregate data for the United States. Table 1 reports estimates of simple Phillips Curves using annual data over the past three decades, as well as over two sub-samples. We choose 1990 as the year in which to break the sample, as it is around this time that the process of globalisation kicked into high gear. The output gap $\widehat{y_t}$ is measured as the cyclical component of real GDP, where the cyclical component is obtained using a Hodrick-Prescott filter with smoothing parameter equal to 100. Inflation $\widehat{\pi_t}$ is measured as the cyclical (also Hodrick-Prescott filtered with smoothing parameter equal to 100) component of the annual change in the GDP deflator. The main point to note here is that the coefficient on the US output gap declines between the first and second samples—the estimated coefficient on the domestic output gap declines from 0.35 to just 0.10. This is a

fairly robust finding and there is a significant literature seeking to understand the causes of the decline (see, for example, Roberts (2006)).

<div align="center">Table 1</div>

<div align="center">**US Phillips Curves**</div>

Sample period	Estimated Phillips Curve
1979–2010	$\hat{\pi}_t = \underset{(0.14)^{***}}{0.65} \hat{\pi}_{t-1} + \underset{(0.06)^{***}}{0.17} \hat{y}_t$
1979–1990	$\hat{\pi}_t = \underset{(0.27)^{***}}{0.87} \hat{\pi}_{t-1} + \underset{(0.16)^{**}}{0.35} \hat{y}_t$
1990–2010	$\hat{\pi}_t = \underset{(0.16)^{***}}{0.59} \hat{\pi}_{t-1} + \underset{(0.05)^{*}}{0.10} \hat{y}_t$

Table 1: Standard errors in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.

The global slack hypothesis holds that the decline in the coefficient on the domestic output gap could be a manifestation of the increased openness of the US economy. Over this period imports as a share of GDP increased from just under 10% in 1978 to a peak of 17.8% in 2008. The US economy became more open along a number of other dimensions as well during this period. To the extent that we believe that slack is an important driver of inflation at business cycle frequencies, this suggests that we might want to augment the measure of slack in these simple Phillips Curve regressions with a measure of foreign slack as well. We define the foreign output gap, $\widehat{y_t^*}$ as a trade-weighted average of the output gaps in the main US trade partners. That is, $\hat{y}_t^* = \sum_{j=\text{US trade partners}} w_t^j \hat{y}_t^j$ where $\hat{y}_t^j$ is the estimated output gap in country j and w_t^j is the time-varying weight of imports from country j in US imports. We use HP-filtered annual data on real GDP from the IMF publication *International Financial Statistics* to compute output gaps in each trade partner. The time-varying weights w_t^j are the ones used by the Federal Reserve Board of Governors to compute the trade-weighted value of the dollar.

<div align="center">Table 2</div>

<div align="center">**US Phillips Curves**</div>

Sample Period	Estimated Phillips Curve
1979–2010	$\hat{\pi}_t = \underset{(0.15)^{***}}{0.47} \hat{\pi}_{t-1} + \underset{(0.08)}{0.03} \hat{y}_t + \underset{(0.12)^{**}}{0.31} \hat{y}_t^*$
1979–1990	$\hat{\pi}_t = \underset{(0.29)}{0.44} \hat{\pi}_{t-1} - \underset{(0.24)}{0.11} \hat{y}_t + \underset{(0.12)^{**}}{0.63} \hat{y}_t^*$
1990–2010	$\hat{\pi}_t = \underset{(0.20)^{**}}{0.46} \hat{\pi}_{t-1} + \underset{(0.06)}{0.06} \hat{y}_t + \underset{(0.12)}{0.12} \hat{y}_t^*$

Table 2: Standard errors in parentheses. *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level.

When we estimate a simple Phillips Curve relationship over the full sample, we see that the estimated coefficient on the foreign slack measure exceeds the one on the domestic slack

measure (indeed, it is 10 times larger) and furthermore is the only one that is statistically significant. The estimated coefficient on the US output gap is small and statistically insignificant. However, when we split the sample in 1990, we find that the estimated effects of foreign slack are *greater* in the pre-1990 period than in the post-1990 period, which would seem to contradict the idea that the changing magnitude of the response to domestic slack is being driven by globalisation.

On the face of it, then, these simple reduced-form econometric exercises seem to pose a challenge to the idea that broader, global, measures of slack or resource utilisation should matter more for inflation over time. This leaves us with a number of possibilities. One is that the global slack hypothesis is simply wrong, and that, to the extent that inflation is driven by slack, domestic slack is all that matters. Another is that the data are not terribly informative about the relative importance of domestic and foreign slack as drivers of inflation, or simply that time series are too short. Measures of domestic and foreign output gaps tend to move together. The pairwise correlation between the US output gap and the foreign output gap is 0.59. There are other possibilities as well, including explanations having to do with changes in the conduct of monetary policy altering the slope of the Phillips Curve and the possibility that the concept of the output gap that is relevant for inflation determination is different from what we have measured.

Theory: the global slack hypothesis

For the purpose of thinking about inflation dynamics in an open economy framework, the basic two-country New Open Economy Macro model of Clarida, Galí and Gertler (2002) has proven to be quite useful. In Martínez-García and Wynne (2010), we worked with a straightforward variant of that workhorse model, and here we highlight a number of key points from that earlier paper.

First, in an open economy, when firms engage in producer-currency pricing, both the domestic and foreign output gaps matter for short-run inflation dynamics. That is, the open-economy Phillips Curve can be written as,

$$\hat{\pi}_t \approx \beta \mathbb{E}_t \left(\hat{\pi}_{t+1} \right) + \Phi \left[\Psi_{\pi,x} \hat{x}_t + \Psi_{\pi,x^*} \hat{x}_t^* \right], \tag{1}$$

where Φ, $\Psi_{\pi,x}$ and Ψ_{π,x^*} are composites of underlying structural parameters, and $\widehat{x_t}$ and $\widehat{x_t^*}$ denote the theory-consistent domestic and foreign output gaps.

Second, in theory, the effects of foreign activity on domestic inflation can be fully captured by information contained in terms of trade, ie the open-economy Phillips Curve can also be written as

$$\hat{\pi}_t \approx \beta \mathbb{E}_t \left(\hat{\pi}_{t+1} \right) + \Phi \left[(\varphi + \gamma) \hat{x}_t + \Psi_{\pi,z} \hat{z}_t \right], \tag{2}$$

where $\widehat{z_t}$ denotes the deviation of the terms of trade from its frictionless level.

Third, these results continue to hold if instead firms engage in local currency pricing, but the open-economy Phillips Curve now takes the form,

$$\hat{\pi}_t \approx \beta \mathbb{E}_t \left(\hat{\pi}_{t+1} \right) + \Phi [\Psi_{\pi,x} \hat{x}_t + \Psi_{\pi,x^*} \hat{x}_t^* - \Psi_{\pi,rp} (\widehat{rs}_t - \left(\xi - \xi^* \right) \widehat{tot}_t)], \tag{3}$$

where $\widehat{rs}_t$ denotes the real exchange rate, $\widehat{tot}_t$ the terms of trade, the coefficients on the Home and Foreign output gaps $\Psi_{\pi,x}$ and Ψ_{π,x^*} are the same as before, while the new coefficient, $\Psi_{\pi,rp}$, is again a composite of underlying structural parameters.

Fourth, there is essentially no robust relationship between the theory-consistent measure of the output gaps $\hat{x}_t$ or $\widehat{x_t^*}$ and the measures commonly used in econometric exercises to evaluate the global slack hypothesis such as the ones used in our estimations above. In Martínez-García and Wynne (2010) we calibrate a fuller version of a two-country model, simulate it and measure the output gap in a theory-consistent manner and using traditional econometric techniques. The correlation between the two measures is only 0.08.

Conclusion

There are strong empirical and theoretical reasons for believing that globalisation has fundamentally altered short-run inflation dynamics. However quantifying the effect has proven challenging, and the mixed results found in the empirical literature are a good illustration of that. Still, it is too early to dismiss the global slack hypothesis on those grounds. After all, the lack of robust evidence may be due to the short sample of data that is available to evaluate the global slack hypothesis, to shortcomings in commonly used measures of resource utilisation, to the high correlation between some slack measures for the United States and the rest of the world, or to the weak relation between theory-consistent and statistical measures of slack. In on-going work, we are pursuing a number of different avenues to shed light on the role of globalisation in inflation dynamics. First, noting the data problems that arise in evaluating the hypothesis using international data, we are looking at whether *intra*national data from the United States might be used to shed some light on it. The idea here is that we can think of the economic relationship between the individual cities and states within the United States as approximating what we might see in a fully globalised world with complete freedom of movement of goods, services and factors of production. One might then argue that, because of its integration with the rest of the state of Texas and the rest of the United States, inflation pressures in Dallas should be less responsive to resource utilisation in Dallas, somewhat more responsive to resource utilisation in the rest of the state of Texas and most responsive to resource utilisation in the United States as a whole. We find some evidence of this, but it is at best inconclusive as we rely on estimates of slack that correspond to the cyclical component of output derived with statistical techniques without imposing any theoretical constraints. Second, we are pursuing a more pragmatic statistical approach to the measurement of domestic and global output gaps using unobserved components models but incorporating some of the key theoretical constraints that the open-economy Phillips Curve prescribes in order to also derive more consistent measures of slack. And third, we are examining ways to take a fully structural approach to modelling global inflation dynamics. Some of our preliminary work along this dimension centred on structural identification and the interpretation of the open-economy Phillips curve is reported in Martínez-García, Vilán and Wynne (2012).

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