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A quarterly Phillips curve for Switzerland using interpolated data, 1963–2016☆

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ABSTRACT

This paper estimates a quarterly Phillips curve for Switzerland, using interpolated data starting in 1963. Since only annual GDP data are available before 1980, the paper first discusses how to interpolate them using a multivariate Chow-Lin procedure and by adapting forecast combination methods. The preferred interpolated series is then used to estimate the Phillips Curve over a 50-year period. The results indicate two structural breaks which appear to coincide with shifts in the Swiss National Bank's monetary policy strategy.

1. Introduction

Economic historians regularly work with imperfect data.[1] This paper studies the case in which the time series in a regression model are observed at different frequencies. This problem regularly occurs with aggregate macroeconomic data. Historical data for many important, but hard to construct series, such as GDP, are available only on an annual frequency whereas others which are much easier to observe, such as prices, are available quarterly or even monthly.

Often, the frequency of observation may increase over time with more recent data sampled more finely, as statistical agencies become more ambitious in collecting the data. This raises the question of how best to combine historical data, that may be annual, with recent data that may be quarterly or perhaps monthly. While researchers interested in the current functioning of the economy may simply drop the historical data, economic historians are critically interested in how the economy has evolved over time. They therefore do not have this luxury. Indeed, research on historical macroeconomic time series typically involves considerable work finding and preparing data for estimation.

The focus in this paper is on the inflation process. Estimated inflation equations, such as Phillips curves, ought to be routinely tested for structural breaks at unknown points in time. In such tests, the beginning and end of the sample is "trimmed" and the search for breaks is undertaken on the remaining observations. This means that long time spans of data are highly desirable. That is often problematic in the case of Phillips curves for advanced economies since data on real GDP that are necessary to construct estimates of the output gap are often only available annually before the 1980s or 1990s.

In this paper, a Phillips Curve for Switzerland is estimated on quarterly data, with the aim of studying as long a sample as possible. Being small and highly open, Switzerland has experienced a number of external shocks, many related to sharp exchange rate movements arising from the Swiss franc's traditional role as a safe haven currency.[2] The Swiss National Bank has also changed the weight it attaches to the exchange rate in setting monetary policy, most recently by adopting an exchange rate floor of CHF 1.20 per euro between 2011 and 2015. Thus, a long time

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[1] For instance, Kaufmann (2016) argues that measurement error in 19th century CPI data makes it difficult to distinguish between periods of inflation and deflation. He goes on to argue that this has led authors to conclude incorrectly that the pre-WW1 evidence that deflation need not be associated with recessions is flawed.

[2] For a discussion of Swiss monetary policy see, for instance, Baltensperger and Kugler (2017), Kugler and Sheldon (2010), Gerlach and Jordan (2012), Bernholz (2007), Jordan and Peytrignet (2007) and Kohli and Rich (1986).

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span of data is required to understand changes that have occurred in the Swiss inflation process.

However, while monthly consumer prices are available since 1921 and monthly import prices from 1963, consistent Swiss real GDP data are available on a quarterly basis only since 1980. A second quarterly real GDP series is available from 1965 to 2013 but it is not compiled consistently with the more recent data, with the result that the correlation of the two series for the overlapping period is just 0.62. Nonetheless, estimates of annual real GDP are available since 1851 and a number of other indicators of quarterly real economic activity are available since the late 1950s. This raises the possibility that quarterly GDP data might be interpolated, allowing the researcher to fit a Phillips Curve on data starting around 1960.

How best to do so is the focus of the first part of the paper. A cubic spline is used to obtain a baseline interpolated series of quarterly real GDP starting in 1960Q1 and ending in 2016Q2. This baseline series is then compared with series obtained using the multivariate interpolation method proposed by Chow and Lin (1971). This method uses 'indicator' series to distribute the annual data over the four quarters of the year.

Next, well-known forecast combination methods are adapted to combine the interpolated data series optimally.[3] The accuracy of the various interpolation methods is assessed by comparing the growth rate of the constructed quarterly data with actual quarterly GDP data for the period after 1980.

The baseline cubic spline interpolation is as strongly correlated with actual real GDP data after 1980 as interpolations obtained using the multivariate Chow-Lin method. However, the measure of quarterly real GDP constructed by optimally combining the four interpolated time series is marginally more closely correlated, in growth rates, with actual GDP than those of the baseline and the Chow-Lin interpolations.

The preferred interpolated series of quarterly real GDP is used to estimate a quarterly Swiss Phillips Curve. Output gaps are first constructed using both the interpolated quarterly real GDP series, starting in 1960, and the actual quarterly real GDP data, starting in 1980. The output gap using the interpolated data is very similar to the output gap calculated using the actual data over the period 1980–2016 for which both gaps are available. Indeed, the correlation coefficient of the two output gaps over this period is 0.93.

Next, the quarterly Phillips Curve is estimated over the sample 1963Q2 to 2016Q3 using OLS. This period covers some important episodes in recent Swiss economic history, including the oil crises of the 1970s, the period of exceptional appreciation of the Swiss franc around 1980, the great moderation and the global financial crisis in the 2000s. The period has been studied previously in the literature using annual data; the quarterly estimates provide an interesting comparison to these earlier results.[4]

In line with the previous literature, there appears to be a break in the mid-1970s (Baltensperger and Jordan (1998)). However, unlike this literature this break does not coincide with a worsening of the inflation-output trade-off so much as a reduction in inflation persistence. A second break in the relationship in the early 1990s is associated with a reduction in the importance of the output gap, which is also similar to findings elsewhere (Gerlach (2016)).

Overall, the paper leads to three main conclusions.

First, estimates of the Phillips curve starting in the 1980s using output gaps computed from the actual and interpolated quarterly real GDP are remarkably similar. This suggests that the estimates of the Phillips curve using the interpolated data for the period 1960–1980 are probably similar to those one would have obtained using actual data if they had been available. Overall, it seems feasible to interpolate annual GDP for Switzerland before 1980 and estimate quarterly Phillips curve models for a much longer period than has been undertaken in the literature.

[3] Forecast combination methods are discussed in detail in Timmerman (2006).

[4] See Gerlach (2016) and Baltensperger and Jordan (1998).

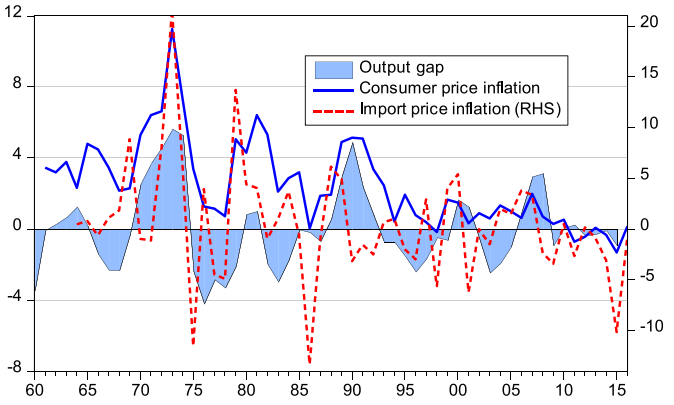

Fig. 1. Output gap, consumer price inflation and import price inflation, 1960–2016.

Second, the simple benchmark interpolation method using a cubic spline seems to work well compared to the more refined multivariate Chow-Lin technique or optimally constructed combined interpolations in the sense that the correlation of the growth rates of the interpolated series with actual quarterly real GDP growth are 0.70 using the cubic spline, 0.70 also using the Chow-Lin method, and 0.74 using the combined interpolations.

Third, tests for structural breaks reveal that there were shifts in the Phillips Curve in 1974 and 1993. These breaks appear to coincide with shifts in the monetary policy regime of the Swiss National Bank (SNB). Specifically, the first break coincides with the introduction of monetary targets following the floating of the Swiss franc, while the second coincides with the effective implementation of medium term targets, which lagged the actual introduction of these measures,[5] and the growing use of the interest rate as an indicator of the monetary stance.

The paper is organized as follows. In the next Section, the monetary and economic background during the sample period is discussed. In Section 3, the baseline and Chow-Lin interpolation methods are evaluated. In Section 4, the method for combining the interpolated series is outlined and assessed. Section 5 presents the Phillips curve estimates, and Section 6 concludes.

2. Monetary and economic background

This section outlines the historical background. Fig. 1 shows the annual output gap, alongside annual changes in inflation and import prices (note that import prices are measured on the right-hand scale) since 1960.

From Fig. 1, inflation increased trend-wise during the 1960s. During this time, the Swiss exchange rate was fixed against the US dollar, and the authorities had little control over domestic inflation. Indeed, the Bretton Woods system relied initially on conservative US monetary and fiscal policy to ensure price stability.[6] In the 1960s, the US was shifting towards a more inflationary path as a consequence of expansionary government spending, partially related to the war in Vietnam. Switzerland, which was experiencing strong economic growth, began to suffer large capital inflows and imported inflation.

The early 1970s are characterized by a sharp business cycle upswing and rising inflation. Renewed speculative capital inflows into Switzerland in early 1971 were followed by the suspension of gold convertibility by the US later in the year. Nonetheless, Nelson (2007)

[5] See Rich (2003) for a discussion.

[6] Although not formally a member of the Bretton Woods institutions, Switzerland effectively participated in the system from 1945 since the currency was fixed to gold. Indeed, Switzerland only officially became a member of the Bretton Woods institutions in 1992. See Baltensperger and Kugler (2017, p. 94).

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