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Inflation persistence, structural breaks and omitted variables : a critical view

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Inflation persistence, structural breaks and omitted variables: a critical view

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Abstract

Recent empirical contributions assess time changes in inflation persistence by means of simple autoregressive models. Their reliability is discussed in the light of the econometric literature on model misspecification and it is showed that their results can be misleading due to the omission of relevant variables.

Keywords: inflation persistence, structural breaks, omitted variables, model misspecification, serial correlation.
JEL codes: E3, E31.

1. Literature review and research background

A recent stream of literature assesses changes in inflation persistence by estimating simple autoregressive models and relying on procedures developed by the new econometrics of structural breaks, based in the last instance on Chow tests (Hansen, 2001). Prominent examples are Cecchetti and Debelle (2006), Levin and Piger (2004) and Gadzinski and Orlandi (2004). However, Cecchetti and Debelle (2006) reckon that results might not be completely reliable due to model miss-specification, being neglected possible exogenous factors that might drive inflation.

This risk should not be understated. Thursby (1982) writes that it is "not clear how to distinguish between omitted variables and structural change". Thursby (1985) shows that the Chow test for structural breaks can be seen as a special case of the RESET test for model misspecification. So it is not clear how to interpret it when applied to a misspecified model: did really a structural break take place or is the test just detecting the omission of a relevant variable?

Furthermore, suppose a researcher estimates a model including only a part of the true model. The power of a Chow test depends on the correlation between the excluded portion of the true model and the included one and on the variance of the included portion of the model in the two sub-samples considered (Thursby, 1982). What we know from the literature regarding inflation dynamics is that both the variance of inflation and its correlation with other macroeconomic factors are not stable through time (see for instance Benati, 2007). Therefore, the actual power of the Chow tests underlying the procedures elaborated by the new econometrics of structural breaks is very likely to have a time-varying bias when applied to misspecified autoregressive models of inflations.

In the end, the omission of relevant variables might prevent to attain the very aim of the literature above, that is assessing if inflation persistence is low or high in presence of structural breaks, because tests for structural breaks are not reliable for a misspecified model, especially when applied to a volatile phenomenon like inflation.

2. Research strategy

In this paper we assess the issue above in the following way. We analyse aggregate inflation series in both the GDP deflator and CPI for the countries included in the sample of Cecchetti and Debelle (2006): Austria, Belgium, Brazil, Canada, Chile, Finland, Germany, France, Italy, Japan, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK, US, New Zealand, and Australia. The frequency of the collected data is quarterly for the GDP deflator and monthly for the CPI with the exception of New Zealand and Australia that have only quarterly data. Both indicators are considered in order to check that results are stable across different inflation measures, with possible different frequencies. The source of the data is the International Financial Statistics dataset of the IMF except for Austria and Belgium, whose data were downloaded from the websites of their national statistical offices. Data samples are described in Table 1.

All the series are seasonally adjusted following the X12 procedure. We estimate for each country an AR(4) model for quarterly data and an AR(12) for monthly ones. For the GDP deflator we also check the effect of using the Schwartz criterion to decide the lag length of the model.

We then test for serial correlation in the residuals. We always test for an order of serial correlation equal to that of the estimated autoregressive model of inflation. Following Dezhbakhsh (1990), we use Durbin's *m* test (see also Godfrey, 1988, p. 117). The presence of serial correlation in the residuals could *per se* be considered as evidence of omitted variables, given also the lag length of the estimated autoregressive models of inflation. Davidson and MacKinnon (1999, p. 274), indeed, interpret Durbin's *m* test as an omitted variable one. However, Kiviet (1986) shows that it might have low power when trying to detect the omission of a relevant variable in autoregressive distributed lag models. Though the samples here adopted are fairly large and our results should be robust to possible small samples limitations, we do not stop econometric testing at this stage.

If we do not find evidence of serial correlation in the residuals, we check for the omission of relevant variables relying on a RESET test *à la* Thursby and Schmidt (1977). This class of tests has been assessed by an extensive literature (see for instance the papers quoted in Hatzinikolaou and Stavrakoudis, 2006) and their performance under serial correlation in the residuals is rather disappointing. However, in absence of serial correlation they usually perform well (Leung and Yu, 2001, Porter and Kashyap, 1984).

A RESET test can be obtained in different ways and it is a well known fact that the diagnostic regression it is based on might be flawed by collinearity among right hand side variables (Thursby, 1979). In this application we choose as diagnostic variables the squares and the cubes of the lags included in the autoregressive model fitted to inflation data, given that this choice assured lack of collinearity for all the time series considered and comparable results across countries and different inflation measures.

On the other hand, if we cannot accept the null of the absence of serial correlation in the residuals, we follow Godfrey (1987, p. 130). We insert the powers and the cubes of inflation lags in the model and we test the null that their coefficients are equal to zero by means of a likelihood ratio test robust to serial correlation.

3. Results and conclusions

Results are contained in Table 2. As it is possible to see, when considering inflation in the GDP deflator, for 12 out of the 18 countries considered there is a strong evidence of autocorrelation in the residuals. Among them only for Finland it is possible to accept the null of absence of omitted variables in the model at a 5% level. The RESET test detects the presence of omitted variables for four out of six countries without serial correlation in the residuals. In the end we find that for at least 15 of the 18 countries considered model misspecification is a serious concern.

Once using a Schwartz criterion to define the most suitable number of lags in inflation, a similar patterns emerges: for 14 out of 18 countries it is not possible to exclude model misspecification. Finally, when considering inflation in CPI, omitted variables are detected for 12 out of 19 countries[2].

The evidence produced in this paper shows that recent contributions on inflation persistence relying on autoregressive models are not reliable as they omit relevant variables. The aim of this literature is to provide evidence on the statistical properties of inflation persistence and it is usually found that once allowing for structural breaks inflation persistence is rather low. However, omitted variables not only induce bias in coefficient estimates but also bias the test statistics at the heart of the procedure used to detect structural breaks. Therefore, any conclusions drawn on this ground is hardly convincing - not even as a first approximation - if one takes “the point of view that investigators should test every econometric model they estimate for any type of misspecification that might be reasonably expected to be present” (MacKinnon, 1992, p. 141). With the exception of a just a few countries and depending on the measure of inflation adopted, no shortcut appears to exist when assessing how and if inflation

[2] We also performed two further robustness checks. In the first place, we fitted on not-seasonally adjusted data of the GDP deflator an autoregressive model with a number of lags chosen by the Akaike criterion and with seasonal dummies. We then applied the misspecification tests above and we found that for only 3 of the 18 countries considered it is possible to exclude the omission of a relevant variable. The 3 countries are Canada, Luxembourg and Sweden. In the second place, we followed Hatzinikolaou and Stavrakoudis (2005) and, similarly to the traditional RESET test, we used as diagnostic variables the squares and the cubes of 4 lags of the fitted values in the 4 lags model for the GDP deflator (Column 2 in Table 2). We implemented a likelihood ratio test robust to serial correlation. In this case, only for Austria it is possible to exclude the presence of omitted variables. Detailed results are available from the author upon request.

persistence changes through time. A theoretical stance should be taken, a full model specified and the coherent methodological approach tackled (see for instance Sbordone, 2006).

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Table 1 – Sample periods.

Country	GDP Deflator	CPI
Australia	1969:3 - 2007:2	1969:3 - 2007:3
Austria	1964:1 - 2007:1	1959:12 - 2007:6
Belgium	1980:1 - 2007:1	1959:11 - 2007:8
Brazil	-	1991:7 - 2007:8
Canada	1957:1- 2007:2	1984:12 - 2007:6
Chile	1957:1- 2007:2	1989:3 - 2007:8
Finland	1970:1 - 2007:1	1987:1 - 2007:7
France	1970:1 - 2007:2	1969:12 - 2007:6
Germany	1960:1 - 2007:2	1962:1 - 2007:6
Italy	1980:1 - 2007:2	1976:12 - 2007:6
Japan	1957:1 - 2007:1	1969:12 - 2007:5
Luxembourg	1995:1 - 2007:1	1994:12 - 2007:6
Netherlands	1977:1 - 2007:1	1987:9 - 2007:6
New Zealand	1987:2 - 2007:1	1975:1 - 2007:1
Portugal	1977:1 - 2007:1	1986:12 - 2007:6
Spain	1977:1 - 2007:2	1976.12 - 2007:6
Sweden	1980:1 - 2007:1	1979:12 - 2007:6
UK	1957:1 - 2007:1	1979:12 - 2007:6
US	1957:1- 2007:2	1977:12 - 2007:6

Note: data on the GDP deflator are at a quarterly frequency, whereas data on CPI are at a monthly frequency with the exception of New Zealand and Australia that have only quarterly data.

Table 2 – Misspecification tests for autoregressive models of inflation (p-values).

Country	GDP Deflator (quarterly frequency)							CPI (montly frequency)		
	Four lags			Number of lags decided by the Schwartz criterion				Twelve Lags		
	Durbin's m test	RESET test	Likelihood Ratio test	Durbin's m test	RESET test	Likelihood Ratio test	Lags	Durbin's m test	RESET test	Likelihood Ratio test
Australia	0.02	-	0.05	0.07	0.01	-	3	0.69	0.37	-
Austria	0.00	-	0.00	0.00	-	0.00	4	0.32	0.00	-
Belgium	0.01	-	0.00	0.01	-	0.00	3	0.04	-	0.01
Brazil	-	-	-	-	-	-	-	0.34	0.00	-
Canada	0.15	0.24	-	0.04	-	0.11	3	0.05	0.17	-
Chile	0.08	0.00	-	0.89	0.00	-	1	0.00	-	0.00
Finland	0.00	-	0.11	0.00	-	0.11	4	0.69	0.68	-
France	0.00	-	0.00	0.00	-	0.00	3	0.04	-	0.00
Germany	0.03	-	0.00	0.04	-	0.00	3	0.06	0.24	-
Italy	0.01	-	0.02	0.05	0.00	-	3	0.00	-	0.00
Japan	0.04	-	0.00	0.04	-	0.00	4	0.24	0.00	-
Luxembourg	0.26	0.08	-	0.09	0.54	-	1	0.07	0.09	-
Netherlands	0.51	0.00	-	0.51	0.00	-	4	0.06	0.97	-
New Zealand	0.00	-	0.01	0.00	-	0.01	4	0.04	-	0.00
Portugal	0.03	-	0.00	0.03	-	0.00	3	0.00	-	0.00
Spain	0.00	-	0.01	0.00	-	0.00	3	0.01	-	0.00
Sweden	0.01	-	0.00	0.05	0.36	-	3	0.80	0.07	-
UK	0.22	0.00	-	0.19	0.00	-	3	0.00	-	0.00
US	0.35	0.00	-	0.35	0.00	-	4	0.00	-	0.00

Notes: the null of the Durbin's *m* test is absence of serial correlation. The null of the RESET test and of the Likelihood Ratio test is absence of omitted variables.

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