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Monetary Targeting

Abstract: In this paper we test the existence of long-term relationship between money supply and inflation, money supply and GDP and money supply and unemployment. Three independent panel cointegration regressions are evaluated where money supply is the explanatory variable, while inflation, GDP and unemployment rates occur as dependent variables. The sample consists of 17 countries (Australia, Canada, Chile, Denmark, Israel, Japan, South Korea, Mexico, New Zealand, Poland, Switzerland, United Kingdom and United States). The data are annual and refer to the period from 1990 to 2013. The results of the empirical analysis in this paper show that there is no significant long-term relationship between inflation and money supply, while there is statistically significant long-term relationship between GDP and money supply, as well as between unemployment rates and the money supply.

Key words: monetary targeting, inflation, money supply

JEL Classification: E31, E41, E52, C33.

1. Introduction

Due to global inflationary trends at the beginning of the second half of the 1970s, central banks in many industrialized countries have implemented monetary targeting in order to achieve disinflation. This meant abandoning the earlier anticyclical monetary policy, which could be used as a basis for monetary policy in terms of simultaneous inflationary and recessionary pressures. One reason was the difficulty in interpreting the nominal interest rate as an indicator of the monetary policy position in the period of high inflation. Another reason was the need

to adjust the interest rate to be more flexible because the change in the interest rates becomes endogenous in the context of achieving monetary targets. The third reason was that they considered that there were beneficial effects of publishing targets of monetary aggregates on expectations. However, the effectiveness of monetary targeting was dependent upon the stability of money demand, which resulted in the selection of specific monetary aggregates to be targeted. It was anticipated to be strong and stable relationship between the growth of monetary aggregates and nominal income (inflation) occurred in the medium term.

Monetary targeting focusing on controlling inflation includes three elements: 1) the information conveyed by a monetary aggregate to conduct monetary policy, 2) publication of monetary aggregate targets in order to focus inflationary expectations, 3) accountability mechanism that excludes large and systematic deviations from monetary targets.

The attractiveness of monetary targeting is that monetary aggregates and cause of changes in inflation and reliable leading indicator of future movements in the inflation rate and the direction of monetary policy. Targeting monetary aggregates implies flexible exchange rate regime and the absence of fiscal dominance. Object target may be a money supply with different widths coverage, money base and total loans.

Monetary targeting is based on the fact that in the long run the price level affects the increase in the money supply. The primary objective of monetary targeting is to ensure adequate growth rates of selected monetary aggregates. The most important characteristics of targeting monetary aggregates are: 1) the choice of the monetary aggregates, 2) target corridor, 3) control mode selected unit.

The demand for money is the key to any reliable connection between money and nominal income. This has important implications for the effectiveness of monetary aggregates as intermediate targets. If the monetary aggregates increase at a constant rate which corresponds to the rate of growth of GDP, adjusted for any change in velocity of money in circulation, then there will be price stability. By linking the growth of monetary aggregates with GDP growth trending, monetary targeting has the role of automatic stabilizers because they act countercyclically. This means that in periods of recession, the quantity of money put in circulation is larger than the growth rate of GDP and thus contraction processes are stifled, while less money than the rate of growth of GDP is needed in periods of expansion, which dims the expansionary effects.

Monetary targeting is appropriate monetary strategy for a country with a stable, reliable and predictable connection between the targeted monetary aggregates and inflation. However, due to financial innovation, capital account liberalization, financial deregulation, changes in the velocity of money in circulation and other factors, the stability of these connections in many countries has declined. By the early 1980s, it became apparent that the relationship between monetary aggregates and inflation and nominal income decreased, which is why many countries have abandoned monetary targeting.

2. Literature Review

Stephen & Kulish (2010) used a structural model with no direct effects of money to show that the finding of positive and statistically significant coefficients on real money growth can be misleading. The model generated data that, when used to estimate analogs of the empirical regressions, produce positive and statistically significant coefficients on real money growth, similar to those often found when using actual data. Favara & Giordani. (2009) showed that shocks to broad monetary aggregates have substantial and persistent effects on output and prices. Hafer, Haslag & Joseph (2007) found that money is not redundant. More specifically, there is a significant statistical relationship between lagged values of money and the output gap, even when lagged values of real interest rates and lagged values of the output gap are accounted for. Also, they found that inside and outside money provide significant information in predicting movements in the output gap. Andres, Lopez-Salido & Valles (2006) found no direct effect of money on inflation and output but that money growth plays a significant role in the interest rate rule and money demand shocks mainly help to forecast real balances while real shocks explain the bulk of price, output and interest rates fluctuations. Nelson (2002) showed that relationship arises from a conventional aggregate-demand channel; claims that an emphasis on the link between monetary aggregates and inflation requires a direct channel connecting money and inflation, are wide of the mark. Svensson (1999) showed that the P* model implies that inflation is determined by the level of and changes in the real money gap (the deviation of current real balances from their long-run equilibrium level), and hence that the real money gap is an important indicator of future inflation. Rudebusch and Svensson (1999) showed that monetary targeting would be quite inefficient, with both higher inflation and output variability. Woodford (1995) showed that the price level remains determinate even in the case of two kinds of radical money supply endogeneity - an interest rate peg by the central bank, and a "free banking" regime - that are commonly supposed to imply loss of control of the price level. Feldstein & Stock (1994) showed that the relation between M2 and nominal

GDP is sufficiently strong and stable to warrant a further investigation into using M2 to influence nominal GDP in a predictable way.

3. Empirical Analysis

In order to test the existence of long-term relationship between money supply and inflation, money supply and GDP, and money supply and unemployment, these were evaluated by three independent panel cointegration regressions in which the money supply acts as an explanatory variable, while inflation, GDP and unemployment rate occur as the dependent variables. The sample consists of 17 countries (Australia, Canada, Chile, Denmark, Israel, Japan, South Korea, Mexico, New Zealand, Poland, Switzerland, the United Kingdom, and the United States). The data are annual and refer to the period from 1990 to 2013. Data on the annual rate of inflation, real GDP per capita, and unemployment rates were obtained from the IMF database (WEO) in October 2013, while data on the movement of money supply obtained from the database of the ECB.

Table 1: The definition and description of the variables used in the models panel cointegration

Variable	Description
log(M1)	Natural logarithm of the monetary aggregate M1
log(GDP_per_capita_ppp)	Natural logarithm of GDP per capita expressed in PPP
INF	Interannual inflation rate, end of year
log(UN_RATE)	Natural logarithm of unemployment rate

Source: Author

3.1. Methodology

In order to assess the long-term relationship between money supply and inflation, money supply and GDP, and money supply and unemployment, three panel cointegration equations are estimated in which the independent variable is money supply and the dependent variable is inflation or GDP or unemployment.

The first step is tested whether there is cointegration relationship between inflation and money supply, GDP and money supply and unemployment rates and the money supply by using the Westerlund test cointegration in panel. The Westerlund test based on 4 test statistic tests the null hypothesis:

H_0: There is no cointegration relationship between the variables versus the alternative hypothesis of the existence of cointegration in panel.

Westerlund test results are shown in Table 2:

Table 2. Results Westerlund test cointegration in panel

	Test	Statistic	P-value
Westerlund test panel cointegration between inflation and money supply	Gt	-4,98	0,53
	Ga	-8,62	0,95
	Pt	-6,80	0,83
	Pa	-8,21	0,67
Westerlund test panel cointegration between GDP and money supply	Gt	-4,21***	0,00
	Ga	-23,62**	0,00
	Pt	-1,16*	0,05
	Pa	-17,66***	0,00
Westerlund test panel cointegration between unemployment rates and the money supply	Gt	-2,99**	0,03
	Ga	-17,26**	0,02
	Pt	-8,30***	0,00
	Pa	-18,92***	0,00

Source: Author
Note: *, ** and *** indicate statistical significance at the level of 10%, 5%, and 1%, respectively.

Westerlund test results are shown in Table 2 and they indicate the following:

1. There is no statistically significant long-term relationship between inflation and the money supply (no cointegration between the two variables). P-value for all four tests (Gt, Ga, Pt and Pa) greater than 0.1, indicate that there is not enough evidence to reject the null hypothesis of no cointegration in panel. Based on this result, it can be concluded that the money supply does not affect inflation in the long term.
2. There is no statistically significant long-term relationship between GDP and money supply, as indicated by all four test statistics within the Westerlund test. Based on the P-values of Table 2, we can conclude that there is sufficient evidence to reject the null hypothesis of no cointegration between these two variables in a given panel, with statistical significance at the 1% level for Statistics Gt, Ga and Pa, while the level significance of 5% based on the statistics Pt rejects the null hypothesis.
3. There is also statistically significant long-term relationship between unemployment rates and the money supply, as indicated by P-values for all four test-statistics within the Westerlund test cointegration in panel.

Based on the test statistics of Gt and Ga with a level of significance of 5%, we can reject the null hypothesis of no cointegration links in the panel, and on the basis of test statistics and Pt Well, the null hypothesis of no cointegration in panel reject the significance level of 1%.

3.2. Rating coefficients long-term relationships

Since the Westerlund test results indicate the existence of cointegration links between unemployment and money supply to GDP and money supply, the two models are estimated where GDP and unemployment rates are the dependent variables. The models are estimated using the MG method which is based on steady-state error correction. On the other hand, since the hypothesis of the existence of links between money supply and inflation is rejected in the first step, the coefficients cointegration relationship between inflation and money supply are not evaluated.

Results for cointegration model links between GDP and money supply are shown in Table 3:

Table 3: Rating cointegration coefficients connection between GDP per capita expressed in PPP and money supply

Dependent variable: log (GDP_per_capita_ppp)	MG method	
Independent variables	Coefficient	P-value
Log(M1)	0, 42***	0,00
Correcting errors equilibrium	-0,19***	0,00
$\Delta\log(M1)_{t-1}$	0,02*	0,05
Constant	1,63***	0,00

Source: Author
Note: *, ** and *** indicate statistical significance at the level of 10%, 5% and 1% respectively.

Results in Table 3 suggest that the long-run relationship between money supply and GDP is positive and statistically significant (coefficient with Log (M1) is 0.42, a P-value of 0.00). This means that in the long run, money supply growth by 1% leads to a GDP growth of 0.42%. This result is statistically significant at a significance level of 1%. The coefficient of the variable which represents the equilibrium error is negative (-0.19) and statistically significant at a significance level of 1%. This result indicates that there is convergence towards the long-run equilibrium level and that it is 19% per annum. The coefficient of the $\Delta\log (M1)_{t-1}$ indicates that in the short term there is a positive relationship between money supply and

GDP, but the relationship is weaker (0.02) and statistically significant at a significance level of 5%.

Results for cointegration model links between unemployment rates and the money supply is shown in Table 4:

Table 4: Rating cointegration coefficients connection between the unemployment rate and money supply

Dependent variable: log(UN_RATE)	MG method	
Independent variables	Coefficient	P-value
Log(M1)	- 0,02***	0,00
Correcting errors equilibrium	-0,28***	0,00
$\Delta\log(M1)_{t-1}$	-0,02*	0,01
Constant	0,04***	0,00

Source: Author
Note: *, ** and *** indicate statistical significance at the level of 10%, 5%, and 1%, respectively.

Results in Table 4 suggest that the long-run relationship between money supply and the unemployment rate is negative and statistically significant (coefficient with Log (M1) is -0.02, a p-value of 0.00). This means that in the long run, money supply growth of 1% leads to a drop in the unemployment rate of 0.02%. This result is statistically significant at a significance level of 1%. The coefficient of the variable indicating the correction steady state error is negative (-0.28) and statistically significant at a significance level of 1%. This result indicates that there is convergence towards the long-term equilibrium level and at 28% per annum. The coefficient of the $\Delta\log (M1)_{t-1}$ indicates that in the short term, there is also a negative relationship between the money supply and the rate of unemployment and the connection is -0.02 and is statistically significant at a significance level of 5%.

4. Conclusion

Demand for money is the key to any reliable connection between money and nominal income. If a money demand is stable, fluctuations links money - income or velocity of money in circulation will be systematically associated with the variations of the determinants of the demand for money. This has important implications for the effectiveness of monetary aggregates as intermediate targets. In the medium term, the quantity theory of money should ensure predictable relationship between monetary target and nominal income. If tendencies of de-

terminants of the velocity of money are predictable (real income, interest rates, inflation expectations), this will also be the tendency of the velocity of money. With an appropriate analysis of the expected speed of movement of money in circulation one can determine the monetary target in order to achieve the long-term potential output growth and inflation target. In the short term, there may be significant deviations from long term targets because the economy is exposed to different real shocks and price shocks. However, the target money supply will stabilize the economy in such shocks. For example, earnings shocks that monetary policy has not corrected will lead to an increase in interest rates, reducing income and employment to the point where it reduces the "resistance earnings". Therefore, the trend of nominal income seeks to re-actualize. Since the long-term growth of real output is of limited range (equal to potential output growth), a medium-term control of monetary aggregates should be an effective instrument to limit inflation. On the other hand, if the economy is exposed to financial shocks that change the velocity of money in circulation, regardless of the determinants of the demand for money, control of the money will not be an effective way to achieve the final target output and inflation.

When the path of money growth to inflation is not direct, it is not necessary to observe inflation associated with the growth of money only in the long term. Open market operations increase money growth and reduce real wages. In case of persisting inflation, real wages are falling in the short term and generate both variations in real aggregate demand relative to potential GDP as well as inflation. This is contrary to the argument that the correlation between money growth and inflation generate only from the function of long-term demand for money, which has a unit price ratio. Variations opportunity costs associated with the movement, both real money and real aggregate demand, and thus contribute to generating the correlation between money growth and inflation. Therefore, the growth of money explains the dynamics of inflation over the effect of monetary policy on real aggregate demand relative to potential GDP. The ability to observe the dynamics of inflation in this way provides the basis for the traditional analysis of adjustment policies, i.e. implications for inflation due to non-monetary events (e.g. an increase in public spending or an increase in oil prices). These events generate current inflation if monetary policy is "adjusted", allowing an increase in money growth. For example, the oil price shock permanently increases the level of price reduction by reducing potential output, but it keeps the current inflation only if the central bank conducts monetary policy that permits the nominal money growth to permanently increase after the oil shock compared to the growth of output. Other pressures on the price level can be treated similarly. Also, changes in public spending, with unchanged growth of money, can perma-

nently affect the price level effects on potential output and short-term change in opportunity cost real money funds, but cannot generate current inflation.

Most countries have abandoned monetary targeting. The reasons for this are the weak link between the traditional criteria for money supply and inflation and the difficulty of controlling the monetary aggregates. A weak relationship between monetary aggregates and inflation is not due to the fact that there is no more relationship between money and inflation, but certain institutional changes (financial deregulation, development of new payment mechanisms, financial innovation, liberalization of the capital account, the change in velocity of money in circulation, etc.) generate the problem of establishing predictable relationship between inflation and any particular criteria of the money supply.

A weak and unstable relationship between money and inflation will cause the following: 1) the achievement of monetary aggregates will not generate the desired outcome of inflation, 2) monetary aggregates will not provide reliable signals about the position of monetary policy, and 3) it will not be an effective anchor for inflation expectations.

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