

The Velocity of Money and Nominal Interest Rates: Evidence from Developed and Latin-American Countries

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Abstract

This study examines the behavior of the velocity of money in developed and Latin-American countries from 1975 to 2000. In most cases the velocity was not constant in the long run. We provide some evidence for a positive association between velocity and interest rates. The velocity and the interest rates were on average higher in Latin-American countries than in developed countries. We also show that the first lag of interest rates was more strongly associated with velocity than the current level of interest rates.

JEL classification: E00, E40

Keywords: Nominal interest rates, lags in interest rates, the velocity of money

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1. Introduction

The velocity of money is a key macroeconomic variable. The concept of velocity is discussed in undergraduate textbooks of macroeconomics (see, for example, Barro, 1997, pages 148-151, and Mankiw, 2000, pages 161-164). Friedman and Schwartz (1963) present the historical behavior of velocity in the United States. In 1869-1879, the velocity was roughly stable (between 4 and 5). Velocity declined to approximately 3 in 1897 and to approximately 2 in 1914. In 1914-1918, the velocity of money rose to 2.5 and then it decreased to approximately 1.5 in 1933. In 1933-1941 velocity was roughly stable. It declined to 1.3 in 1948 and then it increased to 1.7 in 1960. Barro (1997) shows that velocity rose from 1960 to 1980 and had no clear trend thereafter.

Economic schools differ concerning the views on the behavior of the velocity of money. The monetarists claim that velocity is relatively stable. Monetarism is based on the quantity theory of money. This theory assumes that velocity is constant. In this case monetary changes are associated with correspondingly large changes in nominal output. On the contrary, the neo-Keynesian economists believe that the velocity of money is a positive function of nominal interest rates. This assumption has its foundations in the fact that the demand for money depends negatively on interest rates.

The present study tries to shed light on the behavior of velocity in the last quarter of the twentieth century. The velocity of money, V , can easily be derived from the quantity equation:

$$MV = PY, \tag{1}$$

where M is the money supply, P is the price level, and Y is the real product. The data on the money supply and the nominal product are available from the International Financial Statistics. This study focuses on developed and Latin-American countries. It uses indicators of money that are close to $M1$ (except for Sweden and the United Kingdom, for which the International Financial Statistics presents only data for an indicator that is close to $M2$).

2. The evidence from developed countries

Table 1 presents the evolution of velocity for 21 developed countries in five-year intervals between 1975 and 2000. The velocity was typically higher in the 1980s than in the 1990s.

I regressed the velocity of money on nominal interest rates (for annual observations):

$$V = a + bi, \quad (2)$$

where a and b are parameters, and i denotes interest rates. The discount rate (end of period) was typically used as a measure of i . Due to the methodological changes in the data, I omitted regressions for Finland and the United Kingdom. The methodological change forced me to cut the sample for Ireland. Table 2 presents the results of regressions for 19 countries. A positive dependence of V on i prevails. The dependence is significantly positive for 9 countries, insignificantly positive for 6 countries, insignificantly negative for 1 country, and significantly negative for 3 countries. The average t -statistic for b was 2.19 (standard deviation 3.33). For Finland and the United Kingdom, I observed that the decline of interest rates in the 1990s was accompanied by some decline of velocity. This is some evidence that the velocity of money depends positively on nominal interest rates. Of course, the samples considered are relatively short. Moreover, we do not test for heteroskedasticity or autocorrelation. The purpose of this section (and the subsequent section) is to provide only a rough picture of the dependence of velocity on interest rates in individual countries. The tests for heteroskedasticity and autocorrelation are carried out in chapter 4, where we examine a section of panel data.

3. The evidence from Latin-American countries

Table 3 summarizes the velocity of money for 14 Latin-American countries. We consider only those Latin-American countries for which we have a sufficiently long series of interest rates. The velocity was typically low in the 1970s and high in the 1980s and 1990s. Thus, velocity was again not very stable in the long run.

Table 4 shows the results of regressions of velocity on interest rates for Latin-American countries. The interest rates were typically measured by discount rates or deposit rates. Due to the methodological change, I cut the sample for Costa Rica. The dependence of V on i was significantly positive for 7 countries, insignificantly positive for 1 country, and insignificantly negative for 6 countries. It was never significantly negative. The average t -statistic for b was 2.49 (standard deviation 4.64). Thus, V depends positively on i on average.

Even though the dependence of V on i is insignificant for Argentina, Bolivia, and Brazil, the data suggest that very high values of V followed very high values of i in these countries.

Deposit rates (year averages) rose from 372% in 1988 to 17,236% in 1989 in Argentina, and velocity jumped from 11.88 to 22.46 in 1990. In 1990, the deposit rates decreased to 1,518%. In Bolivia, the deposit rates increased from 40% in 1983 to 108% in 1984, and the velocity rose from 6.20 in 1984 to 14.48 in 1985 and 20.62 in 1986. The deposit rates decreased to 69% in 1985 and 33% in 1986. In Brazil, the money market rates (year averages) rose from 1,574% in 1992 to 3,284% in 1993 and to 4,821% in 1994. The velocity increased from 13.67 in 1994 to 20.13 in 1995. In 1995, the interest rates were much lower (53%). It is therefore possible that velocity reacts to interest rates with some lag.¹

4. Developed and Latin-American countries

Interest rates were on average substantially higher in Latin-American countries than in developed countries. For developed countries (Latin-American countries, respectively), the average interest rates were 6.8% (11.1%) in 1975, 12.2% (30.6%) in 1980, 11.0% (93.6%) in 1985, 10.9% (1,285.2%) in 1990, 5.6% (30.1%) in 1995, and 5.6% (15.9%) in 2000. The extremely high average interest rate in Latin-American countries in 1990 was mainly due to hyperinflation in Brazil. The velocity also tended to be higher in Latin-American than in developed countries. If we exclude Sweden and the United Kingdom (where the velocity was M2-based), the average velocity for developed countries (Latin-American countries, respectively) was 5.2 (7.5) in 1975, 6.1 (8.3) in 1980, 6.5 (10.2) in 1985, 5.9 (11.9) in 1990, 4.9 (12.6) in 1995, and 3.8 (11.1) in 2000. This is again evidence that velocity depends positively on interest rates. Among developed countries, the velocity was the highest in Iceland. Also the interest rates were the highest in Iceland (reaching a peak of 49.2% in 1987).

We can examine the dependence of velocity on interest rates in a joint panel of developed and Latin-American countries. We focus on a section of the panel – namely on the years 1980, 1990, and 2000. Figure 1 shows the dependence of velocity on interest rates. The dependence is clearly positive, which can be seen from the corresponding regression:

$$V=3.82+0.17i, \tag{3}$$

(6.26) (5.06)

¹ This rule is likely to hold only on the average. A sharp increase in interest rates in Brazil in 1989 and 1990 was followed by no significant increase in velocity.

where $R^2=0.34$. t-statistics are in parentheses. There are 52 observations. As measured by the t-statistic, the dependence is strongly significant. We have considered only those countries for which the interest rate was measured by a discount rate (or bank rate) and for which velocity was M1-based. We have omitted the outlying observation for Peru in 1990 with extremely high interest rates. The Durbin-Watson statistic is 2.16, which indicates no autocorrelation. To test for heteroskedasticity, we use the Goldfeld-Quandt test (see Kmenta, 1997, page 292), comparing the sums of squared residuals in the regressions with the lowest 20 and the highest 20 interest rates. The critical values of the F-statistic are 2.22 at a 5% level and 3.13 at a 1% level. The actual value of the F-statistic is 3.92, which indicates heteroskedasticity. We observe heteroskedasticity because the dispersion of velocity is high for Latin-American countries. Consequently, the estimates in regression (3) are consistent, unbiased, but inefficient. We do not think that heteroskedasticity is a big problem here since the dependence in equation (3) is strongly significant (the t-statistic is much higher than 2).

One might want to be interested in the robustness of the positive dependence of velocity on interest rates. By eliminating observations with the five lowest and the five highest interest rates, we obtain the following relationship:

$$V=3.87+0.18i \quad (4)$$

(4.10) (2.93)

where $R^2=0.18$ and the Durbin-Watson statistic is 2.25. The dependence remains significant. The Goldfeld-Quandt test (with the lowest 20 and the highest 20 interest rates) yields the F-statistic equal to 4.75, which again indicates heteroskedasticity.

An interesting question is whether the velocity of money depends more strongly on lagged values of interest rates than on current interest rate values. In section 3 we have shown that casual evidence from Argentina, Bolivia, and Brazil indicates this possibility. If velocity is regressed on the first lags of interest rates in 1980, 1990, and 2000, we get (52 observations)

$$V=3.89+0.16i(-1), \quad (5)$$

(7.54) (6.14)

where $R^2=0.43$. This relationship is shown in Figure 2. The given relationship is somewhat more significant than the relationship in equation (3). Argentina, Bolivia, and Brazil are

excluded since their discount-rate series are very short. If we carry out a multiple regression of V on i and $i(-1)$, we obtain

$$V=3.65+0.05i+0.12i(-1) \quad (6)$$

(6.40) (1.01) (3.01)

where $R^2=0.44$ (adjusted $R^2=0.42$). Velocity depends substantially more significantly on $i(-1)$ than on i . Discount rates in the International Financial Statistics are typically measured on an end-of-year basis. Thus, $i(-1)$ indicates interest rates at the beginning of a year, while i relates to interest rates at the end of a year. Equation (6) shows that there may be some lag in the dependence of velocity on interest rates. We note that velocity was constructed from period averages (the nominal GDP) as well as end-of-year data (the money supply).

If we consider the second lag of interest rates, we get (52 observations)

$$V=4.66+0.12i(-2), \quad (7)$$

(8.79) (4.41)

where $R^2=0.28$. This relationship is less significant than those given by equations (3) and (5). The given relationship is presented in Figure 3. In the multiple regression we obtain

$$V=3.65+0.05i+0.14i(-1)-0.02i(-2), \quad (8)$$

(6.35) (0.98) (2.36) (-0.38)

where $R^2=0.44$ (adjusted $R^2=0.41$). This equation again underscores the importance of the first lag of interest rates.

5. Conclusion

This paper examines the stability of the velocity of money over time and a possible dependence of velocity on nominal interest rates in the samples of developed and Latin-American countries in 1975-2000. Among developed countries, velocity was on average higher in the 1980s than in the 1990s. Among Latin-American countries, velocity was relatively low in the 1970s and high in the 1980s and 1990s. Nevertheless, velocity was relatively stable in Austria, Belgium, Denmark, France, Italy, Spain, Sweden, Switzerland, the

United States, Chile, and Honduras. Both for developed and Latin-American countries, the velocity of money depended significantly positively on interest rates in many cases. The velocity and the interest rates tended to be higher for Latin-American than for developed countries. We observe a strongly significantly positive relationship between velocity and interest rates in the joint sample of developed and Latin-American countries in 1980, 1990, and 2000. These findings provide some support for the neo-Keynesian view that velocity is a positive function of interest rates. The evidence from Argentina, Bolivia, and Brazil suggests that velocity may react to interest rates with a time lag. A similar conclusion can be drawn from regressions in the joint sample of developed and Latin-American countries for 1980, 1990, and 2000.

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Table 1: The velocity of money for developed countries.

	1975	1980	1985	1990	1995	2000
Australia	7.42	7.93	10.19	8.45	5.78	4.73
Austria	4.89	6.47	7.12	6.90	5.79	
Belgium	3.54	4.23	4.93	5.23	5.04	3.69
Canada	6.59	8.90	6.80	6.90	5.88	4.73
Denmark	4.48	4.98	4.05	3.38	3.46	
Finland	10.48	12.49	11.41	10.58	3.15	3.25
France		3.60	3.69	3.93	4.31	
Germany	6.44	6.18	6.16	5.13	4.83	
Iceland	12.16	15.43	17.99	14.95	11.78	
Ireland	3.12	2.99	6.33	6.77	4.65	5.07
Italy	2.12	2.26	2.62	2.82	3.06	2.40
Japan	2.97	3.50	3.66	3.69	2.90	2.07
Netherlands	4.59	5.35	4.77	4.24	3.78	2.73
New Zealand	6.67	9.07	11.03	7.70	8.00	7.10
Norway	5.04	6.88	5.52	3.04	2.59	2.48
Portugal	1.66	2.56	3.55	4.12	3.70	2.34
Spain	2.99	3.70	4.32	3.54	3.90	
Sweden	1.76	1.74	1.95	2.11	2.28	2.31
Switzerland	2.93	2.76	3.21	3.76	3.61	2.53
United Kingdom	2.64	3.08	2.44	1.07	0.99	0.91
United States	5.07	5.91	5.96	6.27	6.06	6.84

Notes: For Austria, France, Germany, and Spain, the velocity was derived from M1 (national definitions). For Belgium, Finland, Ireland, Italy, the Netherlands, and Portugal, the velocity was constructed from the money indicator given by a sum of currency and demand deposits (codes 34a.n and 34b.n in the IFS). For Sweden and the United Kingdom, the money indicator corresponded to money plus quasi money (code 351 in the IFS). For the other countries, the velocity was derived from money (code 34 in the IFS). There were major methodological changes in Finland in 1991, Ireland in 1982, and the United Kingdom in 1987.

Table 2: The results of regressions of the velocity on nominal interest rates for developed countries.

	Period	a	b	t _a	t _b	R ²
Australia	1975-1995	4.91	0.29	10.48	7.38	0.74
Austria	1975-1997	5.76	0.12	12.17	1.27	0.07
Belgium	1975-1997	4.95	-0.04	15.92	-1.13	0.06
Canada	1975-2000	4.07	0.32	8.18	6.16	0.61
Denmark	1975-1999	2.49	0.21	7.10	4.63	0.48
France	1977-1998	4.44	-0.06	19.85	-2.44	0.24
Germany	1975-1998	5.15	0.09	13.02	1.15	0.06
Iceland	1975-1998	11.71	0.15	15.30	4.46	0.49
Ireland	1982-1998	5.85	0.05	9.79	0.79	0.04
Italy	1975-1998	2.99	-0.03	16.45	-2.25	0.19
Japan	1975-2000	2.70	0.13	19.45	3.88	0.39
Netherlands	1975-2000	1.28	0.40	2.91	7.25	0.70
New Zealand	1975-2000	6.18	0.21	12.13	4.93	0.50
Norway	1975-2000	3.84	0.05	2.89	0.36	0.01
Portugal	1975-1998	2.90	0.02	8.39	1.08	0.05
Spain	1975-1998	3.20	0.05	16.71	2.99	0.29
Sweden	1975-2000	2.30	-0.04	26.91	-4.03	0.40
Switzerland	1975-2000	2.41	0.19	15.80	4.74	0.48
United States	1975-2000	5.86	0.01	24.13	0.39	0.01

Notes: The observations were missing for France in 1981, Iceland in 1993, Ireland in 1992, and the Netherlands in 1998. Unless stated otherwise, the interest rate was the discount rate (the discount rate was used whenever it was available). For Canada and Switzerland, the interest rate was the bank rate. For France, the interest rate corresponded to the repurchase of agreements. For the Netherlands, the government bond yield was used. For Portugal and Spain, the Banco de Portugal rate and the Bank of Spain rate were used.

Table 3: The velocity of money for Latin-American countries.

	1975	1980	1985	1990	1995	2000
Argentina	4.09	10.61	15.16	22.46	15.53	14.33
Bolivia	10.34	8.36	14.48	15.49	8.24	12.93
Brazil	6.26	9.67	13.07	12.59	20.13	14.67
Chile	11.90	10.64	13.23	12.57	11.19	10.35
Colombia	6.88	7.43	9.11	9.52	10.45	10.32
Costa Rica	6.00	5.67	6.11	7.86	13.86	7.68
Ecuador	6.06	5.96	10.51	10.96	12.63	10.04
El Salvador	6.91	6.24	6.37	9.08	9.48	11.97
Guatemala	10.31	10.47	8.30	10.59	10.96	7.88
Honduras	8.45	8.40	8.92	6.76	8.02	7.35
Mexico	8.99	9.29	13.62	14.65	12.22	12.18
Peru	4.46	8.23	8.19	7.70	16.12	8.86
Uruguay	9.79	10.15	10.84	15.18	17.34	16.93
Venezuela	4.63	4.68	4.29	10.63	10.18	10.26

Notes: The velocity was derived from money (code 34 in the IFS). There was a major methodological change in Costa Rica in 1997.

Table 4: The results of regressions of the velocity on nominal interest rates for Latin-American countries.

	Period	a	b	t _a	t _b	R ²
Argentina	1977-2000	14.47	-0.00	16.14	-0.43	0.01
Bolivia	1979-2000	12.66	-0.03	9.17	-0.73	0.03
Brazil	1975-2000	12.18	0.00	15.16	0.06	0.00
Chile	1977-2000	10.87	0.03	34.96	3.40	0.34
Colombia	1975-2000	5.81	0.10	5.33	2.84	0.27
Costa Rica	1975-1996	3.12	0.16	2.12	3.19	0.34
Ecuador	1975-2000	6.04	0.12	10.08	6.84	0.66
El Salvador	1983-2000	10.76	-0.14	5.03	-0.89	0.05
Guatemala	1978-2000	8.73	0.15	12.20	2.31	0.20
Honduras	1982-2000	8.01	-0.03	18.49	-0.85	0.04
Mexico	1975-2000	8.42	0.09	11.51	5.00	0.51
Peru	1975-2000	10.28	-0.00	12.09	-0.50	0.01
Uruguay	1976-2000	15.58	-0.04	10.33	-1.37	0.08
Venezuela	1975-2000	3.46	0.14	11.70	15.97	0.91

Notes: The observations were missing for Colombia in 1986 and 1989. Unless stated otherwise, the interest rate was the discount rate (the discount rate was used whenever its series was sufficiently long). For Argentina, Bolivia, Chile, El Salvador, Guatemala, Honduras, and Uruguay, the interest rate was the deposit rate. For Brazil, the interest rate was the money market rate. For Mexico, the interest rate was the average cost of funds.

Figure 1. The dependence of velocity on interest rates for 1980, 1990, and 2000.

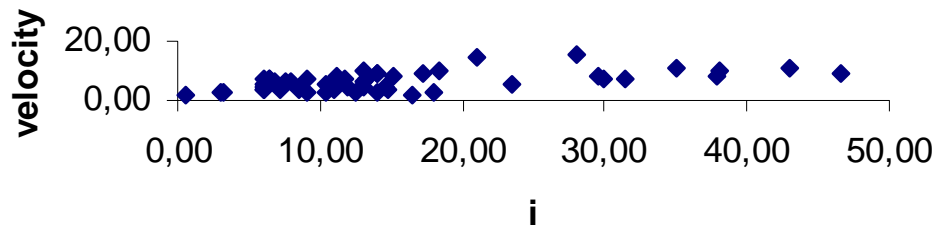


Figure 2. The dependence of velocity on the first lag of interest rates in 1980, 1990, and 2000.

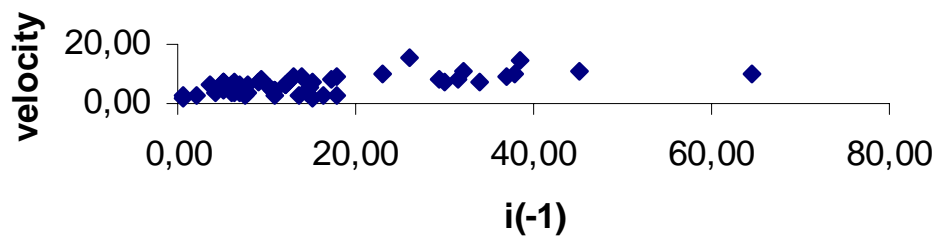


Figure 3. The dependence of velocity on the second lag of interest rates in 1980, 1990, and 2000.

