MODERN QUANTITY THEORIES OF MONEY: FROM FISHER TO FRIEDMAN

(Revised and expanded version)

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Most economic historians who give some weight to monetary forces in European economic history usually employ some variant of the so-called **Quantity Theory of Money**. Even in the current economic history literature, the version most commonly used is the Fisher Identity, devised by the Yale economist Irving Fisher (1867-1947) in his book *The Purchasing Power of Money* (revised edn. 1911). For that reason we cannot avoid it, even though most economists today are reluctant to use it without significant modification.

1. **The Fisher Identity**, or **The Equation of Exchange**: **M.V ≡ P.T**

M = stock of money in coin, notes, bank deposits ('high-powered')

V = the velocity of circulation; the rate at which a unit of money circulates in effecting transactions in course of one year; the average number of times it 'turns over'

P = some measure of the price level; e.g., the Consumer Price Index

T = the total volume of monetary transactions that take place in the economy during the course of that same year.

a) **This is more of an identity (≡) or tautology than it is a causal equation**: it simply states that total spending, in terms of the money stock multiplied by the rate of its turnover or circulation, necessarily equals total spending in terms of the total volume of monetary transactions multiplied by the current price index. The two values on each side of the ≡ sign are necessarily identical.

b) **Problems with the Fisher Identity:**

i) **M** and **P,** it has been argued, are extremely difficult to estimate or calculate. For the medieval, early modern, modern, and present day eras this is a form of nitpicking that in no way invalidates the model. Good proxies can be provided for most of these eras, certainly good enough to indicate general movements of both prices and monetary stocks. The other two objections are far more important.

ii) **T** really is quite impossible to calculate for any period or even to comprehend. That is, even if we could attach a numerical value to T, it would be rather meaningless: T = the total volume of all transactions in the economy, both intermediate and final, from raw materials to fully manufactured products along with all services. How can we resolve the problem of multiple counting? How can we add up all the transactions

involving so many different commodities and services: with what common denominator? Adding together apples and oranges (as pieces of fruit) is a very simple task by comparison.

iii) **V,** as a measure of the velocity of circulation or turnover of money, is not in fact an independent variable, but rather a residual one, which has to be calculated algebraically by first knowing the other three. Thus we can calculate V only by this formula: **V = (P.T)/M**

2. **The Cambridge Cash Balances Equation: M = k.P.T**

This is a lesser-known rival to the Fisher Identity that emerged during the 1920s at Cambridge, with a formula that resolved at least the problems concerning Velocity:

a) **Its originators at Cambridge (especially A.C. Pigou) asked two principal questions**:

(1) how much 'high-powered' money (usually called M1), do people currently wish to hold in the form of cash balances (money held in coin, notes, bank deposits), rather than being spent or invested?

(2) What, therefore, is the ratio of those cash balances to the total money value of all transactions in the economy?

b) That ratio is indicated by the letter **k;** and this form of the Quantity equation now becomes: **M = k(P.T)**. The letter **k** thus indicates the proportion of the total value of all monetary transactions that the public chooses to hold in cash balances; and thus it tells us the necessary amount of **M** that is required for that level of **P.T** (total spending). Note that P times T again equals the total monetary value of all transactions; and thus suffers from the same problems of estimating the value of T, as indicated above for the Fisher Identity.

c) **Liquidity Preference:** a concept further developed by Keynes, who asked a fundamental question. Why do people wish to hold cash balances, instead of immediately spending or investing that money? He suggested three motivations.

(1) **transactions motive:** people hold a stock of ready cash in order to meet their day to day needs in buying goods and paying for services, etc. This is deemed to be the major need for holding ready cash.

(2) **precautionary motive:** to have ready cash on hand in order to meet some unforseen emergency, as a contingency fund for future needs.

(3) **speculative motive:** to have ready cash to take immediate advantage of some special investment opportunity -- a cash fund to speculate with.

d) **Cash Balances and Opportunity Cost:**

What is the cost of holding these cash balances? The true cost is the **opportunity cost:** i.e. the interest or other investment income *foregone* by not investing those balances. Consequently, we should find that cash balances are to some extent interest-sensitive, and vary with interest rates. That is, the proportion of national income held in cash balances (**k**) should fall as real interest rates rise, because rising interest rates will increase the opportunity cost of holding those balances; and conversely that proportion **k** held in cash balances should rise with falling real interest rates.

e) **Note that mathematically, the Fisher and Cambridge Cash Balances equations are related**: k is the reciprocal of V; V is the reciprocal of k

f) **What is the difference between k and V?**

Why is k a more useful variable than V? Because **k** is much more 'predictable;' and conceptually **k** is an 'active' variable -- i.e. we should be able to predict roughly what proportion of total national expenditures people wish to hold in cash balances. But **V**, on the contrary, is a passive (i.e. resulting from) or 'residual' variable, calculated as noted only by first knowing M, P, and T. Thus one might say that **k** (cash balances) is a **predictive** measure of velocity, while **V** measures only resulting velocity.

3. The Basic Suppositions Concerning the Older Quantity Theories of Money

a) **The Demand for Money is chiefly a TRANSACTIONS DEMAND:**

b) **The Transactions Demand for Money will be proportional to the aggregate value of transactions (i.e. k as proportion of P.T);** and this proportion will not vary in the short run;

c) **The Supply of money is exogenously determined,** determined independently of the economy (by some external authority or events).

d) **Full Employment prevails:** so that any increase in aggregate demand will not increase the volume of output or transactions (T);

e) **Those with excess money will spend it on goods and services;** those with insufficient supply of money will cut their expenditures on goods and services.

f) **The Transactions Velocity of Money is, at least in the short run, very stable.**

4. The Modern Form of the Quantity Theory: Friedman's Income Version

a) While the Cambridge cash balances approach apparently resolved the problem of V, it did not resolve the quite intractable problem of T. Modern economists, however, have more or less resolved that problem by ignoring the total volume of transactions, and by looking instead at the Net National Income or the aggregate of net national expenditures.

b) To understand this, we can begin with the Gross National Product or its equivalent, the Gross National Income: as the total current money value of all final goods and services produced in the economy in a given year. From that dollar amount we deduct a sum for 'depreciation' (for depreciation of worn out, wasted capital stock) in order to arrive at Net National Product. Thus, just as Gross National Product (GNP) = Gross National Income (GNI), so Net National Product (NNP) = Net National Income (NNI), which is represented here by the capital letter Y. That letter Y will be familiar to anyone who has studied at least the rudiments of Keynesian economics:

$$\mathbf{Y = C + I + G + (X - M).}$$

That is, Net National Income (Y) equals the sum of total national Consumption (C) plus total Investment (I) plus Government Expenditures (G) plus the net difference between total Export incomes (X) and total expenditures on Imports (M).

c) Since this value **Y** is usually expressed in terms of current dollars, we must now express that net national income in dollars of unchanging values, i.e. in what are called 'constant dollars' that reflect a constant or stable purchasing power, which has been adjusted for inflation (thus the term: 'deflated net national income'). That value of a deflated NNI, or 'real NNI,' or 'net national income in constant dollars,' is expressed by lower-case **y.** Upper-case **Y** of course measures NNI in current dollars, which currently has meant a declining purchasing power, because of inflation.

d) This new value **y** or real **NNI** is obviously much more measurable than **T.** To calculate **y:** divide **Y** by **P.** That is, calculate the NNI by deducting depreciation from the GNP; and then divide that result (NNI) by some agreed upon price index (e.g. consumer price index): $\mathbf{y = Y/P}$.

For example: the value of the Gross Domestic Product in 2003 was $1,218.772 billion. Divide that amount by the GDP Price Index (whose base is 1992 = 100), which is 122.317 -- i.e., meaning that this price index is 22.32% higher than the weighted average of prices for all items in the price basket for 1991. The result (divided by 1.22317) is $996.362 billion, which is the 'real' GDP for 2003 in constant 1992 dollars. Unfortunately the data currently available are for GDP only, not for NNP; and these GDP data will have to serve as proxies for Y and y.

e) So, by using that **'y'** value to express constant or deflated net national income (NNI), in place of unmeasurable T, in the two quantity theory equations, those Fisher and Cambridge equations

now become:

i) Fisher: **M.V = P.y**

Thus **V** measures the income velocity of money: the rate at which a unit of money circulates in producing total net national income (or net national expenditures or net national product).

ii) Cambridge Cash Balances: **M = k.P.y** or, **M = kPy**

Thus **k** measures the proportion of aggregate national income that the population collectively holds in cash balances.

iii) While the Cambridge version is conceptually preferable, it is mathematically related to the much more widely used Fisher equation, or better the modern income version of that equation (k = 1/V). So you will presumably also prefer to use it: but at least please use it in this modernized form: **M.V = P.y** [**MV = Py]**

iv) **Examples for 2003 (for the CPI: 1992 = 100)**

(1) **M = k.P.y** **k = M/(P.y)**

M_{1B} = \$265,465.200 million

P = 122.317

y = \$996,361.121 million

GDP = P.y = 1.22317 *x* \$996,361.121 million = \$1,218,772.000 million

k = 265,465.200/ (1.22317 *x* 996.3651.121) = 265,465.200/1,218,771.000 = 0.218

[Thus cash balances in high-powered money M_{1B} = 21.8% of the total GDP (in current prices)]

(2) **M.V = P.y** **V = (P.y)/M**

M_{1B} = \$265,465.200 million

P = 122.317

y = \$996,361.121 million

V = (1.22317 *x* 996.3653.121)/ 265,465.200 = 1,218,772.00/265,46.200 = 4.591

k = 1/V k = 0.218; 1/0.218 = 4.591 = V; 1/4.591 = 0.218 = k

f) **What factors affect V and k?**

i) **Any changes affecting those three elements of liquidity preference**: for the transactions, precautionary, and speculative demands for money.

ii) **Interest rates and levels of national income**:

iii) **Changes in population**: population structures, market structures, transaction costs, etc. requiring that a greater or smaller proportion of national income be held in cash balances.

iv) **Changes in financial instruments**: many of which economize on the use of money, coined money, and so speed up the effective velocity of coinage

v) **Supply shocks**: effects of famine, war, war financing, etc; sudden increases in the supply of food, fuel, etc.

vi) **Predictions about the future value of money**: i.e. a form of 'rational expectations:' if you believe that in the future money will lose its purchasing power, you will get rid of it, i.e. exchange it for assets of more stable value: and thus reduce cash balances and increase money velocity.

g) **Keynesian Criticisms of the Quantity Theories of Money**:

i) While quantity theorists believe that **k or V** are stable, at least in the short run, Keynes and his followers believe(d) that these variables are highly unstable and volatile.

(1) in particular, they argue that k and V are highly sensitive to interest rates in the short run, which in turn are functionally related to changes in the money supply. In short, Velocity varies inversely with the money supply and directly with interest rates; alternatively, that k varies directly with the money supply and inversely with interest rates. Remember that the interest rate represents the opportunity cost of holding cash balances.[1]

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[1] See J. M. Keynes, *General Theory of Employment, Interest, and Money* (1936), p. 298: 'The primary effect of a change in the quantity of money on the quantity of effective demand is through its influence on the rate of interest.' And further, on p. 336: 'Now, if the wage-unit is somewhat stable..., if the state of

(2) Thus, in the short run at least, an increase in the money supply M should lower interest rates, which in turn should reduce Velocity (or permit a rise in k). Furthermore, a more plentiful money supply reduces the need to **economize** on the use of money, thus also reducing Velocity (or encouraging larger cash balances).

ii) While quantity theorists have looked upon the aggregate money supply (continental or world -- depending on the era) as largely **exogenous**, Keynesians have considered it to be largely **endogenous**, and a function of the real factors determining production and trade.

iii) The classic Quantity Theory of Money, as noted earlier, assumed a normal or equilibrium state of Full Employment, meaning that all resources would be fully employed, so that any increase in monetized spending would have to drive up prices proportionally, since any further increase in production and trade was impossible (in the short run). Keynes, writing during the Great Depression years, argued that underemployment of resources was more often the normal state; and that an increase in monetized spending would induce the productive employment of further resources, resulting in an increased output and trade that would counteract any potential inflation from that increased spending.

iv) **Keynes on longer-term inflation**: In criticizing the classical Quantity Theory of Money, he stated: 'So far, we have been primarily concerned with the way in which changes in the quantity of money affect prices in the short period. But in the long run is there not some simpler relationship? This is a question for historical generalisation rather than for pure theory...' [*The General Theory of Employment, Interest, and Money* (1936), p. 306.]

v) **Observations**:

(1) Can we assume such perfect elasticity of response of V or k to changes in M and to changes in interest rates: Would an historian, usually studying somewhat 'longer runs' than those assumed by economists, believe that V or k would always change in exact proportion to changes in M, over long periods of time?

(2) We may deal with that question by assuming that, to the extent that changes in V or k are not exactly proportional to the changes in M, the difference is taken care of by increases in production and trade, i.e. by the changes in **y**.

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liquidity-preference is somewhat stable..., and if banking conventions are also stable, the rate of interest will tend to be governed by the quantity of the precious metals, measured in terms of the wage-unit, available to satisfy the community's desire for liquidity.'

But again the historian may doubt that all the changes -- in M, V or k, and y -- are always so neatly counterbalancing, so that P (the price level) remains stable.

(3) We may agree that the money supply, especially for any given region or country, is far more endogenous than was assumed by the classical Quantity Theory; and that changes in real factors, changes in investment, production, and trade, may well induce necessary changes in the money supply, especially if the money supply is heavily based on credit instruments. But what about a pre-modern money supply that is far more based on precious metals? Are changes in the supply of precious metals and in mint outputs so fully endogenous in the Keynesian sense? Furthermore, what about coinage debasements: what determines them?

(4) In summary, supposing that the money supply was essentially endogenous, one may argue that the various economic processes increasing y (NNI) – e.g. population growth, technological changes, investment, changing foreign trade patterns -- induced the requisite monetary expansion: in M, or in V, or in both together. If, however, inflation also occurred (a rise in P), historians must then explain why the evident monetary expansion was greater than the rise in real output and real incomes: why, with ΔP, $\Delta(M.V) \rangle \Delta y$.

(5) The following section develops this theme; but to make the argument perfectly clear and to ensure a logical flow, many of the points made in this series of observations are necessarily repeated.

5. **Monetary and Real Factors in the Quantity Equations**

a) If you look carefully at these equations, you will see that they are not in fact purely monetary, but contain a *real* element, which is much more clearly seen in the modern versions: i.e. **y** for *real* NNI or NNP.

b) Thus, in terms of M.V = P.y, what will happen when you increase the stock of M, increase the Money Supply? Some combination of any or all of the three following might well happen:

i) Some increase in **y:** an increased quantity of M in circulation stimulates the economy and promotes increased production and trade, thus increasing incomes: thus producing a rise in NNP and NNI.

ii) Some reduction in V: since money is more plentiful, there is less need to economize on its use; its rate of circulation slows down; or some fraction of that increased M goes into hoards or larger cash balances. Furthermore, if an increased M results in lower interest rates, V should also fall for that reason (i.e. k would rise).

iii) Some increase in the Price Level **P**. But note carefully: to the extent that **y** rises, and to the extent that **V** falls, then the rise in the price level (**P**), the degree of inflation, will be proportionally much less than the increase in **M.** Conceivably, an increase in **M** could be totally offset by both a fall in V and an increase in y -- so that no inflation would result. Thus inflation is far from being an automatic result of increasing the money supply -- it is from being predictable; and thus price changes depend upon purely real as well as monetary factors. But we have reason historically to doubt that all these factors will so automatically and neatly counterbalance each other.

b) **Consider the older views on these issues of inflation**:

i) Old-fashioned quantity theorists of 19th century, and even Fisher, were looking essentially only at short term changes, and they assumed that any economy in 'equilibrium' must be operating at full employment, with no capacity for increased output, and with a constant money velocity. Thus, in their view, a 10% increase in **M** must produce a proportionate or 10% increase in **P,** the price level. Historically, however, that proves to be quite false: there is almost never any linear relationship between changes in money supplies and prices.

ii) **Keynes**: formulating his *General Theory of Employment* during the grim depression years of the 1930s, with mass unemployment. He assumed an economy with a large amount of unemployed resources, a highly elastic economy very responsive to changes in demand. He was also assuming that changes in **M** resulted endogenously from changes in investment or government expenditure, increasing output, income, and aggregate demand. Such increases in an economy of unemployed resources would be reflected by a rise in real net national product and income (**Y)** without any inflation, at least until the point of Full Employment was reached. But, Keynes argued, once that point of full employment was reached, the traditional quantity theory would then finally apply: further increases in spending would be purely inflationary -- his concept of the 'inflationary gap'.

c) **The Phillips Curve:**

i) Phillips is a modern British economist (1958) who found a close correlation between changes in the price level and unemployment rates, from the 1860s to the 1950s:[2] the closer that an economy approached full employment, the higher or faster rose the price level; the higher the rate of unemployment, the more stable was the price level. This is not the either/or proposition of the traditional Keynesian backward L-shaped macro-diagram for Y = C + I + G + (X-M), but a relationship plotted along a rising

[2] A. W. Phillips, 'The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861 - 1957,' *Economica*, 25 (1958), 283 - 299.

or falling curve, demonstrating a trade-off between unemployment and inflation: the less of the one, the more of the other.

ii) An inverted form of the actual Phillips curve (in the form of an upward sloping aggregate supply curve) can best demonstrate this in terms of what we are talking about. Here full employment means not just full employment of the labour force, but full employment of all resources in the economy. We thus begin, as did Keynes, with an economy with considerable underemployment of resources -- at much less than FULL EMPLOYMENT. Thus, as aggregate demand rises, and as supply increases to meet that demand, resources in some sectors become more or less fully employed, producing some price increases in those sectors. That is, diminishing returns set in and supply becomes less and less elastic, less capable of expanding except at very high cost, thus producing price increases. But in other sectors, supply remains more flexible, more elastic, so that production can expand there without rising prices. As aggregate demand further increases, however, more and more sectors encounter these rigidities with rising costs, and a rising price level becomes more and more general.[3] To repeat: the more fully employed resources become across all sectors and markets with rising aggregate demand, the greater proportionally will be the increase in the price level and the less proportionally will be the increase in real output. But it is difficult to envisage any economy, over time, which has no capacity for further output -- absolute full employment. There are always some technological and organizational changes possible to achieve some real gains.

iii) To put this in terms of the modern quantity theory: in so far as an increasing M or increasing V, or an increase in both variables, means an increased aggregate demand, we can expect to find some unpredictable combination of rising output and incomes on the one hand (i.e. increasing **y**); and then rising prices (**P)** on the other: and the closer the economy approaches full employment, the more increased spending will be inflationary. Conversely with heavy unemployment, in an economy with much of its resources lying idle, unutilized, an increasing **M** and rising aggregate demand will produce increased real output and incomes (in **y**), without any significant price increases. Thus the extent of inflation, or price increases, depends as much on these real factors as on the purely monetary factors.

iv) Friedman and other 'monetarists' have criticized the economic logic involved in the Phillips curve (concerning expectations of real vs. nominal or money incomes, etc.); and have offered a radically revised version. But time and space, and our mutual energies, do not permit an extended discussion of that debate here.

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[3] In fairness to Keynes, he virtually said as much in his *General Theory of Employment, Interest, and Money* (1936), p. 300: 'It is probable that the general level of prices will not rise very much as output increases, so long as there are available efficient unemployed resources of every type. But as soon as output has increased sufficiently to begin to reach the `bottle necks', there is likely to be a sharp rise in the prices of certain commodities.'

d) **The effect of population growth may be twofold**:

i) **on the supply side**: for **y**: population growth can lead to fuller or full employment of resources, diminishing returns, rising marginal costs across most sectors of the economy, in the absence of further technological changes (including changes in markets, financial instruments).

ii) **on the demand side**: for **M** and **V**: population growth will initially increase the demand for money (and will thus increase **k**), and thus reduce any inflationary impact from any increase in **M.** But population growth may also or subsequently change the structure and distribution of that population; and increased urbanization, and consequent changes in markets and financial structures, may lead to a reduced **k** -- or, to say the same thing, an increased **V**, an increased velocity of money circulation.

Mayhew's Estimates of Money Supplies, Velocity, Prices, and National Income in England, 1300 - 1670

Date	**1300**	**1470**	**1526**	**1546**	**1561**	**1600**	**1643**	**1670**
Money Supply in millions of £ sterling	0.900	0.900	1.400	1.450	1.450	3.500	10.000	12.000
Velocity (Income V)	5.178	3.889	3.571	5.517	9.310	6.286	3.500	3.407
Price Level: PBH Index	104.8	104.6	135.1	172.3	289.3	478.3	597.8	635.7
National Income Y in millions £ st.	4.660	3.500	5.000	8.000	13.500	22.000	35.000	40.880
Population in millions	6.000	2.300	2.300	2.900	3.000	4.100m	5.100	5.000

Source: Nicholas J. Mayhew, 'Population, Money Supply, and the Velocity of Circulation in England, 1300-1700,' *Economic History Review*, 2nd ser. 48:2 (May 1995), p. 244.

The Money Supply, Gross Domestic Product (GDP), Prices (CPI), Population and Bank Rate in Canada
1955 - 2008 annual means

	M: MB	M1B	V = Y/M	k	P	y	GDP = Y	Population	Inflation:		
Year	**Money: Monetary Base in billions**	**Money: M1B in billions**	**Income Velocity of M: Monetary Base**	**Cambridge cash balances k = 1/V**	**CPI 1992= 100**	**Real GDP: in billions of 1992 dollars**	**Gross Domestic Product in billions current market prices**	**Canadian population in millions**	**Percent Change in CPI**	**Bank Rate in percent**	**Real GDP per capita in dollars**
1955	2.2588				16.83			15,681,250		1.896	
1956	2.3793				17.07			16,070,250	1.39%	3.153	
1957	2.4378				17.60			16,579,500	3.12%	4.023	
1958	2.5973				18.04			17,062,250	2.51%	2.499	
1959	2.7276				18.25			17,467,500	1.15%	5.128	
1960	2.7500				18.48			17,855,250	1.23%	3.539	
1961	2.8565		14.414	0.06938	18.70	220.176	41.1730	18,224,500	1.22%	3.061	12,081.34
1962	3.0239		14.771	0.06770	18.87	236.740	44.6650	18,570,750	0.89%	4.477	12,748.02
1963	3.1361		15.293	0.06539	19.22	249.561	47.9610	18,919,000	1.86%	3.875	13,191.00
1964	3.3160		15.847	0.06310	19.57	268.564	52.5490	19,277,250	1.81%	4.042	13,931.65
1965	3.5971		16.105	0.06209	20.03	289.288	57.9300	19,633,500	2.34%	4.292	14,734.43
1966	3.8743		16.730	0.05977	20.78	311.875	64.8180	19,997,500	3.79%	5.167	15,595.69
1967	4.1888	16.5524	16.639	0.06010	21.53	323.675	69.6980	20,363,750	3.61%	4.979	15,894.66
1968	4.2691	15.8087	17.833	0.05608	22.39	339.997	76.1310	20,692,000	3.99%	6.792	16,431.33
1969	4.7133	15.4483	17.785	0.05623	23.43	357.717	83.8250	20,994,250	4.65%	7.458	17,038.80
1970	4.9789	14.8384	18.112	0.05521	24.21	372.512	90.1790	21,287,500	3.31%	7.125	17,499.11

	M: MB	M1B	V = Y/M	k	P	y	GDP = Y	Population	Inflation:		
Year	**Money: Monetary Base in billions**	**Money: M1B in billions**	**Income Velocity of M: Monetary Base**	**Cambridge cash balances k = 1/V**	**CPI 1992= 100**	**Real GDP: in billions of 1992 dollars**	**Gross Domestic Product in billions current market prices**	**Canadian population in millions**	**Percent Change in CPI**	**Bank Rate in percent**	**Real GDP per capita in dollars**
1971	5.5635	16.2273	17.692	0.05652	24.87	395.827	98.4290	21,747,314	2.72%	5.188	18,201.19
1972	6.3914	18.3692	17.197	0.05815	26.08	421.392	109.9130	22,187,140	4.89%	4.750	18,992.61
1973	7.3540	20.5982	17.535	0.05703	28.06	459.600	128.9560	22,453,775	7.57%	6.125	20,468.70
1974	8.3454	21.8008	18.458	0.05418	31.13	494.769	154.0380	22,772,045	10.96%	8.500	21,727.02
1975	9.7236	23.9002	17.856	0.05600	34.46	503.858	173.6210	23,102,980	10.68%	8.500	21,809.21
1976	10.9117	25.3933	18.328	0.05456	37.06	539.673	199.9940	23,414,365	7.55%	9.292	23,048.82
1977	12.0083	27.2680	18.402	0.05434	40.03	552.087	220.9730	23,694,035	8.01%	7.708	23,300.69
1978	13.4578	29.8391	18.196	0.05496	43.61	561.537	244.8770	23,935,651	8.95%	8.979	23,460.28
1979	14.8698	31.4288	18.802	0.05319	47.59	587.449	279.5770	24,170,445	9.13%	12.104	24,304.45
1980	16.0130	33.0368	19.633	0.05093	52.43	599.695	314.3900	24,471,129	10.16%	12.891	24,506.22
1981	17.1964	33.8707	20.962	0.04771	58.94	611.572	360.4710	24,785,059	12.43%	17.931	24,675.05
1982	17.4193	35.0318	21.807	0.04586	65.31	581.639	379.8590	25,083,479	10.80%	13.958	23,188.15
1983	17.7398	40.1299	23.190	0.04312	69.13	595.062	411.3860	25,336,505	5.86%	9.553	23,486.34
1984	17.9203	44.9908	25.088	0.03986	72.11	623.481	449.5820	25,577,353	4.30%	11.312	24,376.30
1985	18.7576	59.3663	25.894	0.03862	74.97	647.907	485.7140	25,813,854	3.96%	9.647	25,099.18
1986	19.9900	72.7812	25.640	0.03900	78.10	656.262	512.5410	26,068,353	4.18%	9.214	25,174.68
1987	21.0964	83.5278	26.495	0.03774	81.49	685.897	558.9490	26,399,956	4.34%	8.403	25,981.00
1988	22.2465	84.1931	27.559	0.03629	84.79	723.059	613.0940	26,754,940	4.05%	9.686	27,025.26
1989	23.5343	87.7845	27.948	0.03578	89.03	738.813	657.7280	27,219,748	4.99%	12.293	27,142.53
1990	24.4104	89.4378	27.854	0.03590	93.27	729.008	679.9210	27,638,583	4.76%	13.045	26,376.44
1991	25.3470	94.5995	27.039	0.03698	98.51	695.745	685.3670	27,987,829	5.62%	9.034	24,858.85

	M: MB	M1B	V = Y/M	k	P	y	GDP = Y	Population	Inflation:		
Year	**Money: Monetary Base in billions**	**Money: M1B in billions**	**Income Velocity of M: Monetary Base**	**Cambridge cash balances k = 1/V**	**CPI 1992= 100**	**Real GDP: in billions of 1992 dollars**	**Gross Domestic Product in billions current market prices**	**Canadian population in millions**	**Percent Change in CPI**	**Bank Rate in percent**	**Real GDP per capita in dollars**
1992	26.7329	100.0131	26.203	0.03816	99.98	700.655	700.4800	28,319,473	1.49%	6.783	24,741.11
1993	28.2746	107.0800	25.719	0.03888	101.83	714.092	727.1840	28,648,235	1.86%	5.088	24,926.22
1994	29.2574	118.2703	26.348	0.03795	102.00	755.758	770.8730	28,958,270	0.16%	5.766	26,098.17
1995	29.5420	128.2989	27.433	0.03645	104.21	777.698	810.4260	29,262,649	2.17%	7.308	26,576.47
1996	30.1993	143.0047	27.711	0.03609	105.85	790.613	836.8640	29,570,577	1.58%	4.531	26,736.48
1997	31.7384	160.1786	27.813	0.03595	107.57	820.638	882.7330	29,868,726	1.62%	3.521	27,474.83
1998	33.5764	173.3043	27.250	0.03670	108.63	842.258	914.9730	30,125,715	0.99%	5.104	27,958.11
1999	36.5423	180.5998	26.885	0.03720	110.52	888.953	982.4410	30,369,575	1.73%	4.917	29,271.16
2000	38.1102	209.4913	28.223	0.03543	113.53	947.357	1,075.5660	30,650,631	2.73%	5.771	30,908.24
2001	39.6666	230.0036	27.919	0.03582	116.41	951.357	1,107.4590	30,973,522	2.53%	4.313	30,715.17
2002	42.3101	254.3483	27.280	0.03666	119.03	969.716	1,154.2040	31,322,332	2.25%	2.708	30,959.24
2003	43.9059	265.4449	27.700	0.03610	122.32	994.297	1,216.1910	31,626,552	2.77%	3.188	31,438.68
2004	45.2319	288.4226	28.524	0.03506	124.56	1,035.808	1,290.1850	31,932,015	1.83%	2.500	32,437.91
2005	47.3058	308.4193	28.991	0.03449	127.34	1,076.965	1,371.4250	32,258,138	2.23%	2.917	33,385.84
2006	49.6239	335.3395	29.145	0.03431	129.90	1,113.400	1,446.3070	32,532,462	2.01%	4.313	34,224.29
2007	52.1663	352.5202	29.386	0.03403	131.65	1,164.409	1,532.9440	32,881,904	1.35%	4.604	35,411.84
2008	54.4343	n.a.	29.395	0.03402	135.78	1,178.445	1,600.0810	33260314	3.14%	3.208	35,430.97

Sources: CANSIM on CHASS, and Statistics Canada