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**Is Cash Dead? Using Economic Concepts
To Motivate Learning and Economic Thinking**

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Is Cash Dead? Using Economic Concepts To Motivate Learning and Economic Thinking

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Abstract: Economics is at its best when used to shed light on questions of interest to students. Even better if the answers are at odds with commonly held but incorrect views. The velocity of circulation is probably the most neglected concept in macroeconomics classes but it can be used to open up a discussion on the behaviour of people and why demand for money may rise or fall. It can be used to address the question “Is Cash Dead?” Despite the rise in the number of ways that people can pay without using cash, there seems to be no drop in the amount of cash people actually wish to hold. This is a puzzle and a good opportunity to get students thinking about why this might be.

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1. INTRODUCTION

The velocity of circulation (V) makes its grand entrance as the left hand side of a definition ($V=PY/M$), is then re-arranged to sit alongside another variable ($MV=PY$), and is quickly consigned to the bin labelled “stays constant”. From that point on V makes no further appearances on stage and is rapidly forgotten.

This is a shame because V can in fact be used to stimulate learning and economic thinking in a number of ways.

1. It is easy to calculate so a course lecturer can set a student assignment that focuses on the key skills of sourcing, selecting and presenting data.
2. Students can then provide an interpretation of what a rising or falling V means in terms of people demanding money.
3. Students can analyse why V may be rising or falling. The emphasis is on proposing plausible theories that use economics to explain what is observed.

In particular, a focus on the velocity of circulation of cash allows students to address the question of whether or not we are actually moving to a cashless society (as many people probably believe).

In this paper we focus mostly on the velocity of circulation of cash as that is most relevant to considering the “cashless society” question. However, the velocity of circulation for other monetary aggregates is easy to calculate and also useful.

The velocity of circulation has not always been so neglected. This paper examines how principles texts have treated the velocity of circulation and how it has changed over time. We suggest some potentially useful narratives that might enrich the teaching of macroeconomics and conclude with some suggestions for the classroom.

2. WHAT IS V?

The velocity of circulation is most easily thought of as the speed at which money circulates around the economy.¹ For a given nominal value of expenditure, how many times does a unit of currency change hands? If economic agents wish to hold a large amount of money relative to their expenditures then velocity will be slow and the converse is true for smaller desired holdings. This idea is captured in the definitional equation of

$$\text{velocity of circulation (V)} = \text{Nominal GDP (P.Y)} / \text{Money supply (M)}$$

The variable P is the “price level”², Y is real GDP and M is one or other of the measures of monetary aggregates³.

From there this identity is usually re-arranged to the familiar “equation of exchange” or $M.V = P.Y$. For most texts, the purpose of the equation of exchange is to explain the relationship between M and P . Hence at this point, it is usually assumed that V is constant and that Y is determined by things other than M or P . As Blaug (1995) explains:

“...the quantity theory of money really consists of three interrelated propositions: (a) the causal arrow runs from money M to prices P ...; (b) there is a stable demand for nominal money-balances-to-hold, sometimes known as the velocity of circulation of money V ...; and (c) the volume of transactions T or the volume of output Y ... is determined independently of the quantity of money or the level of prices but rather by real variables such as endowments, preferences and technology.” (page 29)

From these propositions and the equation of exchange the crude quantity theory of money can be derived where:

$$P = (MV)/Y \quad \rightarrow \quad M = kP \quad \text{where } k = (Y/V)$$

¹ For the really interested there are usually two concepts of the velocity of circulation. One is called the transactions velocity where the number of transactions (T) is the quantity variable, i.e. $V = (PT)/M$. The income velocity usually takes the quantity variable as real GDP hence the right hand side has nominal GDP, i.e. $V = (PY)/M$. In practice the number of transactions (T) is not observable so it is the income velocity that is being referred to. These measures can be quite different. For example, an economy with a large number of transactions for second hand goods will have a different transactions velocity than another economy with a smaller number of such transactions. However, both may have the same income velocity of circulation. This paper will use the term “velocity of circulation” and is referring to the income velocity measure.

² The exact definition of price level is usually left vague. The common implication is that the consumers’ price index (CPI) the relevant measure. However, if the income (or GDP) measure of the equation of exchange is used then P is more accurately the GDP deflator. For practical purposes at principles level, this distinction makes little difference.

³ While any of the usual monetary definitions can be used, the focus of this paper will primarily be on notes and coins due to the interest in the idea of a cashless society.

In other words the price level will always be some constant multiple of the money supply determined by the ratio of Y to V .

All of this serves to get to the end point which is to show that changes in the price level are brought about by (exogenous) changes to M .

To make this more explicit, sometimes the equation of exchange will be converted into a dynamic (approximation) form where

$$\% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Y^4$$

With this form it is now possible to interpret each of the variables in growth form so that

$\% \Delta M$	=	growth in the money supply
$\% \Delta V$	=	change in the velocity of circulation.
$\% \Delta P$	=	inflation
$\% \Delta Y$	=	economic growth

If $\% \Delta V$ is assumed to be constant (usually equal to zero) and $\% \Delta Y$ is assumed to grow at a constant rate (e.g. 3 percent) then there exists a clear relationship between money growth and inflation.⁵

Another way to think about V is that it is “...the inverse of the percentage of income that people keep in the form of money. ... Velocity is therefore essentially a measure of income-adjusted money demanded” (Caplan, 2009). This turns out to be a very useful pedagogical way to think about V as if V is rising then money demand is falling in real terms and vice versa.

The quantity theory of money is one of the “oldest surviving theories in economics” (p27, Blaug et al, 1995). Blaug (1995) credits John Locke with the earliest coherent statement of the quantity theory in 1692. However, the early economists did not simply assume the velocity of circulation away or see it as little analytical use.

Laidler (1991, p16) notes how early monetary economists (for example Mill and Hume) were well aware that assuming a constant velocity of circulation was convenient but did not hold in the real world. Laidler (1991, p127) lays out the work of Knut Wicksell who saw the availability of credit as a major influence on changes in V and hence on changes to the price level. He also notes the work of Fisher in setting out some determinants of the velocity of circulation (p72) including both speculative and precautionary types of motives. Bordon and Jonung (1987, p19) note that Irving Fisher stresses the transaction motive for money and so expected V to continue to rise as financial innovation reduced

⁴ a more mathematically accurate method is to take logs and then totally differentiate. However, this method is well beyond Principles courses so the percentage change approximation is often used.

⁵ This is equivalent to taking the Classical Dichotomy (the distinction between real and nominal variables and that money affects nominal but not real variables) as a reasonable starting position to take.

the need for money balances to settle transactions. Blaug (1995) notes that the three interrelated propositions that underlay the quantity theory of money (see above) “...are highly controversial and by no means truisms” (page 29).

3. HOW IS V TREATED IN TEXTBOOKS?

Has it always been the case that economics educators would consign V to the “held constant” bin early in the lesson? As table 1 shows, the answer is no. The most striking example is that of the 1951 edition of Samuelson where the velocity of circulation is given quite some space. However, more recent textbooks spend much less time discussing V – in some cases almost no time.

TABLE 1: Survey of Principles Texts

Text	Pages on the QTM / EOE ⁶	Comments
Samuelson “Economics” (1951), 2 nd Edition	9	Although the QTM appears in an appendix it is dealt with in some depth. The text starts with the simple form $M = kP$. After discussing the inadequacy of this, V is then introduced. The author asserts that “... <i>the velocity of circulation is not even approximately constant.</i> ” The author puts the failure of quantity theorists (who took V as constant) down to focusing on the transactions demand for money and ignoring other reasons why people hold money (“ <i>the velocity varies with changes in interest rates, expectations, saving and investment schedules, and other economic variables.</i> ” – i.e. certainty, stability of the financial system, etc.).
Samuelson et al “Economics” (1975), 2 nd Australian edition based on the 9 th US Edition	8	This edition is somewhat softer on the notion that V is nowhere near constant but there is still a clear assertion that an assumption of constancy is not reasonable (“ <i>while V is definitely not a constant, its movements are subject to some regularity and predictability</i> ”). The velocity of circulation gets a further mention in the appendix to a later chapter (18)
Begg, Fischer and Dornbusch “Economics” (1984). 1 st edition.	1	The QTM discussion is a side box. The text argues that V will be constant except as interest rates and inflation vary (“ <i>...if inflation and nominal interest rates settle down at some particular level, velocity will become constant</i> ”).

⁶ QTM: Quantity Theory of Money. EOE: Equation of Exchange.

Abel and Bernanke "Macroeconomics", (2005), 5 th edition.	4	The text starts with the definition of V and re-arranges to $MV = PY$. Notes that V for $M1$ is "...clearly not constant" and notes potential reasons (interest rates and financial innovation). Velocity of $M2$ is "...closer to being constant". There is no discussion of how and why V might or could change. A graph of $M1$ and $M2$ velocity is shown.
Stiglitz and Walsh "Economics" (2006), 4 th edition.	2	The velocity of circulation is defined and explained and then assumed as essentially constant (<i>"For a given level of velocity..."</i>).
Mankiw "Principles of Macroeconomics" (2015), 7 th edition.	3	The text starts with the definition of V and re-arranges to $MV = PY$. V is considered stable (<i>"The velocity of money is relatively stable over time."</i>). There is no discussion of how and why V might or could change.
McTaggart, Findlay and Parkin "Economics", (2013), 7 th edition.	2	The text starts with the definition of V and re-arranges to $MV = PY$. The text implicitly assumes the stability of V . There is no discussion of how and why V might or could change.

4. THE VELOCITY OF CIRCULATION

Modern texts pay less attention to the velocity of circulation than older ones and are more likely to assume (explicitly or implicitly) that V is constant. Who is right?

Data

Figures 1 and 2 show the velocity of circulation for notes and coins (N&C) and for $M1$ for New Zealand. The N&C graph is from 1961 and $M1$ is from 1936.

Figure 1: Velocity of circulation for Notes and Coins (1961 – 2014)

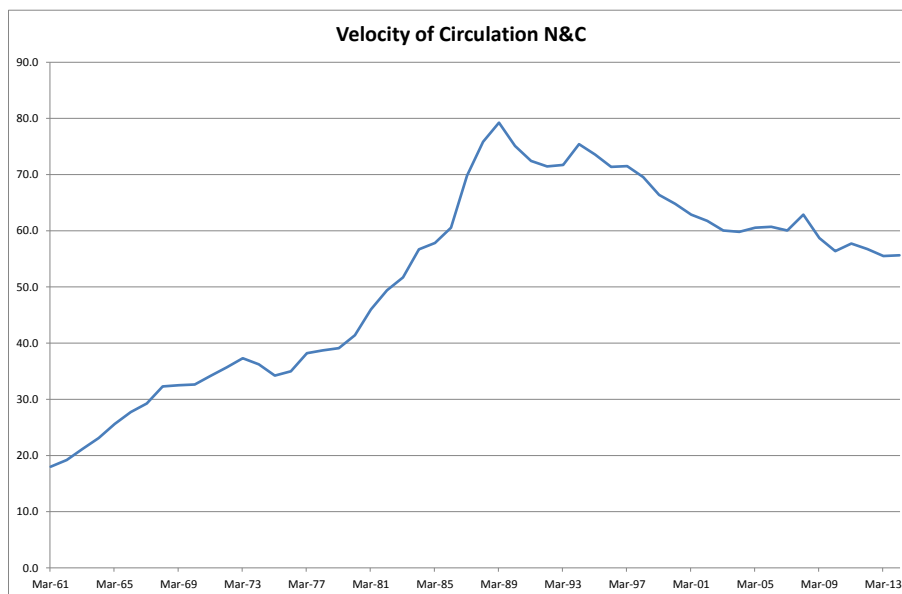
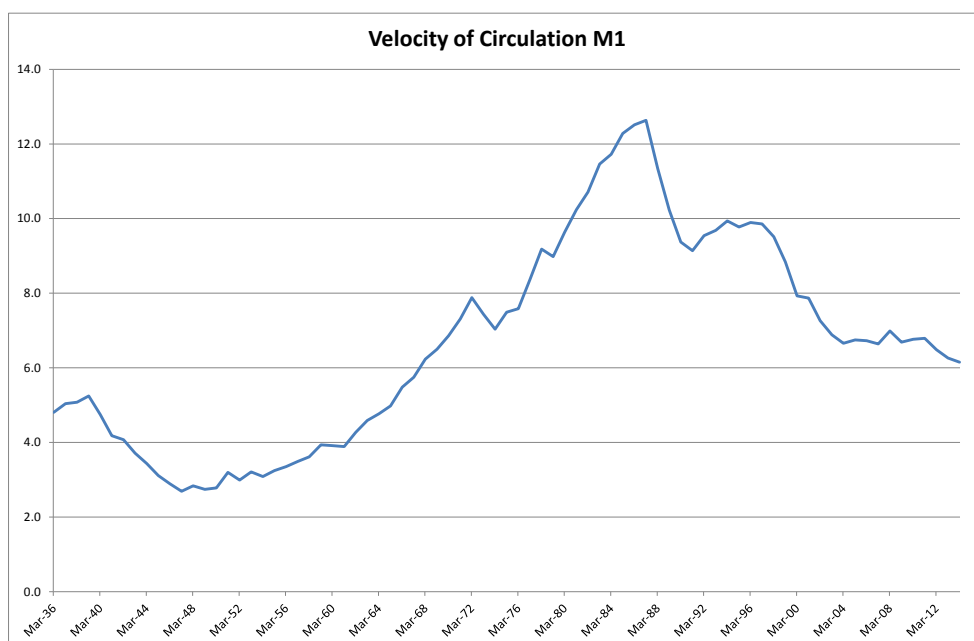


Figure 2: Velocity of circulation for $M1$ (1936 – 2014)

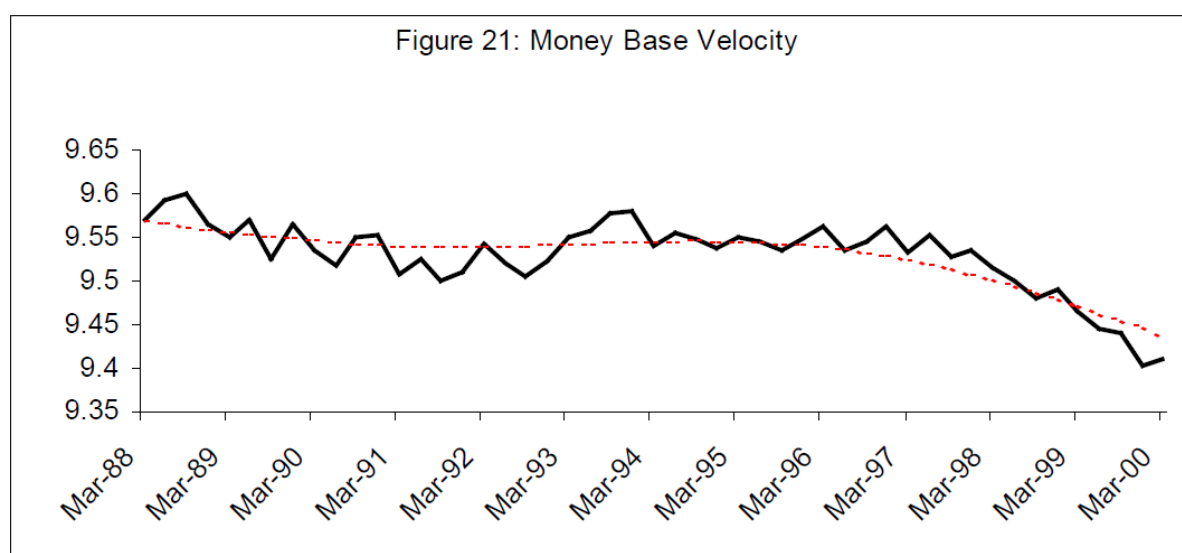


$M1$ velocity is noticeably U shaped from the 1930's until around 1987. After 1987 there is a clear downward trend. Notes and coins follows the same pattern for the same time period although the post mid-1980s decline is less steep than it is for $M1$.

The U shape until the late 1980s is unsurprising. In what is a widely cited work, Bordo and Jonung (1987) examine the long run velocity of circulation for $M2$ from the late 1800s until around 1980 for a range of countries. They find a consistent "U shaped" curve for most countries with a turning point around the middle of the 20th century. Within that broad picture they find significant fluctuations, particularly around major events. For example, V declines significantly (so demand for money rises) in all countries at the time of the Great Depression.

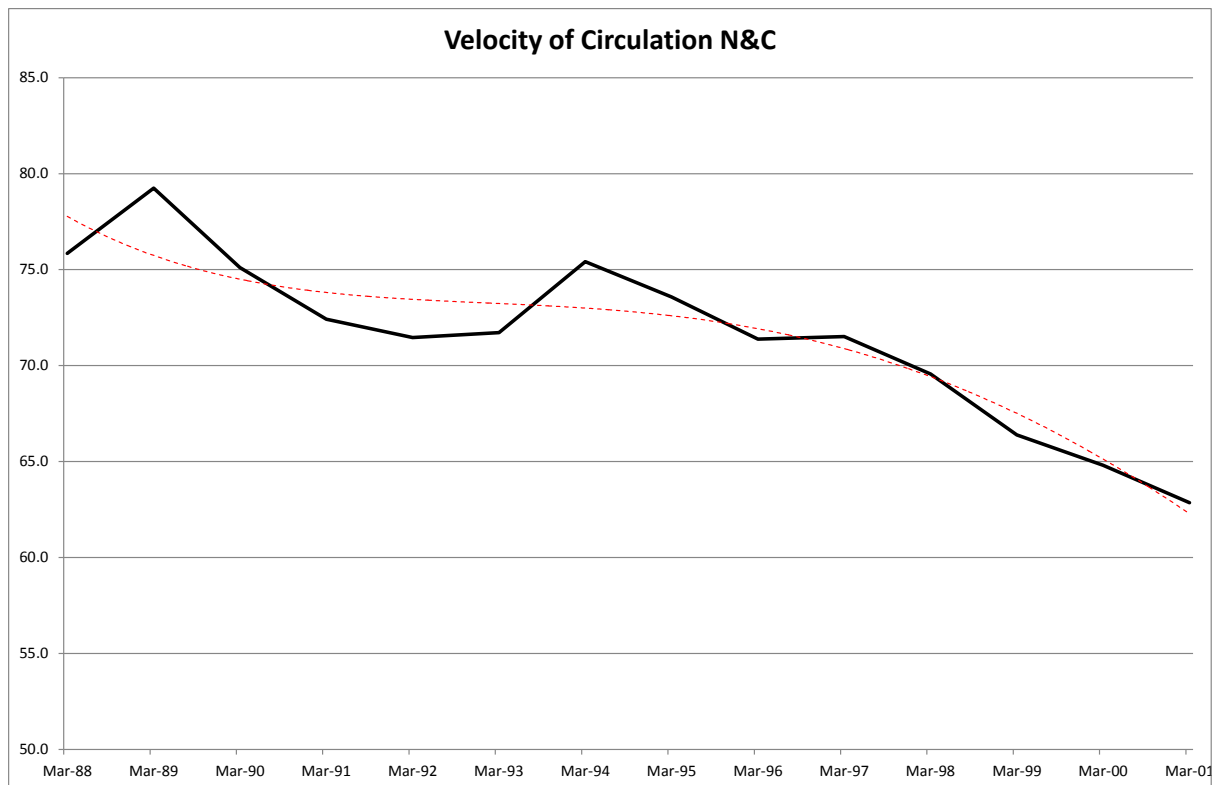
The decline in V is also consistent with other studies (e.g. Siklos and Eckhold 1997). Razzak (2001) examines the velocity of circulation for the monetary base (essentially notes and coins) from 1988 to 2001. Razzak uses quarterly data and a CPI measure for the price level which differs from our study. He finds little evidence of a trend from 1988 to 1997 but then a declining trend after that. However, the Razzak study is for a relatively short time period and the conclusion is based on a trend line⁷. When Razzak's graph is compared to our data for the same period, a distinctly similar pattern is revealed (see figures 3 and 4).

Figure 3: Razzak (2001)



⁷ Razzak uses the term "trend" in the sense of decomposing a time series into its three constituent parts: trend (or permanent), seasonal (or business cycle) and irregular.

Figure 4: Our data for the same time period



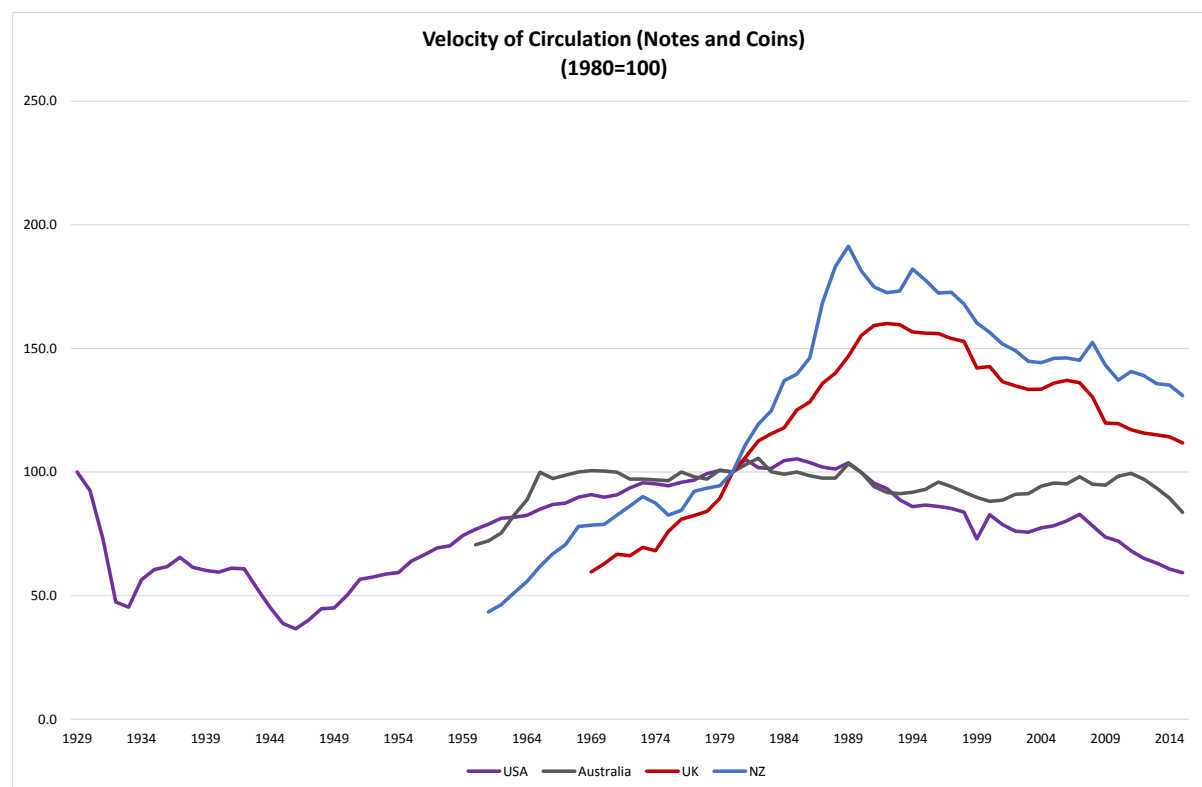
(Trend line is a simple 4th order polynomial best-fit function).

The long run picture then, is for a U shaped velocity of circulation until a turning point in the 1980s. Since then V has largely declined although not uniformly.

In the short run however, V is more stable (as Razzak (2001) notes). From 1988 to 2014 (the period of decline) the average percentage change from one year to the next is -2.2 percent. In those 26 years, only seven have percentage changes outside the range (-5.0, +5.0) – six are negative and one positive. Clearly V is not a random walk.

Figure 5 below shows V for notes and coins for four selected countries. All four exhibit a similar pattern although of differing magnitudes with Australia the least pronounced.

Figure 5: Notes and Coins Velocity of Circulation for NZ, Australia, UK and US (Index 1980=100)



In broad terms the overall picture is one of declining velocity of circulation from the start of the 20th century to around the middle of the century. There then follows an increasing velocity until around the late 1980s / early 1990s. After that the velocity of circulation declines.

A falling V means that from the start of the 20th century to the middle of it, demand for cash holdings was falling. For around the next 40 years cash demand falls as shown by V rising. After that demand for cash increases again. Explaining these rises and falls is the next task.

5. WHAT CAUSES V TO CHANGE?

Bordo and Jonung (1987) discuss a number of possible explanations for the U shaped curve that exists until around the 1980s.

- income (an idea advanced by Friedman and Schwartz in 1963) – money is a luxury good and demand for holding cash balances rises as income rises. However, this explanation suggests a falling velocity and fails to explain the subsequent rise.
- interest rates – while well understood as a determinant of money demand, the role of interest rates fail to explain the long run behaviour.
- expected inflation – higher rates of expected inflation will increase the velocity of circulation. However, this is unlikely to explain long term, secular changes in V .
- financial innovation – the rising availability of credit instruments and money substitutes reduces the need for cash holdings and hence increases V .
- money as a medium of exchange – if the transactions motive for holding money is the biggest influence on money demand then the need to hold money will decline and V will rise as advancing technology in the finance sector makes alternative payment methods more common.
- randomness – however this is unlikely to explain a long run trend.

Bordo and Jonung (1987) do not find any of these explanations wholly satisfactory. Instead they explain the fall in V by

“... the monetization process. This process consists of two interrelated developments: (1) the growing use of “money” for settling transactions at the expense of a decline in barter and payments in kind, occurring simultaneously with an expansion of markets and a decline of production for own consumption; and (2) the rise of a commercial banking system supplying the public with notes and deposit facilities.”

The subsequent rise in V is

“...explained by increasing financial sophistication and improved economic security and stability. Financial sophistication as defined here refers to both (1) the emergence of a large number of close substitutes for money, such as bonds, common stocks, and other financial assets, that reduce the demand for money as an asset; and (2) the development of various methods of economizing on money balances, such as the use of credit cards, the transfer of funds by telegraph, by telephone, or electronically, and modern cash management techniques that reduce the transactions demand for money.”

The argument here is that money substitutes such as credit cards and the ability to transact electronically reduce the need for balances to be held in an easily spent form. Ireland (1991) finds evidence that supports Bordo and Jonung's institutional view.

These arguments foreshadow what should be a continuing rise in V as demand for cash continues to fall as society moves to an even more financially sophisticated system. Siklos and Eckhold (1997) expected this. Many in society would likely agree given their day to day experience with online payments, use of credit cards and new mobile phone based technologies. This view is reinforced by headlines such as "*The countries where cash is on the verge of extinction*"⁸ and "*Sweden Is Developing the World's First Cashless Economy*"⁹. Many people have a growing sense that cash is costly to handle and riskier to hold as suggested in a news article headed "*The real cost of carrying cash*"¹⁰. Reading that "*Woman donates \$26,000 to Salvation Army - by mistake*"¹¹ simply confirms what we all thought all along – cash is risky.

But V does not continue to rise. This implies a greater demand for cash as Boaden (2008) noted when he said "The demand for currency by the New Zealand public continues to grow steadily each year despite the popularity of electronic methods of payment." Partly there will be a confusion between what money people wish to use for transaction purposes and what money they wish to hold in total with the former being seen and the latter unseen.

What has caused the somewhat unexpected decline in V ? This is the very interesting question for students to propose theories for. There are no clear and obvious explanations as to why people are holding more cash and not less. Razzak (2001) speculates that stable and low inflation as well as lower interest rates may be having an effect meaning that cash holders are willing to hold greater quantities of cash¹². Razzak also suggests that the underground economy (with its greater use of cash) and ATM fees (meaning households prefer to make fewer withdrawals of larger amounts) might also increase the demand for cash. However, none of these explanations would explain the continuing *long run* decline.

⁸ <http://www.bbc.com/capital/story/20160922-the-countries-where-cash-is-on-the-verge-of-extinction>

⁹ <https://www.good.is/articles/sweden-becoming-first-cashless-modern-society>

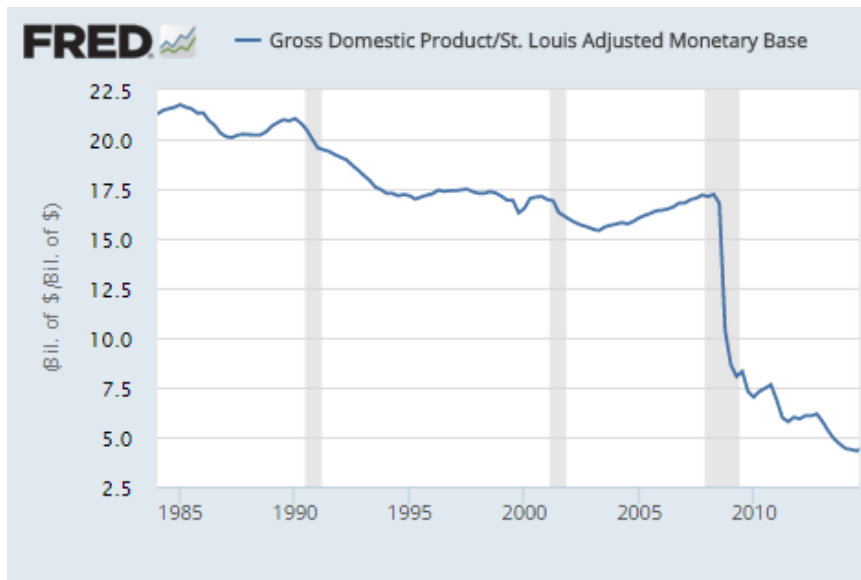
¹⁰ <http://www.stuff.co.nz/business/money/78960155/the-real-cost-of-carrying-cash>

¹¹ <http://www.stuff.co.nz/world/australia/81833663/woman-donates-35000-to-salvation-army-by-mistake>.

The woman in question donated her cushions to the second hand store forgetting she had stored cash in them.

¹² See this article for a supporting resource: <http://www.economist.com/news/britain/21707061-low-interest-rates-mean-amount-cash-circulation-rising-plastic-banknotes-come>

The Federal Reserve Bank of St. Louis (2014) in one of its short reports on the economy note how, rather than being constant in recent years, V has slowed dramatically following a period of decline since the mid-1980s as has occurred in New Zealand (see graph below).

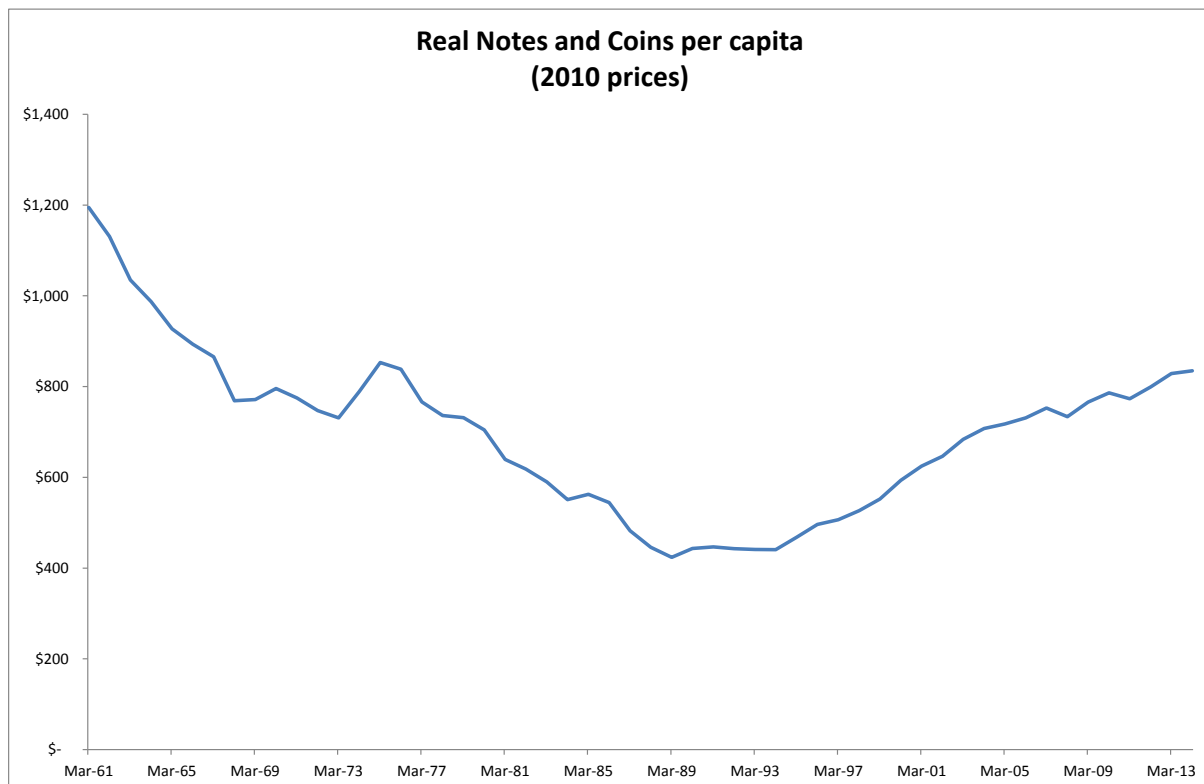


(Source: Federal Reserve Bank of St Louis, 2014).

The Federal Reserve Bank of St Louis (2014) credit the cause of the recent decline to the “...private sector’s dramatic increase in their willingness to hoard money instead of spend it.” Why this increase? They suggest two reasons: (i) a “gloomy economy”; and (ii) a sharp reduction in interest rates which prompts a move towards holding more cash in investment portfolios. The exact meaning of a “gloomy economy” is difficult to determine. One possible interpretation is that a poor economy means fewer transactions so velocity falls but this is a dramatic fall. We suggest the increased perceived risk premium of the financial sector following the global financial crisis has led to an increased desire to hold cash as a relatively risk-free asset. This is exacerbated by the fall in interest rates but would likely have occurred regardless as faith in the financial sector was eroded. After all, interest rates have been low before. Again none of this explains the *long term* decline.

Figure 6 shows the real value of notes and coins per capita for New Zealand. As can be seen, the quantity of cash falls until around the late 1980s before rising again.

Figure 6: Real Notes and Coins per Capita



For whatever reason, money holders are holding more cash relative to the value of their transactions and more cash in real terms. . It would seem that the shift to a cashless society is yet to occur in New Zealand, Australia, the UK and US at least.

Some countries do seem to be shifting in that direction. Sweden (which is mentioned in the news articles above) does seem to be one of these as the following table of notes and coins values shows.

Banknotes and coins	2011	2012	2013	2014	2015
Average value of banknotes & coins in circulation (SEK bn)	99	94	88	80	77

Source: <http://www.riksbank.se/en/Notes--coins/Statistics/>

However, the interesting question is to explain those who are not.

6. BRINGING THIS INTO THE CLASSROOM

Appendix 2 contains a suggestion for a student assignment. The assignment aims to build three useful skills:

1. collect, select and present data;
2. explain and interpret results; and
3. propose plausible theories that are grounded in economics for those results.

A graph of the velocity of circulation is easy to create. If not used in a take home assignment, a graph of V could be created in class time and be used for participation type credit. All it requires are monetary aggregates (available from most central bank websites) and nominal GDP¹³. From there, the following narrative is helpful.

1. For the first part of the 20th century, V slows down.

V declines as households shift towards money and away from other payment methods (e.g. barter) and from consuming their own household production. The economy is specialising, trading and “monetising”.

2. It then speeds up until around the mid to late 1980s.

The subsequent rise reflects the development of the financial system and alternative ways to pay. Demand for cash therefore declines so V rises. The high inflation rates of the 1970s and 1980s may also have contributed to the continuing rise of V for notes and coins through this time. Higher inflation rates results in greater costs of holding cash so we would expect V to rise. However, V was rising before this period so inflation cannot be a full explanation.

3. V then declines and has continued to do so.

The fall in V from the 1980s is more surprising and difficult to explain but also very interesting. By the mid-1980s there was an expectation that financial innovation would continue to drive V ever upwards – especially for notes and coins – as financial innovation reduced the demand for cash. But for whatever reason, demand for cash has been rising. Exactly why this is can be a great question for discussion even in a large lecture setting. Students can discuss with their neighbour before sharing “plausible theories” as to why people are holding more cash. Some suggestions include:

¹³ See appendix 3 for a list of data sources.

- falling confidence in the finance system (which could be due to recurring financial markets events such as the 1980s savings and loans crisis, the 1987 stock market crash, the 2008 GFC, and European Sovereign Debt crises).
- an expanding black market and grey economy where transactions are conducted in cash.
- a greater number of smaller value transactions require greater holdings of cash.
- a rise in the precautionary motive as continued low interest rates that have existed since the early 1990s make the cost of holding cash small.
- leakages due to tourists not converting currency, losses “down the back of the couch”, etc.

4. *Are we moving towards a cashless society?*

Cash, it would appear, is not dead despite widely held views that a “cashless society” is upon us. The Reserve Bank of New Zealand (Boaden 2008, Flavell 2011) notes the continued growth in cash rather than its decline and figure 6 above (which is on a real per capita basis) confirms this. Popular media articles will pick up on this, often with some surprise in their tone.¹⁴ While it is true for New Zealand that the proportion of money that people hold as notes and coins relative to $M3$ declined from around 8.8 percent in 1961 to 1.6 percent in 2015 all of this decline occurred prior to 1990 and the proportion has varied little since then (and averaged 1.7 percent). The value of notes and coins in circulation grew by an average of 6.4 percent from 1990 to 2014 while nominal GDP grew by 4.9 percent. While more and more transactions are conducted in non-cash ways, cash holdings are still very attractive. Perhaps people just like it.

5. *V is not constant long term but is close enough to being so short term*

For purposes of instruction it is useful to assume that V is roughly constant. Is this reasonable? The velocity of circulation is clearly not a random walk and V typically does not vary dramatically from one period to the next. The velocity of circulation for $M1$ in New Zealand was 9.4 in 1990 and had fallen to 6.1 in 2014. On a straight line basis that’s an average decline of 1.4 percent per year.¹⁵ For principles of macroeconomics courses this can be taken as close enough to being constant *in the short run*. For a more sophisticated treatment, the instructor could use the dynamic form:

¹⁴ See for example <http://www.smh.com.au/money/why-cash-isnt-going-the-way-of-the-cheque-20160224-gn2m8g.html> in Australia and <http://www.stuff.co.nz/business/money/9134911/Cash-refuses-to-die> in New Zealand.

¹⁵ A strict average of the absolute values of the percentage changes has an average of 3.4 percent per year.

$$\% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Y$$

Rather than assuming $\% \Delta V = 0$, it could be assumed that $\% \Delta V = -2\%$. That does not negate the basic point but does provide a more nuanced and correct treatment.

6. *Monetary policy is more complicated when V isn't constant*

A closer examination of the velocity of circulation provides a platform for further discussion on how variation in V could make monetary policy more complicated than an assumption of constant V would suggest. For example, attempts by central banks to stimulate economies following the Global Financial Crisis may have been partially neutralised by a slowing velocity of circulation. RBNZ Governor Dr Alan Bollard noted in a 2012 speech delivered to the Australian National University in Canberra that the "...early evidence suggests that it (*quantitative easing*) does work to some degree to stimulate the economy, although the precise mechanisms involved are still a matter of some debate" (RBNZ, 2012). In a world where the velocity of circulation is not constant, monetary policy becomes substantially more difficult. This is not necessarily a new realisation. In 1983 Gerald Bouey, as Governor of the Bank of Canada, stated that "We did not abandon $M1$, $M1$ abandoned us." (Bouey, 1983). The belief that central banks could simply target $M1$ growth in order to control inflation had proven to be incorrect and the world is indeed a far messier place.¹⁶

This contrasts with the way in which monetary policy is sometimes taught – that a central bank simply pulls the lever and gets the expected outcome that it wants. This may be more relevant to instructors of intermediate macroeconomics.

¹⁶ The Bank of Canada has an excellent piece at <http://www.bankofcanada.ca/2000/10/can-a-bank-change/>. Sections 2.4 to 2.6 are particularly relevant and include the quote from Bouey. Canada was the 2nd country, after New Zealand, to introduce an explicit, publically known inflation target.

V CONCLUSION

The assumption that the velocity of circulation is constant is a useful one in Principles of Macroeconomics courses. It allows instructors to draw the link between money and prices which is a key concept underlying monetary policy. However, V is not constant, particularly over the longer term, and there are some interesting questions that can be examined by having a look at what actually has happened to V . The decline in V for the first half of the 20th century and the subsequent rise until around the 1980s are easy to explain and are built on interesting stories about money and methods of payment. The decline from the 1980s is more puzzling and a good opportunity for students to put forward plausible theories for what is happening.

Asking how many students believe that we are moving to a cashless society is likely to reveal that a majority do believe this to be true. But is cash dead? The evidence provided by graphs of real notes and coins per person and the velocity of circulation of notes and coins suggests otherwise. Such graphs are easy to create and relatively straightforward for students to grasp. The topic lends itself to an assignment that builds useful skills or to more active and interactive forms of teaching as it is simple to do in real time.

In the short term, assuming V is constant is tolerably close to reality. However, incorporating a non-zero value in the dynamic (percentage change) form of the quantity theory of money is not difficult. By moving away from the simple assumption of “ V is constant”, we are forced to confront the question that the central bank must face – what assumption *should* be made about V ? This alerts students to the more complicated nature of monetary policy in a changing and uncertain world. This latter point is probably more relevant to instructors of intermediate macroeconomics but could easily be covered in principles courses.

Economics is at its best when it addresses questions that students had never thought to ask because surely the answer is obvious but when it turns out the answer is not.

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APPENDIX 1: MONETARY AGGREGATES DEFINITIONS

Notes and coin held by the public

Notes and coin on issue minus currency held by *M3* institutions.

M1

Includes notes and coin held by the public plus chequeable deposits, minus inter-institutional chequeable deposits, and minus central government deposits, all in New Zealand dollars.

M2

Consists of *M1* plus all non-*M1* call funding (call funding includes overnight money and funding on terms that can of right be broken without break penalties) less inter-institutional non-*M1* call funding. (See "Transaction EFTPOS (excl. cheque)").

M3

The broadest monetary aggregate. Represents all New Zealand dollar funding of *M3* institutions. Consists of notes & coin held by the public plus NZ dollar funding minus inter-*M3* institutional claims and minus government deposits.

Source: <http://www.rbnz.govt.nz/statistics/c1>

Transaction EFTPOS (excluding cheque)

Deposits accessible by EFTPOS but not cheques are to a degree as liquid as those accessible by cheque. However, banks set spending limits for EFTPOS withdrawals. As a result, these deposits are not a universal means of payment. Most spending using EFTPOS is from chequeable deposits and included in Transaction balances (cheque). The *M1* definition therefore incorporates most deposit balances widely used as a means of payment. A large proportion of non-*M1*, *M2* balances is accessible by EFTPOS and is recorded here.

Source: <http://www.rbnz.govt.nz/statistics/c3>

APPENDIX 2: SUGGESTED STUDENT ASSIGNMENT

Data for earlier periods can be difficult to find. Hence it may be necessary to provide historical data to students and require that they find the more recent data that is more readily available. Individual course instructors will need to make this decision for themselves.

For this assignment, you will need to find GDP data from the online Statistics New Zealand tool “Infoshare” (you can find the link on the Statistics NZ webpage <http://www.stats.govt.nz/>). You will also need to find monetary aggregates data from the Reserve Bank of New Zealand website (<http://www.rbnz.govt.nz/>).

1. Create a graph of the velocity of circulation (V) for notes and coins for 1961 to the most recently available time period.
2. What does a rise in V mean in terms of the demand for money? What does a fall in V mean?
3. From the start of the 20th century to around the middle (just before your graph starts) the velocity of circulation falls. Use economic concepts to explain this.
4. If done correctly, your graph should show a rising V from 1961 until 1989. Use economic concepts to explain this.
5. From 1989 your graph should show a declining V . Use economic concepts to explain this. (This period of time is actually challenging to explain because of what it implies about demand for money given what many people *think* is happening to the demand for money.)

APPENDIX 3: POSSIBLE DATA SOURCES

An index for *M1* and *M3* is available for a range of countries from <http://stats.oecd.org/>.

UK data:

- <http://www.bankofengland.co.uk/boeapps/iadb/index.asp?first=yes&SectionRequired=A&H ideNums=-1&ExtraInfo=false&Travel=NlxSTx>
- <http://www.ons.gov.uk/economy/grossdomesticproductgdp>

Australian data:

- <http://www.rba.gov.au/statistics/tables/> (table D3)
- <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5206.0Jun%202016?OpenDocument>

New Zealand data:

- <http://www.rbnz.govt.nz/statistics/c1>
- <http://www.stats.govt.nz/>

US data

- https://www.federalreserve.gov/paymentsystems/coin_currircvalue.htm
- <https://fred.stlouisfed.org/series/GDPA>
- Earlier data for monetary aggregates can be found here <https://research.stlouisfed.org/wp/2003/2003-006.pdf> (page 48)

Many data items have multiple sources and the ones listed here may not be the best. Local knowledge is likely to be useful in this regard.