Index

1. Abstract

This paper surveys the incumbent obsolescence of paper money as a medium of payment, presenting advantages and disadvantages of a cashless society. By reviewing economic literature, it finds that proactively supporting a reduction in outstanding cash may increase consumer and producer welfare, government revenues, unlock crucial monetary instruments, while tampering unlawful activities. Furthermore, empirical results based upon the Swedish economy demonstrate that central banks policy will be unaffected by this change. Accelerating the transition to a cashless society seems to be therefore beneficial.

2. Introduction

Over the course of history, there have been many different forms of payment systems. Originally barter represented the only mean of conducting trade; eventually, manifold forms of money emerged, firstly as commodity and then as fiat currency. As Hollow (2012) notes, the issue of establishing more efficient and less exploitable alternative monetary systems in substitution to conventional notes-and-coins schemes has constantly attracted a great deal of attention since pre-1900 utopian literature and continued to vex thinkers right up until the twenty-first century. Whilst the cashless question posed by utopians is characterised chiefly by a social undertone – such as alleviating poverty and public dislocation – technical problems seemed insurmountable until Bellamy's *Looking Backward*, in which he describes a 'cardboards' credit framework that is often considered as the archetype of modern payment cards (Evans and Schmalensee, 2005). However, while the desire to dispense with cash is, as explained, certainly nothing new, such proposals remained confined to imagery and only found their ubiquity after the second half of the twentieth century when proper payment cards made their appearance thanks to McNamara's intuition (Greenbaum and Rubinstein, 2011). Ever since then, pundits have been envisaging the acclaimed

demise of paper instruments in favour of a cashless society. Seventy years after McNamara's Diners Club, 19.5 billion cards are in circulation worldwide and a growth of 24% is expected within the next five years. The estimated share of payments through non-cash methods varies profoundly: while in most developed economies the majority of consumers' transactions are already carried out electronically, especially in Scandinavian countries, South Korea and Kenya, others, such as Germany, Italy and Austria are still reluctant of moving away from physical exchanges (Bagnall, 2014). In the United States, 11% of M2 is composed of paper currency and the rest consists entirely of electronic entries for bank deposits and money market funds, cumulating to nearly 60% of transactions and more than 80% of their value (Lemieux, 2016).

It is no surprise that payment instruments are shifting from paper to electronic. This transition parallels trumping metal coinage in favour of paper in the past and represents the typical trend of any evolutionary process. Eventually, as in any technological environment, the best innovation tends to win out sooner or later. As a result, the context dictates what is superior: the return to barter during hyperinflation crisis, such as in post-war Germany or more recently Zimbabwe is undoubtedly a paragon.

In economic literature, lots of diverging definitions of a cashless society can be found. Many involve total absence of money, such as the ones depicted by Woodford's 2003 monetary treatise that legitimises a cashless framework for monetary policy or Wicksell's pure credit economy. Often the debate revolves around the clash of economic ideas between monetarists and post-monetarists, whose dispute can be summed up essentially as follows: Does money matter? (Barbaroux, 2007). Although the widespread development of electronic money and stored value cards are prime requisite to wonder whether it does or not (Goodhart, 2000), today the consensus on this matter is fundamentally unilateral. Indeed, the scope of this paper is not to question the veracity of post-monetarism, but rather to underline the obsolescence of cash as medium of exchange, advancing the idea of scaling back gradually paper in circulation

coins and notes (up to say, $20, as Sands (2016) argues) are left in circulation, this could have the benefits of a cashless society, whilst preserving paper currency for small transactions.

4. Implications for central banking

There is no reason to believe that a cashless society would drastically affect negatively the monetary stance of central banks. In fact, conventional policy could be conducted still setting the overnight interest rate with the aim of stabilizing output and inflation; nonetheless, there could be important advantages that central banks could retain, bar the loss of money printing revenues. The following analysis will begin with the latter.

4.1 Seigniorage revenues

Historically, when metal coins were issued and spent by central governments, seigniorage was simply the difference between the face value of a coin and the market value of the materials contained in that very coin. In fiat money economies, the difference between the face value of a currency note and its marginal printing cost are almost equal to the face value of the note – marginal printing costs are effectively zero. Printing fiat money is therefore a highly profitable activity – one that has been jealously regulated and monopolised by the state (Buiter, 2007). This activity generates a “monetary income”, deriving form low risk securities obtained from the assets held against issued banknotes.

Of course, with a transition to a cashless society, revenues generated through seigniorage would be annulled, as money would be issued only in the form of deposits and made available directly to banks, through refinancing operations. Given that seigniorage is only earned on the issuance of physical cash (Dyson & Hodgson, 2016), the “monetary income” generated by central banks, redistributed to the Treasury and eventually used to increment government spending, would be come down to zero (note

that this process is a little more complicated in the Euro zone, as revenues are transferred to national banks based on their share in the ECB's capital, and these, in turn, transfer such income to the state (Bank of Italy, 2017)).

Between 2006 and 2015, 0.4 percent of GDP was gained per year by printing new banknotes and spending them in the US. During the same period, this amounted to 0.55% in the eurozone (Rogoff, 2016). Seigniorage income is particularly important as it allows central banks to maintain independence from the Treasury. However, it must be noted that, as rate on the main refinancing operations decreased, significant reduction the seigniorage income of the ECB occurred. Indeed, the average rate for 2016 was 0.01%, compared with 4% for 2008: this meant that interest income on banknotes in circulation fell from the €2.2bn of pre-crises levels to only €10m last year (ECB, 2016). Subsequently, in the recent low interest environment, seigniorage does not play a pivotal role in central banks revenues and central bank independence may be guaranteed as far as rates are low. This stands in contrast with Storti and De Grawe's conclusions (2001), in which the advent of a cashless society harms CBs independence, as they would not be capable to self-sustain, resorting to the intervention of the Treasury to bear losses.

In addition, one may argue that in a cashless or reduced cash society, the demand for central banks electronic reserves should rise, potentially quite sharply; hence central banks might earn more profits on reserves depending on the spread between the deposit rate and the interest received on such assets (which currently represents the majority of the ECB revenue after the increase in balance sheet imputable to QE, (ECB, 2016)). The amount of reserves can be even further bolstered by imposing higher requirements (whether banks were not to deposit any excess reserves).

Ultimately, there are a plethora of instruments that central banks can adopt in order to trigger an increase in their revenues, in order to compensate for seigniorage loss. While it is true that in the past seigniorage revenues represented a substantial share

of financing, this no longer occurs in today low rates environment. In any case, it should be noted that CBs are not for-profit organisations, although excess income may favour governments. Nonetheless, it is important for CBs to retain some level of fiscal sustainability in order to guarantee their independence, that yields many benefits associated to monetary policy execution.

4.2 The zero lower bound constraint

There is an important asymmetry in monetary policy design: in times of boom, when the economy is overheating beyond desirable levels, central banks can simply readjust the target policy rate upwards if necessary. However, in deeply recessionary times, interest rates cannot be lowered further than zero, thus making it necessary, beyond this boundary, to resort to unconventional monetary policy instruments such as quantitative easing, forwards guidance or credit easing.

In 2009, the wide consensus among economists was that the FOMC should have reduced the funds rate to -5% in order to provide the adequate stimulus that the economy requested, following Taylor's rule of thumb. According to this historical policy rule and economic forecasts, the federal funds rate should have wandered in negative territory for several years, as indicated by Rudebusch (2009). This would have stimulated inflation through other asset price, exchange rate and credit channel of monetary policy transmission, hence supporting economic recovery.

Nevertheless, this was not possible as the very zero lower bound constraint derives from the mere existence of a risk-free nominal instrument that carries a zero interest rate, namely paper currency. In effect, when faced with significant negative rates, undertakings in the economy will prefer not to hold any shrinking capital, and rather resort to cash, earning positive returns. Theoretically, there could be a plethora of alternatives in order to discourage a flight to paper money, such as taxing cash possession with the aid of stamps applied on banknotes, resulting in a decrease in

4.3 Helicopter money

Within the field of unconventional monetary policy, there is a valid alternative to avoid either lowering nominal or recurring to unconventional monetary policy. Milton Friedman coined the term “helicopter money”, inferring to money dropped from central banks, as it occurs in humanitarian contexts (Dyson and Hodgson, 2016). If the recipients of this largesse credibly believe that it will not have to be repaid back (e.g. in the form of higher taxes in the future), this would represent an increase in the real net wealth of the private sector. Unlike QE, helicopter money benefits everyone equally rather than increasing the wealth of the already wealthy. To implement it, central banks would need a distribution channel that guarantees that new money would find its way into the accounts of the intended recipients, especially if targeting the low-income households (Dyson and Hodgson, 2016). As a result, it is evident that a cashless society would, ceteris paribus, raise the efficiency of helicopter money.

5. Withdrawing paper currency from circulation

Ultimately, it appears that a cashless society could eradicate crimes and tax evasion, increase overall welfare, and provide central banks with additional tools to conduct monetary policy. In order to achieve this goal, governments have the possibility of withdrawing of paper currency either instantaneously or progressively. The former is a rather radical approach, that was followed by India in 2016. The latter was adopted recently by the ECB and seems to be a sounder strategy, at least in western economies. In the following sections, possible ways to implement such approaches are investigated, along with implications for governments and central banks.

5.1 Authoritarian government approach

As Goodhart (2000) pinpoints, the sole method to eradicate paper money at once is the case of an authoritarian government prescribing all transactions to go through

Moreover, paper currency per capita peaked in 2005 at €1144 and has been decreasing ever since, reaching €631 per person, a figure which is indeed drastically lower than those reported earlier when treating the US and the Euro Zone. Moreover, Swedish researcher Niklas Arvidsson, states that out of the total physical money in circulation only around 40-60% is in actual circulation, while the rest is hoarded either in households, bank deposit boxes, or in the underground economy (KTH, 2015), a claim that would result in only €315 per head. The distribution of the data of graph 6 closely resembles chart 3 as the Swedish population has increased slowly during 1960-2017, from 7.5 to 10 million. Figure 5 demonstrates that for the longest period, inflation adjusted cash in circulation per capita has walked around base year levels, to then decrease during the inflationary 1990s, peaking during mid 2000s and finally reducing to about a 20% of the base year level in 2017. This is particularly important as it provides some measure of the real value of currency per capita held over time, that remained constant before the advent of new technologies of payment. In addition, paper money/nominal GDP has decreased over time at a steady rate, reaching less than 2% in 2017 (figure 4), in contrast with the 10.1% and 7.4% of respectively Europe and US. Thus, Sweden represents a perfect case study in order to assess the effects of the passage to a reduced cash society on economic performance, which will be addressed empirically in the following section.

6.1 Empirical analysis

Milton Friedman was convinced that a stable long-term relationship existed among base money, inflation and economic growth. He argued that the best way to ensure stable growth and inflation was simply to keep the money supply on a steady, predictable growth path, following the famous quantity theory of money. Following his thought line, coined as monetarism, popular belief was that the underlying factor causing high inflation rates throughout the 1970s in the US was the neglect of monetary aggregates by the FED. More recently, it has been proved that money supply is neutral

in the long run on real economic activity (McCandless and Weber, 1995) and should influence only inflation rates and nominal output. As a result, it is hypothesised that in the case of Sweden, the decline in M0 should have influenced only nominal GDP and inflation rates. This is particularly relevant in order to argue that a shift to a cashless society should not in any way tamper economic performance. To demonstrate this hypothesis, three linear regressions are developed linking the narrowest measure for money to nominal GDP, real GDP and CPI based inflation. The following equations express such relationships:

(1) $RealGDPgrowth_t = a + B_0\, M0\mathrm{growth}_t + e_t$

(2) $NominalGDPgrowth_t = a + B_0 M0\mathrm{growth}_t + e_t$

(3) $CPIgrowth_t = a + B_0 M0_{\mathrm{growth}} + e_t$

If predictions are correct, it shall result that B_0 is not statistically different from zero in the first regression, while it should be significant in 2 and 3. The data gathered to compute the analysis generates from the World Bank, Statistics Sweden and the Federal Reserve Bank of St. Louis, whereas M0 is derived from aggregating Edvinsson and Ögren (2012) with annual reports of the Riksbank (2017b), covering annually the period from 1960 up to 2017. The variation in growth of M0 from positive to negative after 2006 (as it can be evinced in figures 3 and 6) posed the question of possible existence of heteroskedasticity. However, through Cook-Weisberg tests, the presence of such issue was rejected in all regressions. Table 3 summarises the results obtained while figures 7 to 10 provide a graphical representation of data distribution.

Table 3. Regression results

Regression number	(1)	(2)	(3)
	Real GDP growth	Nominal GDP growth	CPI growth (inflation)
M0 growth 1960-2017	0.0141	0.419***	0.390***
	(0.28)	(5.54)	(5.79)
Constant	2.519***	5.791***	2.847***
	(6.84)	(10.55)	(5.82)
Number of observations	56	56	56

T statistics in parenthesis. * stands for p<0.05, ** p<0.01 and *** p<0.001

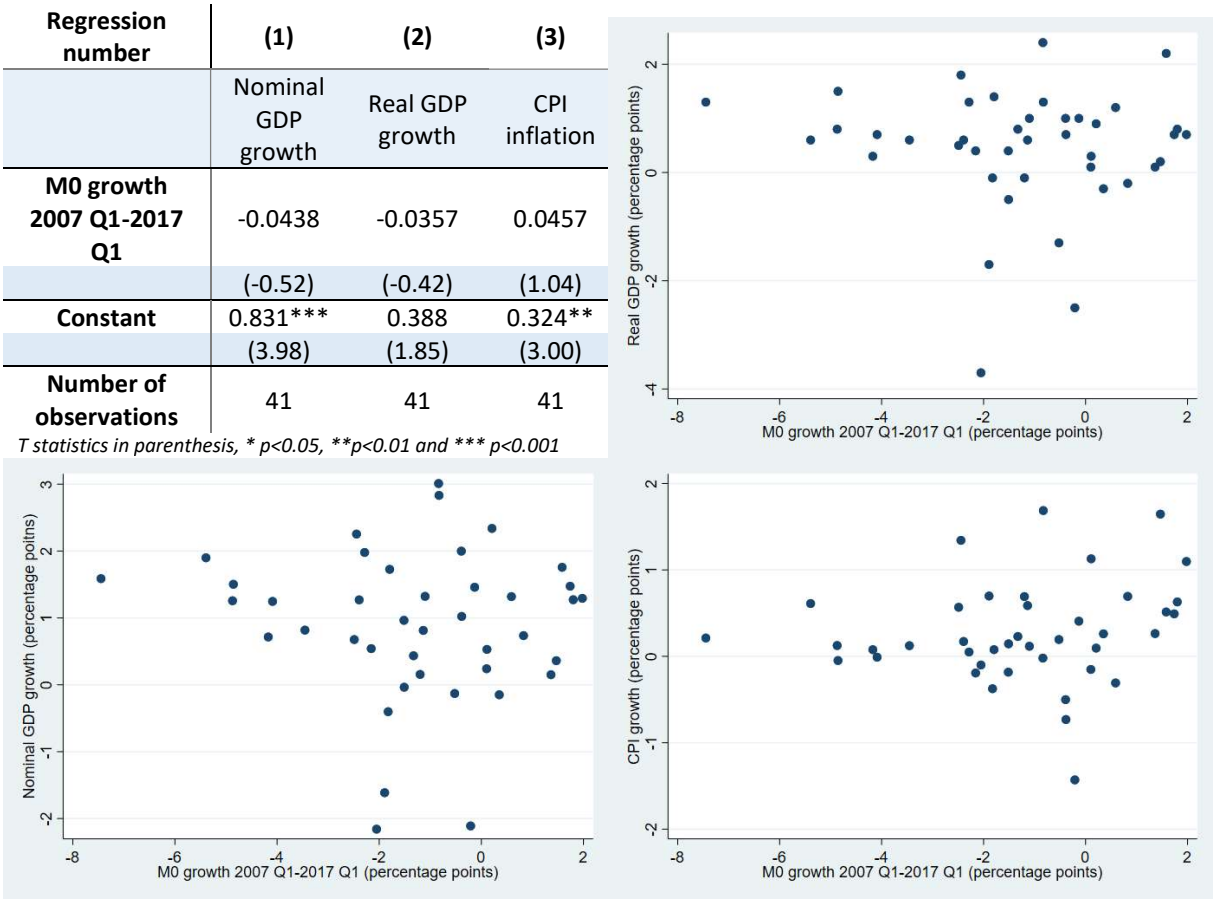
Figures 7 to 10 (clockwise). M0 growth 1960-2017 and data distribution of different regressions by number

The outcome of the regression analysis confirms the initial hypothesises. At a 95% confidence level, it results that no relationship exists between real GDP growth and M0 growth rates, while a tight and significant connection (p-value<0.001) subsists between M0 and CPI or nominal GDP growth rates. In particular, the marginal effect of a 1%

Table 4 & figures 11 to 13 (clockwise). Regression outcomes for quarterly data

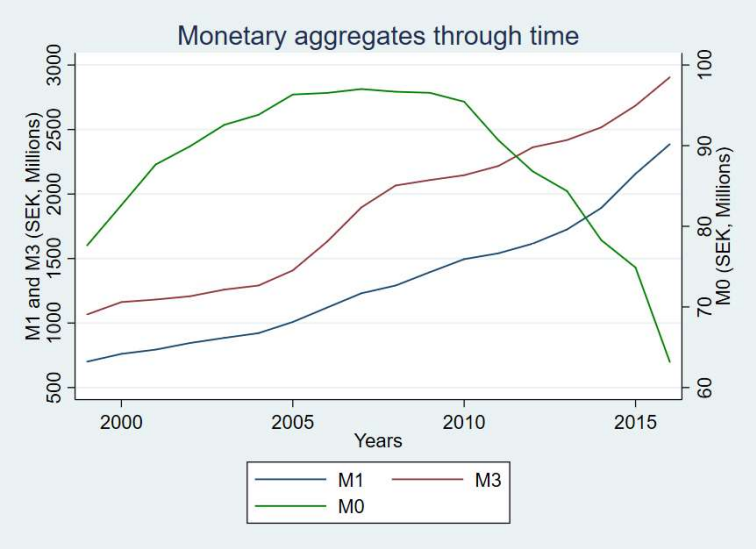
Regression number	(1)	(2)	(3)
	Nominal GDP growth	Real GDP growth	CPI inflation
M0 growth 2007 Q1-2017 Q1	-0.0438	-0.0357	0.0457
	(-0.52)	(-0.42)	(1.04)
Constant	0.831***	0.388	0.324**
	(3.98)	(1.85)	(3.00)
Number of observations	41	41	41

*T statistics in parenthesis, * p<0.05, **p<0.01 and *** p<0.001*



The output clearly indicates that over the last ten years, at 5% significance level, no relation links either on real, nominal GDP growth and inflation with changes in narrow money. There are various reasons why this could be the case. Firstly, it stands out that M0 might be a bad estimator for the amount of money supply in the economy. In fact, while an increase in banknotes and coins in circulation does increase broader measures of money, such as M1 or M3, a decrease in the amount of these in circulation might not affect neither M1 or M3, as the difference might be issued in the form of electronic deposits. Indeed, broader measures have been surging during 2006-2007, in opposition to M0, as shown in figure 14.

Figure 14. Evolutions of Swedish monetary aggregates



Source: own elaboration integrating data from Edvinsson and Ögren (2012), 2017 Riksbank annual reports (2017) and Statistics Sweden.

Secondly, it might be that a reduction in size of M0 with respect to economic output over the years could have reduced its influence, playing a diminishing role in altering agents' expectations. Thirdly, it might be that economic activity could have been affected by different factors that were not taken into consideration, such as negative interest rates. Lastly, one may also argue that expectations may be sticky and could take time before they manage to adjust. In any case, the transition to a reduced cash society does not seem to have compromised Swedish economic activity. Whether monetary aggregates were or not to affect inflation expectations, this would be irrelevant for central banks in any case, as nowadays they virtually play no role in their monetary stance, being interest rates the main transmission mechanism.

7. Cryptocurrencies

In the picture portrayed by this paper, a cashless economy would simply result in the abandoning of paper money in favour of alternative payment methods such as debit and credit cards, mobile technologies, wire transfers or even cheques. Central banks still retain the monopoly and create their liabilities simply with the "stroke of a pen".