

**The effect of electronic money on the growth rate of currency in
circulation Singapore 2007-2016**

تأثير النقود الإلكترونية على معدل نمو العملة في التداول سنغافورة 2007-2016

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Abstract:

The purpose of this study is to examine the potential impact of electronic money substitution on the central bank's currency in Singapore from 2007 to 2016. The study concluded the the narrow definition of money should be re-introduced through the introduction of electronic money, and that the replacement of electronic money to the currency of monetary authority of Singapore contributes in reducing the currency level in circulation by 0.2 percent.

Key words: cash drop rate, currency in circulation, electronic money, interest rate, the velocity of money rate.

ملخص:

الغرض من هذه الدراسة هو دراسة التأثير المحتمل لإحلال النقود الإلكترونية محل عملة البنك المركزي في سنغافورة من عام 2007 إلى عام 2016، وخلصت الدراسة إلى أن التعريف الضيق للنقود يجب إعادة تقديمه من خلال إدخال النقود الإلكترونية ، وأن استبدال النقود الإلكترونية بعملة سلطة النقد في سنغافورة يساهم في خفض مستوى العملة المتداولة بنسبة 0.2 في المائة.

الكلمات المفتاحية: معدل التسرب النقدي ، العملة في التداول ، النقود الإلكترونية ، سعر الفائدة ، معدل

دوران النقود .

1. INTRODUCTION

The development of information and communication technology has had a direct impact on the banking industry. The emergence of so-called banking technology, which revolutionized financial innovations that have 24 hours of work every day of the week, has been helped by external networks such as the Internet and mobile phones. The most important finance in the area of retail payments are those that include what is known as electronic money. The unique characteristics of electronic money enable it to replace the central bank's currency in settling retail payments. In addition to its ability to flow freely between international borders, electronic money has constituted a new challenge for central banks and the effectiveness of monetary policy instruments. Many researchers have argued that central banks may lose control over monetary aggregates.

In this study, we are trying to study the potential impact of the electronic money substitution on the Central Bank's currency in Singapore. Therefore, we formulated the problem as follows:

- What is the effect of the spread of electronic money on the growth of the currency of monetary authority in Singapore?

1.1.Objectives of the study:

- Determining the precise concept of electronic money
- Rebuilding the narrow definition of money
- Identification of the effect of electronic money on money in circulation.

1.2.The importance of the study :

The importance of the study lies in the attempt to determine the effect of electronic money on money, and in the event of proven impact, the recommendations of the monetary authorities are determined in order to ensure the effectiveness of monetary policy.

1.3.Previous studies:

(Monetary Policy Implications of Digital Money, Aleksander Berentsen, 1997):

The researcher in this study assessed the ability of electronic money to replace the currency of the Central Bank and other means of exchange, and presented a model showing how the economic agents choose between different means of payment, and stressed that electronic money on The basis of the card facilitates transactions of small value payments in transactions (p2p), so expect to reduce this type of electronic money from the use of the currency of the central bank and limit the spread of credit cards and debit cards, and also demonstrated that electronic money based on the software has the ability to reduce the use of checks And a card Credit cards, debit cards in remote payments such as online payments.

(Monetary, Economic and Financial Effects of Electronic Money, Mohamed Ibrahim El Shafei, 2003): The researcher aims to study the theoretical analysis of the effects of monetary, economic and financial electronic money, and study the status of electronic money in Egypt descriptive study only, according to the researcher includes the effects of monetary impact of electronic money on the ability The central bank to approve interest rates, as well as affect the effectiveness of monetary policy, as well as the levels of the legal reserve, while the economic impact includes consumption, investment and employment.

(Development of Electronic Money and Its Impact on the Central Bank Role and Monetary Policy, Mohamad Al-Laham and Haroon Al-Tarawneh 2009):

In this study, the researchers raised the problem of the growth of electronic money and the possibility of replacing the central bank's currency, adding that there are no clear answers to the expected impact of electronic money on monetary aggregates, the banking system and its possible effect on the exchange rate, interest rates, . The researchers aim to assess the extent to which electronic money is considered a form of money, in which case it poses a challenge to the central bank's control over monetary policy and money supply. The researchers relied on the analytical method to determine the impact of money in many areas. The researchers found that the ability to control money supply depends on the narrow definition of M1 money. As the components of M1 decline in conjunction with the growth of electronic money, M1 becomes an inaccurate measure of the

definition of money. This will weaken the ability of the central bank to manage monetary policy, especially through open market policy.

(Neda Povska, he use of electronic money and its impact on monetary policy, 2014): In this study, the researcher adopted the European Parliament's definition of e-money as the study was on the European countries, defined the characteristics of electronic money and the difference between them and other electronic payment devices, and divided Electronic money to electronic money software, and electronic money based on devices. The researcher also analyzed the electronic money market in Europe and confirmed that the first legislation allowing the issuance of electronic money by banks and other institutions was in 2000. The electronic money market was characterized by weakness in the first because of the limited definition of cash value stored on cards, Server, in addition to imposing a high initial capital on non-bank institutions, which weakens their competition against banks. In 2009 new legislation was introduced to define e-money to include both types of electronic money systems as well as to reduce the initial capital of non-banking institutions exporting them from € 1 million to € 350,000. This definition was adopted in most European countries starting mid-2011 The researcher concluded that the effect of electronic money on monetary aggregates as a result of the replacement of electronic currency in the currency of the Central Bank remains small due to the low percentage of electronic cash contribution in the settlement of the total amount of transactions, but indicated by its expectations that there will be a great expansion in the use of money only Which will have an impact on the role of the central bank and monetary policy.

2. Theoretical framework

2.1. Definition of electronic money:

While the broad concept of e-money refers to all computer-based money transfer mechanisms (eg, credit or debit cards) and their access devices (eg ATMs, point-of-sale devices), the exact concept of electronic money applies to all Online money transfer systems (guttman, 2002, p03) Electronic money is the electronic representation of traditional money (hassen, 2001). According to Directive 2009/110 / EC of the European Parliament, electronic cash means electronically stored cash value, including magnetically, as it represents in our debtors (liabilities) to the issuer upon receipt of funds for payment transactions, which are accepted by another natural or legal person Not a source of electronic cash (European Parliament, 2009, p09).

2.2. Main areas of e-money

2.2.1. e-money in a virtual environment

The most successful schemes to date fall essentially into the category of pre-funded, personalized online payment schemes, involving the transfer of funds stored in an online account (excluding traditional bank deposits). Accounts are typically accessible via Internet browser, e-mail and/or, in some cases, via mobile phone text messaging (SMS). Examples of pre-funded personalized online payment schemes include Paypal, Digicash and Moneybookers.

Two main categories exist according to the storage device used:

2.2.1.1. Card-based e-money ('electronic purses') which relies on a device containing hardware-based security features (typically in the form of a microprocessor chip embedded in the plastic card). The card is used for authentication rather than account information.

Aside from conventional e-purses, smartcards for public transport are the second most widely-used application of card-based e-money.

2.2.1.2. Software-based e-money (sometimes referred to as 'digital cash' or 'network money') which employs specialized software on a personal computer, typically allowing electronic value to be transferred via telecommunication networks and the Internet. The value held by a customer is stored centrally on a server under the control of the issuer and customers access their purses remotely (Phoebus Athanassiou, 2008, p07).

The main differences between card-based products and software-based products are certain aspects of the technical security features and the storage medium of the electronic money. However, there are also many similarities: in both cases the user has to pay in advance for the value stored as electronic money units, which can then be used for payment purposes. In the processor memories and during transfers between them, the electronic money is represented by an encrypted string of bits. Moreover, many card-based products have the potential to be used not only for face-to-face payments but also for payments via telecommunications networks. Therefore, whenever electronic money is being transferred via such networks, the term "network money" can be used, regardless of the kind of product. Electronic money differs from other existing forms of money in various ways. In comparison with cash, which uses only physical security features, electronic money products use cryptography to authenticate transactions and to protect the confidentiality and the integrity of data. Electronic money no longer needs to be physically exchanged like banknotes and coins, and thus can be more easily used for remote payments. In addition, unlike cash, in most schemes currently available, electronic money received by the beneficiary cannot be used again. Stored-value products are generally prepaid payment instruments in which a record of funds owned by or available to the customer is stored on an electronic device in the customer's possession. The amount of stored "value" is decreased or increased, as appropriate, whenever the customer uses the device to make a purchase or other transaction, without necessarily involving a personal bank account. By contrast, "access" products typically involve a telephone or a standard personal computer, together with the appropriate software which allows customers to access their deposit accounts and to transfer the deposits therein via computer networks, such as the Internet or other telecommunications links (European central Bank, 1998, p07) .

2.3.Key features of e-money schemes

Various e-money schemes are being developed and they differ considerably in their features, many aspects of which are still to be finalised.

2.3.1 e-money products differ in their technical implementation. To store the prepaid value, card-based schemes involve a specialized and portable computer hardware device, typically a microprocessor chip embedded in a plastic card,

while software-based schemes use specialized software installed on a standard personal computer.

2.3.2. institutional arrangements may vary. Typically, four types of service provider will be involved in the operation of an e-money scheme: the issuers of the e-money value, the network operators, the vendors of specialized hardware and software and the clearers of e-money transactions. From a policy point of view, the most important providers are the issuers, since e-money is a balance-sheet liability of these institutions. In contrast, the network operators and vendors only supply technical services, while clearing institutions are typically banks or specialized bank-owned companies that provide a service that is no different from that provided for other cashless payment instruments. Typically, there is more than one issuer, but in some cases there may be a single issuer, with other institutions "buying" the value from the issuer and then "selling" it on to consumers.

2.3.3. products differ in the way in which value is transferred. Some e-money schemes allow transfers of electronic balances directly from one consumer to another without any involvement of a third party such as the issuer of the electronic value. More usually, the only payments allowed are those from consumers to merchants, and the merchants in turn have to redeem the value recorded (for example, at the end of the day they transfer the total value to their bank, which then credits their bank account with the funds). Fourthly, related to transferability is the extent to which transactions are recorded. Most schemes register some details of transactions between consumers and merchants in a central database, which could then be monitored, although a few schemes envisage keeping only limited records of individual transactions or no records at all. In cases where direct consumer-to-consumer transactions are allowed, these can only be recorded on consumers' own storage devices and can be monitored centrally only when the consumer contacts the e-money scheme operator (for example, to reload a card with more value).

2.3.4. in most e-money schemes currently being developed or pilot-tested, the "value" stored on the devices is denominated only in the national currency. It is possible, however, for balances to be held and payments to be made in several different national currencies (Crocett, 1996, p07).

2.4. Definition of Monetary Authority of Singapore (MAS)

As Singapore's central bank, the Monetary Authority of Singapore (MAS) promotes sustained, non-inflationary economic growth through appropriate monetary policy formulation and close macroeconomic surveillance of emerging trends and potential vulnerabilities. It manages Singapore's exchange rate, foreign reserves and liquidity in the banking sector. MAS is also an integrated supervisor overseeing all financial institutions in Singapore -- banks, insurers, capital market intermediaries, financial advisors, and the stock exchange. With its mandate to foster a sound and progressive financial services sector in Singapore, MAS also helps shape Singapore's financial industry by promoting a strong corporate governance framework and close adherence to international accounting standards. In addition, it spearheads retail investor education. MAS ensures that Singapore's financial industry remains vibrant, dynamic and competitive by working closely

with other government agencies and financial institutions to develop and promote Singapore as a regional and international financial centre. (<http://www.mas.gov.sg/About-MAS.aspx>) (MAS, 2018)

2.5. Definition of Singapore's Monetary Authority for Electronic Money

A Stored Value Facility (SVF) is a form of prepaid electronic cash or card that can be used within the system of the SVF issuer. The SVF issuer is known as the holder of the stored value. Some electronic SVFs are also known as e-money. Usage of SVFs usually does not require Personal Identification Numbers (PINs) or signatures. The Payment Systems (Oversight) Act (PS(O)A) and its related regulations governs the issuance and management of SVFs. Stored value facilities are either stored for single purpose or stored multi-purpose value facilities (MPSVF). Multi-purpose stored value facilities are used to pay for goods and services provided by the issuer only (such as prepaid phone cards), while the multi-purpose stored value facilities allow customers to pay for goods and services provided by merchants or other organizations. Under the Payment Control (Payment) Act, any entity may issue value-added facilities stored without the consent of the Monetary Authority of Singapore, provided that the total outstanding value outstanding remains below the established threshold (currently S \$ 30 million). This regulatory law liberalizes the stored value facility market and allows flexibility in meeting consumer needs and providing additional options for payment methods. Any multi-purpose stocked value facility with a stored value over S \$ 30 million requires the approval of the Monetary Authority of Singapore as a facilitation of the widely accepted stored value (WSFV), together with the appointment of an authorized bank. Among the widely accepted multi-purpose value-based facility systems in Singapore are the following cards: NETS CashCard, NETS FlashPay, the EZ-Link card and the Singapore Youth Olympic Games DBS Visa Prepaid Card (SYOGPPC) ((EMEAP, 2012, p12).

3. Theoretical Model:

3.1. The scientific and traditional definition of money:

The definition of money is defined as the currency of export (C), which consists of paper money (banknotes issued by the Central Bank, In addition to the auxiliary currency, and current deposits (D) are called deposit money, bank money or internal money, and specifically the money supply in the narrow sense is equal to:

$$M1 = C + D$$

D : Current deposits

C: Currency is traded outside banks.

This traditional definition of money, but the new definition will solve the electronic money in the definition of money.

3.2. The new definition Money after the emergence of electronic money:

Traditionally, the currency is classified into several different levels including M1, cash in circulation, M1 including M0, trading securities, and other cash equivalents easily convertible into cash. M2 includes M1, short term deposits with

banks, money market funds for 24 hours, M0 is the highest level of liquidity followed by M1 and M2.

$$M0 = \text{cash} = C$$

Electronic money will replace conventional funds, which means that electronic money will replace part of the cash and demand deposits but the total amount of currency in circulation remains constant, and based on this analysis gives a new definition of cash levels that include money

$$M0 = C'$$

C: represents the amount of cash before the advent of electronic money

C': represents the amount of cash after partial replacement with electronic money.

E: The amount of cash transferred to electronic money.

We will focus on the effect of electronic money on M0 and thus the dependent variables will be M0 growth rates from 2006-2017 where MR represents the growth rate of M0.

3.3.Elements of the theoretical model:

increasing the rates of substitution of electronic money (Es) and the currency leakage ratio (k) are independent variables.

3.3.1. increasing the rates of substitution of electronic money (Es) refers to the percentage of electronic money to the amount of M. We have chosen the rate of replacement of electronic money as an independent variable because electronic money replaces part of the cash and deposits on demand. Therefore, the rate of electronic money exchange represents the level of growth of electronic money in a country.

3.3.2. The currency dropout rate (k) refers to the cash withdrawal ratio of customers on demand deposits. We use the currency leak rate as an independent variable because it represents the amount of cash and demand deposits in circulation.

3.3.3. Interest rates (i): We use the interest rate as an independent variable because it determines the form of retention of wealth.

3.3.4. Cash Flow Speed (v): We use the money turnover rate as a variable within the model. Therefore, our theoretical model includes those factors.

Therefore, the theoretical model is:

$$MR = \log 0.2 Es + k - i - v$$

$$MR = \beta_0 - \beta_1 Es + \beta_2 K - \beta_3 i - \beta_4 v + \varepsilon_t$$

When electronic money replaces part of the cash, the amount of cash will be reduced from C to C' in the current year. Thus, the M0 growth rate will also be reduced. At the same time, electronic money exchange rates will increase. Therefore, increasing the rates of substitution of electronic money leads to a reduction rate of growth of M0. The relationship between Es and MR is negative. We know that the currency leak rate is $k = C / D$. Before the emergence of electronic coins, $M0 = C$. Then, $M0 = C'$. Thus, $M0 > M0'$. At the same time, we know $K = C / D$

As a part of the demand deposits are replaced by e-cash, D will change to D'. In addition, most electronic money comes from rolling cash. In general, k will go

down. Thus, the growth rate of M0 and k moves in the same direction, so MR and k have a positive relationship.

Finally, when people use electronic money on a large scale, the growth rate of M0 and Es has a negative relationship, while the growth rate of M0 and k has a positive relationship.

table 1: The most important factors affecting the development of currency in circulation

	m1	c	D	MR	E	Es	i	k=C/d	v	GDP
2007	63 938,60	16 668,50	47 270,40	0,09	1 776,00	0,03	0,0533	0,35	2,8	179 980,00
2008	75 703,80	18 997,40	56 706,40	0,14	1 955,00	0,03	0,0538	0,34	2,5	192 230,00
2009	93 472,10	20 206,50	73 255,60	0,06	1 988,00	0,02	0,0538	0,28	2,1	192 410,00
2010	112 487,00	22 299,50	90 187,50	0,10	2 030,00	0,02	0,0538	0,25	2,1	236 420,00
2011	130 591,90	24 690,30	105 901,60	0,11	2 166,00	0,02	0,0538	0,23	2,1	275 070,00
2012	140 709,10	26 361,30	114 347,80	0,07	2 351,00	0,02	0,0538	0,23	2,2	304 450,00
2013	154 597,30	28 851,60	125 745,70	0,09	2 445,00	0,02	0,0538	0,23	2,0	311 540,00
2014	160 217,70	31 506,90	128 710,80	0,09	2 588,00	0,02	0,0535	0,24	1,9	304 100,00
2015	160 445,80	34 042,30	126 403,50	0,08	2 722,00	0,02	0,0535	0,27	1,9	309 760,00
2016	172 753,50	38 525,00	134 228,50	0,13	2 802,00	0,02	0,0535	0,29	1,9	323 910,00

Source: Prepared by the researcher based on data of the Monetary Authority's of Singapore site web.

-M1,C,D,GDP unit: S\$ MILLION

4. Estimating mathematical model coefficients using Eviews 10

Dependent Variable: MR
Method: Least Squares
Date: 12/07/18 Time: 11:03
Sample: 2007 2016
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.021693	0.087623	-0.247571	0.8143
ES	-0.252773	0.062791	-4.025624	0.0100
I	-2.643766	0.201142	-13.14377	0.0000
K	2.360769	0.425952	5.542335	0.0026
V	-0.470996	0.167627	-2.809786	0.0375
R-squared	0.821609	Mean dependent var	0.096000	
Adjusted R-squared	0.678896	S.D. dependent var	0.025033	
S.E. of regression	0.241686	Akaike info criterion	-4.300670	
Sum squared resid	0.029206	Schwarz criterion	-4.149377	
Log likelihood	26.50335	Hannan-Quinn criter.	-4.466638	
F-statistic	11.16387	Durbin-Watson stat	1.962401	
Prob(F-statistic)	0.004257			

$$MR = \beta_0 - \beta_1 Es + \beta_2 K - \beta_3 i - \beta_4 v + \varepsilon_t$$
$$MR = -0.02169 - 0.2527Es + 2.3607K - 2.6437i - 0.4709v$$

5.Results:

It is clear from the results obtained by Eviews 10 that it is fully in line with the expectations of economic theory. This is evident in the inverse relationship between MR and ES, I and V, on the one hand, and the positive relationship between MR and K. The coefficient of -0.2527 indicates the effect of the electronic money exchange rate (Es) if the effect of the remaining variables is constant. The high rate of electronic money exchange in one unit will result in a decline in the growth rate of the currency MR by 0.2527%. The coefficient of -2.6437 also refers to the effect of the interest rate (i) if the effect of the remaining variables remains constant. The increase in the interest rate in one unit will result in a decline in the rate of MR growth by 2.6437%. While the coefficient of 2.3607 indicates the effect of the monetary dropout rate (K) if the effect of the remaining variables is constant. The increase in the cash drop rate in one unit will lead to an increase in the rate of growth of the currency MR by 2.3607%. The coefficient of -0.4709 refers to the effect of the rate of cash flow (v) if the effect of the remaining variables is constant. The high rate of money circulation in one unit will lead to a decline in the rate of MR growth by 0.4709%.

It is clear from the results obtained by Eviews 10 that it is fully in line with the expectations of economic theory. This is evident in the inverse relationship between MR and ES, I and V, on the one hand, and the positive relationship between MR and K.

In the light of the calculated statistics, the explanatory power of the model is shown by the high coefficient of selection (82.16%), while the total moral value of the model as a whole is statistically significant (11).

Conclusion:

In this paper we tried to answer one of the potential effects of electronic money on the rate of growth of the currency in circulation, and therefore on the part of the money supply, in addition to a range of other variables that can affect it, such as interest rate, the rate of cash dropout. Based on previous studies, which we agree with the need to reformulate the narrow definition of money supply to include the size of electronic money as it replaces the other components.

The study also shows that the growth of electronic money in Singapore can affect the level of currency in circulation, by reducing the level, and this increase in the impact the greater the volume of electronic money, so the monetary authority in Singapore to monitor and monitor the development of the use of electronic cash, The impact may include the following electronic money effects:

- Electronic money and returns of the Central Bank.
- Electronic money and open market policy.
- Electronic money and compulsory legal reserve.

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