Money Stock As Total Debts

A Case Study on the Financial Accounts of the United States

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Abstract

The deposit creation theory recognizes banks create new deposits to finance loans under the fractional reserve system, suggesting that total debts owed by households, businesses, government and foreign sectors approximate total money stock denominated in a specific currency unit. To further investigate the money-debt relationship observed in the previous case study on Japanese Yen (JPY) for a period between 1980-2019, this paper examines the case of United States Dollar (USD) against time-series retrieved from the Financial Accounts of the U.S. We found total debts approximate M2 during 1945-2020, reconfirming the macroeconomic validity of the theory in the USD case. Furthermore decomposition analyses on the money-debt relationship revealed total debts held by public and private sectors approximate M1 (consisting of currency and checkable deposits) and time deposits respectively as observed in the JPY case. Then the paper briefly discusses implications for data reliability, macroeconomic theory and fallacy of modern money theory (MMT).

Keywords: credit, debt, deposit creation, fractional reserve banking, financial accounts, money

I. Introduction

Banks as the Providers of Money Stock

Money, as a means of payment, plays a central role in virtually all economic activities, affecting day-to-day decisions of private individuals, business corporations and governments around the globe. Despite its significance, however, the underlying system structure seems to receive little attention by the general population. Without its proper understanding, economic policies fail and the whole society could suffer from unintended consequences. Today bank deposits serve as a chief means of payment and constitute the majority of money stock. Regarding the role of banks, the deposit creation theory recognizes that deposits, which account for 90% of total money stock (M2) of the U.S. as of December 2020[1], are created through bank loans under the fractional reserve banking system. The theory has a long tradition among economists and its antecedents numerous (Wicksell, 1898; Hawtrey, 1919; Keynes, 1930). MacLeod (1856), among others, is one of the influential literatures that takes the deposit creation theory in economic analyses. The leading American economists in the 1930s, including the Chicago school economists and Irving Fisher, carefully studied what caused the nation-wide banking closures and subsequent depression, proposing the money and banking system reform to prevent future crises, ensure price stability and full employment.[2] Robert H. Hemphill, who

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[1] Calculated from Currency Component of M1 [CURRSL] and M2 [M2SL], retrieved from FRED, Federal Reserve Bank of St. Louis, accessed September 1, 2021.

[2] Phillips (1995) provides a detail account of the background, thesis and outcomes of reform proposals in the 30s. The proposals, in principle, consisted of 1) requiring 100% reserve ratio on checkable deposits, and 2) establishing and authorizing the "Currency Commission" a la Fisher (1945) to provide money banks need for 100%

was a credit manager at the Federal Reserve Bank of Atlanta at the time, attributed the fragility and inherent instability[3] of the domestic financial system to the fractional reserve banking, and wrote down the following foreword to the Irving Fisher's proposal on 100% reserve system in 1935 (Fisher, 1945):

> Neither the banker nor the borrower ordinarily realize that a loan just completed, is putting into circulation that much new money ... If all bank loans were repaid, no one would have a bank deposit, and there would not be a dollar of currency or coin in circulation. This is a staggering thought. We are completely dependent on the commercial banks. Someone has to borrow every dollar we have in circulation, cash or credit.

Analysts at the Bank of England emphasizes the role of banks as creators of new money against the common misconception that banks are intermediaries of existing funds between savers and borrowers (Mcleay et al., 2014). More recently, Werner (2016) verified the empirical validity of the theory under a fully controlled test performed in collaboration with a cooperative bank in Germany, which highlighted a significant regression in the recognition of the role of banks in economics profession during the last century. In order to examine the validity of the deposit creation theory at a macroeconomic level, Yamaguchi & Yamaguchi (2021a,b) analyzed the Flow of Funds Accounts statistics published by the Bank of Japan and found that the total debts from banks approximate total money stock M3 during 1980-2019 in the case of Japanese Yen (JPY).

The purpose of this paper is to examine the deposit creation theory in the case of United States Dollar (USD). The money-debt relationship suggests that total debts from banks approximate total supply of money, difference being the amount of public money issued by the government as interest-free stable currencies. Today public money are issued in the form of coins in most nations, and constitute a small percentage. For instance, coins in Japan are issued by the national government. As of 2018, coins amounts to 4.8 trillion Yen, which is roughly 0.3% of total money stock M3 (1,425 trillion Yen). In the U.S., public money in circulation is mostly the U.S. Treasury Currency.[4] Thus we shall observe the money-debt relationship holds in the USD case.

Public Money & Debt Money

Public money are interest-free money issued by the government or authorities of the time, such as the Monarchs in the west and the Emperors in Japan. Historically, public money took various forms both in the east and west – from commodity, precious metals and paper currencies. With the information technology and infrastructures available today, public money can be issued electronically.

Examples in the North America include the Spanish silver dollars, the early American coins, the paper currencies circulated in the British colonies, the United States Notes

reserve ratio, and to manage total money stock towards price stability objective. The former arrangement structurally increases resiliency, safety and stability of the domestic financial system by making all M1 backed by legal tender, thus achieving M0 = M1. Note that deposits are merely promises by banks to refurnish currency (i.e. legal money) on demand under the fractional reserve banking system. The latter arrangement transforms all interest-bearing money ('Debt Money') into interest-free stable currencies issued by the government ('Public Money'). As a byproduct of the reform, much of national debts are also liquidated, freeing the nations from financial servitudes in the form of compounding interests on public debts. For separation of powers, public money are issued by an independent committee established under the direct supervision of the legislature. This mechanism ensures the commission is isolated from political pressures by other branches of government in fulfilling the price stability objective and other roles. See Yamaguchi (2010, 2011, 2021) for ASD model-based studies, and Benes & Kumhof (2012) for DSGE model-based study on the topic.

[3] Keynes (1930, p.23) famously used the expression when he observed the primary function of banks as creators of deposits in the second chapter of his treatise.

[4] Since 1966 the U.S. Treasury Currency comprises silver dollars and fractional coins, U.S. notes, and other currency items in the process of retirement. See p.12 and 28 of FRB (2021) – All Table Descriptions (July 10, 2021).

as well as gold and silver certificates.[5] In the United Kingdom, one of the recent examples of public money in paper form was the *Currency Notes* issued by the Treasury as authorized by the Currency and Bank Notes Act 1914 (4 & 5 Geo 5, c.14, 6th August), which remained legal tender until 1928.

Examples of public money in Japan include the *Wadōkaichin*, which was the first silver (and copper) coins issued in the first year of Wado era (708) as ordered by the Emperor. Gold, silver and other metal coins circulated during the Edo period.[6] Then there was a significant outflow of gold in 1859 from Japan due to arbitrage by foreign traders, who exploited the different conversion ratio between gold and silver in the Japanese and overseas market. In 1868, the new Meiji government issued the *Dajōkan-satsu* as fiat money in paper form. It was one of the first nation-wide public money. Hence one can see accordingly that almost all money circulated in Japan was public money for over 1,000 years. With the creation of the Bank of Japan in 1882, however, the conversion of public money into bank notes began from 1885.[7] The conversion was completed by the end of 19th century. Today public money exists only as coins and accounts for 0.3%.

Debt money, on the other hand, are issued as interest-bearing debts, often by private organizations other than the issuer of public money. Today the central and private banks are the issuers ('lenders') of debt money.[8] The *fractional reserve* banking began in medieval Europe where money changers and bankers start to issue notes and create 'deposits' on their books above the amount they were actually entrusted by their customers. Under the fractional reserve banking, deposits are, both legally and practically, IOU representing indebtedness of the bank to its 'depositors', and simultaneously, the indebtedness of 'borrowers' to the same bank. To quote the words of Fisher (1945), "the bank lends not money but merely a promise to furnish money on demand – money it does not possess (pp 7-8)". In the Japanese civil code today, the legality of deposits as loans to banks is established by *Article 587 Loans for Consumption* and *Article 666 Deposit of Fungibles*. Together with the fractional reserve requirement, private banks are licensed to *relend* the currency that were *loaned* to them, i.e. create deposits *ex nihilo*.[9]

[5] See del Mar (1895) and Zarlenga (2002b), for instance, for further readings on the general history of money, various experiments, and the struggle over the political control of money power in the U.S. before and after 1913.

[6] The gold coins were called *koban*, which literally means a small oval-shaped coin. It had a fixed denomination under the quaternary system. After the Meiji restoration, the new government adopts decimal system in 1871.

[7] The bank notes were made convertible to silver specie first, largely due to shortages of gold. They were later made convertible to gold specie from 1897 with the increased reserves from the reparation of the Sino-Japanese War. The gold standard was suspended and resumed several times until 1941 when the specie reserve system was eventually abolished just before the Second World War.

[8] It should be noted that the distinction of public and debt money are not drawn by the ownership status of the issuers. This is particularly relevant today since not all central banks are privately-owned. The Governor and Company of the Bank of England, for instance, was incorporated in 1694 by the Royal Charter as a joint stock company. However, the whole of the the bank's capital stock was acquired by HM treasury under the Bank of England Act 1946, and is now held by the Treasury Solicitor on behalf of the Treasury. Accordingly the bank is considered to be a public sector body. Nevertheless the bank continues to issue debt money against, among other things, the treasury securities, i.e. public debts. Another example is the Bank of Japan. The bank, which was modeled after the National Bank of Belgium, was established as a joint stock company initially, whose shares were held by the Imperial household, private individuals and banks. Today 55% of its shares, or *prioritized investment securities* as the bank wished to be referred to, are held by the Government of Japan. The rest is held by private persons (40.4%), financial institutions (2.0%) and others (2.6%) as of March 2020. The shares are listed on the Tokyo Stock Exchange (JASDAQ: 8301) since November 1983. The shareholders receive annual dividends but not entitled to exercise voting rights. Accordingly the bank is often seen as a government agency. However the bank issues notes and reserves (debt money) against government bonds just like the Bank of England. The Federal Reserve ('the Fed') in the U.S., created in 1913 by the Federal Reserve Act, consists of the board of governors, Federal Open Market Committee and 12 regional reserve banks (chartered as private corporations). Shares of the regional banks are owned by its member banks (private banks), who select six of nine directors of the board of the regional banks. The Fed earns interest on the treasury securities in its portfolio just like other central banks. Thus the Fed issues debt money.

[9] Deposit of fungibles should not be confused with bailments, which does not assume a transfer of ownership.

II. Methods & Data

Accounting System Dynamics Modeling

We employ the Accounting System Dynamics (ASD) modeling framework proposed by Yamaguchi (2003) as the analytical foundation. As the name suggests, the ASD exploits the rigorous foundation of double-entry bookkeeping and accounting system, which dates back, at least, to the times of Middle Ages in Italy, and the system dynamics (SD) modeling proposed by Jay W. Forrester (Forrester, 1961), whose mathematical foundation, calculus, goes back to the time of Isaac Newton and Gottfried W. Leibniz. Thus the method allows students as well as practitioners to easily develop a dynamic model of interest while maintaining the flow-of-funds ('transaction items') & balance-sheets consistencies implemented by the double-entry rules (Yamaguchi, 2003).

The modeling framework was developed with a focus on business strategy and financial analysis. Therefore applications are not limited to macroeconomic modelings. For a brief comparison of different modeling approaches, the term "Stock-Flow Consistent" is redundant from the ASD modeling perspective as the accounting itself is a system of bookkeeping that captures both stock and flow variables by construction. A strict conformity with the double-entry rules maintains both the balance sheets and flow-of-funds (transaction items) consistency in all ASD-based models.

Concerning the previous study in the JPY case, Yamaguchi & Yamaguchi (2021a) explains the theory underlining the money-debt relationship using step-by-step examples based on ASD modeling. Hence we omit further details of the method in this paper.

Financial Accounts of the United States

As we examine whether the macroeconomic relationship holds against historical data, it becomes desirable to select the world's largest economies in terms of Gross Domestic Product as a starting point. The nominal GDP of the U.S. was at 20,936 billion USDs and ranked the 1st (World Bank, 2021). Japan maintained its GDP at 5,064 billion USDs, ranking in the 3rd as of 2020 after China in the 2nd at 14,722 billion dollars. Furthermore data availability and reliability of the underlying statistics would also affect the accuracy of results. With some preparatory research, the author have decided to select the economy of United States Dollar (USD) and Japanese Yen (JPY) as reliable targets of analysis as both economies compile and publish the most comprehensive time-series data on both monetary aggregates and sectoral balance sheets.[10] A case study on JPY has been performed in the previous study (Yamaguchi & Yamaguchi, 2021a). Thus we will examine the case of USD in this paper.

The present study relies on the Financial Accounts of the United States (hereafter abbreviated as *FAUS*) compiled by the Federal Reserve Board as the primary data source. As a brief side note on the matrix structure of the FAUS, it consists of 33 sector columns and 33 instruments rows in total (including the sector and instrument discrepancies) as of 2020 (FRB, 2021). At the highest level of sector classification, the FAUS consists of Domestic Nonfinancial sectors (100), Domestic Financial Sectors (108), and Rest of the World sector (133). The Domestic Nonfinancial Sectors (100) equals the sum of the following sectors from 101 through 107: households and nonprofit organizations (101), nonfinancial business (102), which includes nonfinancial corporate business (103) and nonfinancial noncorporate business (104) as its sub-sectors, and general government (105), which includes federal government (106) and state and local governments (107) as its sub-sectors. Similarly, the Domestic Financial Sectors (108) equals the sum of the sectors from 109 through 132 including Monetary Authority (109), Private Depository Institutions (110). We use a standard spreadsheet for data analyses so that readers can replicate results against time-series retrieved from the Federal Reserve Economic Data (FRED) attached in the Appendix.

[10] Section VI discusses data availability in other areas.

III. Hypothesis & Definitions

Hypothesis: Money Stock ≈ Total Debts

Yamaguchi & Yamaguchi (2021a) observed that total debts from private depository institutions, be it mortgage loans, consumer credits or business loans, approximate the total money stock M3 of Japanese Yen (JPY) and referred this macroeconomic relationship as *Money Stock as Total Debts*. The U.S. economy operates under the fractional reserve banking system as in the Japanese case.[11] Accordingly we will examine whether the money-debt relationship holds in the case of U.S. Dollar. Before we proceed into analysis, however, it may be helpful to summarize different types of money circulating under the present system.

Base Money & Money Stock

Figure 1 below (next page) illustrates the components of monetary aggregates.[12] Under the current fractional reserve system, national governments issue coins shown by the green area at upper left corner. As explained earlier, these coins are issued and circulated as interest-free stable currencies – public money. However the amount is relatively small. In Japan, coins constitute 0.3% of total money stock M_3 as of 2018. On the other hand, central banks issue reserve deposits ('reserves') shown at the bottom left corner through purchases of financial assets in the open market operations such as the government bonds or treasury securities. Today the reserves are issued and recorded digitally with no direct convertibility with commodities such as gold and silver. Based on reserve deposits held at the central bank account, private banks create new deposits to finance loans to non-banking private sectors, i.e. deposit creation. When banks withdraw their deposits as central bank notes, notes are issued and put into circulation at this point. Both coins and notes are legal tender ('currency'), also called *cash*. [13]

These different types of money can be aggregated and grouped into as the followings:

- Base Money (M_0)
- Money Stock (M_1 & M_2 or M_3)

Base Money, also called monetary base, is the sum of all components shown inside the purple ellipse in Figure 3. The white blank arrows indicate financial transactions that directly increase (or decrease) the base money or money stock such as the open market operations by central bank or new loans granted by private banks. Although not explicitly shown in the figure, note that government expenditures financed by private banks through security investments would also increase money stock. Thus any repayment of debts owed to private banks decrease money stock conversely. Solid black arrows, on the other hand, indicate financial transactions that do not affect the amount of base money or money stock such as the conversion of deposits into cash.

Definition of Total Money Stock

There are two approaches to obtain total money stock data. One way is to simply use the time series published by monetary authority of the currency area under study. In the case of U.S., it is the federal reserve system. Another way is to define money stock from the Flow-of-Funds Accounts data or Financial Accounts in the U.S., which is also published by the monetary authority (usually central banks). For our purpose, the latter approach is desirable in terms of consistency in data specification among different components of monetary aggregates (M_0 through M_3) and total debts by banks compiled under the same statistical framework. The previous case study

[11] Some central banks do not impose reserve requirements including the Bank of England and Sveriges Riksbank in Sweden. The board of federal reserve system recently announced reduction of required reserve ratio to zero percent for all depository institutions, effective March 26, 2020.

[12] Adopted from: Fig. 4.1 Monetary aggregates and life cycle of money, Yamaguchi & Yamaguchi (2021a, p.75).

[13] *Cash* represents a possessory right of the payment objects, i.e. bearer money, whereas *bank deposits* are merely claims on currency loaned to banks.

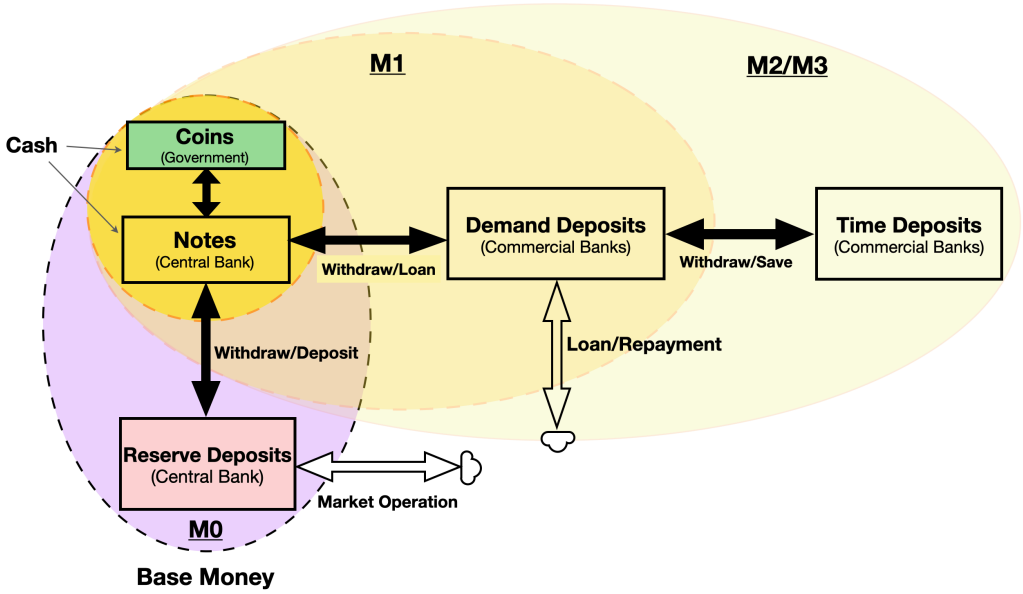

Figure 1: *A Stylized Definition of Monetary Aggregates (M_0–M_3) under fractional reserve banking system*

on Japaneses Yen used time-series retrieved from the Flow of Funds Accounts published by the Bank of Japan (hereafter abbreviated as *FAJP*). By following the same approach, this paper employs money stock defined by instrument items in the *FAUS* as explained below.

Total money stock are defined as M2 in most economies. Some central banks, however, define M3, such as in Japan, to differentiate time deposits held by different depository institutions (banks, postal savings, etc.), and even M4 such as in Mexico where additional liquid assets are included. One needs to only specify money and exclude liquid assets in such cases. In the USD case, the appropriate indicator of total money stock is M2. One can estimate M2 from the FAUS by simply adding all currency and deposit items (level; asset) held by all sectors except Monetary Authority (109), or taking the corresponding liability items (level; liability) held by private depository institutions (110). The former method is called the asset approach and the latter liability approach. We take the latter approach to obtain the M2.[14]

Specifically M2 is obtained as the sum of the following levels in the FAUS (denoted as L. followed by an instrument item number):

- Checkable Deposits & Currency (L.204) held by Private Depository Institutions (110); Liability
- Total Time and Savings Deposits (L.205) held by Private Depository Institutions (110); Liability

After obtaining M2 from the FAUS, we compared it against M2 published separately in

[14]Under the liability approach, one needs to consider if the currency component is included in the original data or should be added manually to the definition of total money stock. In the FAUS, Currency and Checkable Deposits (L.204) is a single item. Therefore it is assumed here that Currencies in the FAUS (federal reserve notes) are included in the liability item. In the FAJP, Currency, which consists of government coins and Bank of Japan notes, is a single item, and separately arranged from the Checkable Deposits. Therefore Yamaguchi & Yamaguchi (2021a) added the Currency in defining total money stock M3 of Japan under the liability approach. Note also that public money (coins) and debt money (notes) are itemized altogether as Currency in the FAJP. In the FAUS, on the other hand, public money (treasury currencies) and debt money (federal reserve notes) are itemized separately. As explained in the Introduction, public and debt money must be separated in the money-debt analysis. This is a limitation of the FAJP in terms of item classification.

the FRED to check its reliability. Figure 2 below depicts discrepancies between two time series of M2 during 1981-2019 in million dollars. A line shown in light blue is the M2 obtained from the FRED (hereafter abbreviated as *M2-FRED*)[15], and the other line shown in solid blue is the M2 obtained from the FAUS (hereafter abbreviated as *M2-FAUS*).[16] Both series are annualized. Observation dates are the beginning of calendar years – January 1st.

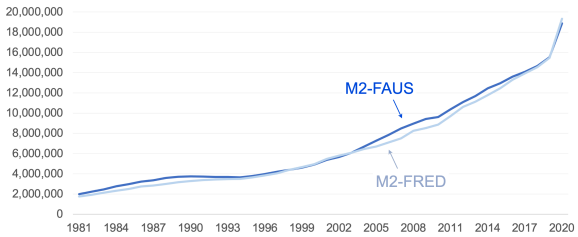

Figure 2: *Comparison of M_2 between 1981-2020*

As shown in the graph, the two series do not match precisely. Specifically M2-FAUS is higher than the M2-FRED except for the period between 1998-2003 and 2020 when M2-FRED is higher than the other. The gap is at its widest in 2007 at 975,060 million, and the smallest at 1,461 million dollars in 1998. Although there can be several factors for the discrepancy observed, one such factor and potentially the major one, is that the two series do not share the exact same definition. Thus components in each time series do not match, resulting in the discrepancies observed. It is beyond the author's capacity to estimate the true value of M2 precisely from items in the FAUS. However, Figure 2 shows there are no significant discrepancies between the two or any outliers in M2-FAUS thus defined, making it reliable for the money-debt analysis. Accordingly we will use M2-FAUS as the M2 of the U.S. Dollar unless specified otherwise.

[15]Board of Governors of the Federal Reserve System (US), M2 [WM2NS], retrieved from Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/WM2NS, accessed December 10, 2021. Time series starts from 1981.

[16]M2-FRED is published in billion dollars whereas all FAUS-related data are in millions. Accordingly we have converted the unit of M2-FRED into millions by simply multiplying it by 1000 for comparison. Also the M2-FRED data is published on *weekly* basis. Thus the data is *annualized* based on the "end of period" aggregation method upon the retrieval. Note also the graph starts from 1981 as the M2-FRED data is available since November of 1980.

Definition of Total Debts from Banks

Banks are called Private Depository Institutions (110) in the FAUS, which is one of the sub-sectors under the Domestic Financial sectors (108). Private Depository Institutions (PDIs) include all domestic deposit-taking financial institutions such as the U.S.-chartered depository institutions (111), foreign banking offices in U.S. (112), banks in U.S.-affiliated areas (113), and credit unions (114). In this paper we will hereafter call the PDIs collectively as Banks for simplicity of exposition.

Hence total debts from banks is defined and estimated by the sum of the following levels (denoted as L.) under the asset approach:

- Loans (L.214) held by Private Depository Institutions (110); Asset
- Treasury Securities (L.210) held by Private Depository Institutions (110); Asset
- Treasury Securities (L.210) held by Monetary Authority (109); Asset

The reason to include treasury securities held by banks and monetary authority is because they also constitute a significant share of total debts that affect money stock. See Yamaguchi & Yamaguchi (2021a) for the accounting logic and theory behind this definition.

IV. Results

Money Stock M2 ≈ Total Debts from Banks

Figure 3 below (next page) shows the result of money-debt analysis on the FAUS during a period between 1945-2020. It is observed that total money stock, defined as M2 in the U.S., has increased correspondingly with the increase in total debts from banks. In fact we found the money-debt relationship in the USD case holds since 1945. The result validates our initial hypothesis, reconfirming the

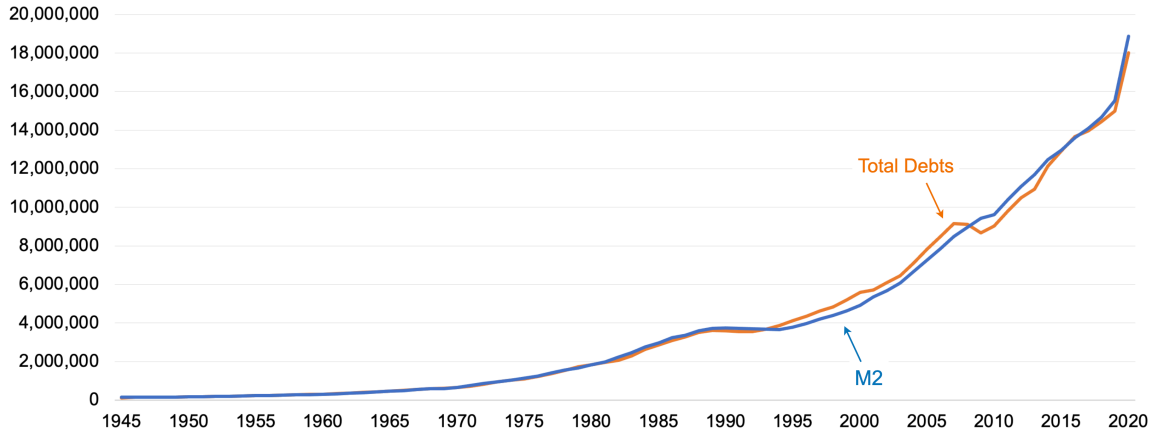

Figure 3: *Total Money Stock M_2 ≈ Total Debts from Banks in the U.S.: 1945-2020 (in Million USD)*

deposit creation theory at a macroeconomic level. The widest gap between M_2 and total debts is 844,567 million (or 844.5 billion) dollars observed in 2020. It can easily be observed from the graph that total debts is positively correlated with the M2.

Your Money is Someone's Debt from Banks

We then performed a simple linear regression analysis on the two macroeconomic variables. The correlation coefficient (R) is found to be high at 0.99795. From this, we assumed there is a strong linear relationship between the two. Figure 4 shown on the right hand side summarizes the result. Specifically the linear regression equation is determined as follows (in millions):

$$\text{M2} = 1.017 * \text{Total Debts} - 64,957 \quad (R^2 = 0.9959) \quad (1)$$

The coefficient of determination (R^2) is also high and coefficient of the linear regression function is 1.017, indicating that an increase in debt has increased almost the equal amount of M2. The result in USD case is consistent with the previous case of JPY where total debts approximate the M3. In fact the correlation coefficient between the two is found to be higher in the USD (= 0.998) than the JPY case (= 0.987) during an overlapping period between 1980-2019 (cf. Figure 9 in the Appendix).

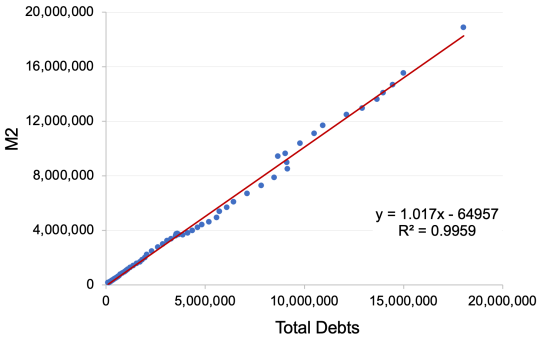

Figure 4: *A Simple Linear Regression on M_2 & Total Debts from Banks: 1945-2020 (in millions)*

We can thus express the macroeconomic relationship governing the quantity of money and debts as follows:

$$\text{Money Stock} \approx \text{Total Debts from Banks} \quad (2)$$

The money-debt relationship defined above states that total debts owed by households, businesses, government and foreign sectors approximate total money stock in the economy. In other words, *your money is someone's debts from banks*. Today the majority of money exists as monetary claims and obligations (debt money) among depositors, banks and borrowers, as opposed to public money issued by governments (Figure 1). This is the essence of monetary system based on fractional reserve banking as the proponents of the deposit creation theory have argued.

Money-Creating Debts drive Nominal GDP

How has the growth of money-creating debts (bank credits) contributed to the growth of GDP of the U.S.? To further analyze the money-debt relationship observed in the USD case, we then performed a simple linear regression analysis on Total Debts and the nominal GDP from 1947 through 2020.[17] A correlation coefficient (R) between the two is found to be at 0.9866 and the coefficient of determination (R^2) is 0.9735 as shown in Figure 5 below. Note that the length of vertical axis is

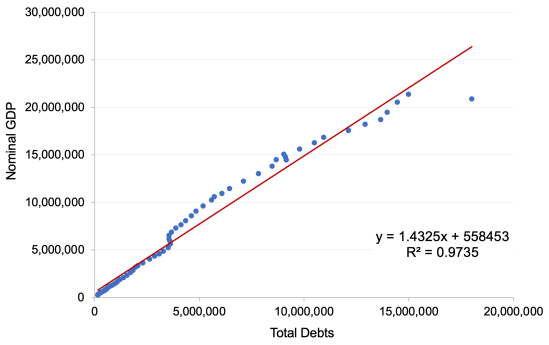

Figure 5: *A Simple Linear Regression on GDP & Total Debts of the U.S.: 1947-2020*

adjusted to fit into the space despite larger values. Specifically the linear regression equation is determined as follows (in millions):

$$\text{GDP} = 1.4325 * \text{Total Debts} + 558,453 \quad (R^2 = 0.9735) \quad (3)$$

A sudden and significant increase in Total Debts is observed at the upper right of the figure, which is the latest data point in 2020. This is clearly a deviation from the long-term correlation between the two. It is largely due to the unprecedented economic stimulus implemented by the U.S. government and Federal Reserve during the COVID pandemic. Based on the simple linear regression analysis alone, however, it is difficult to analyze how such disturbances to the long-term trend are signaling any significant developments in the economy or indicating future policy challenges. From the money-debt relationship (equation 2), it can be inferred that the correlation between M2 and the GDP has also been high. Figure 9 in the Appendix shows results of regression analysis performed on the two as a reference.

A close positive correlation between Total Debts and GDP of the U.S. is consistent with the case in Japan during 1980s. Werner (1997, 2005), for instance, observed that the growth rate of nominal GDP of Japan is highly correlated with that of bank credits that were channeled into the GDP-related ('real') circulations.[18]

V. Decomposition Analysis of Money ≈ Debts Relationship

We have so far observed the money-debt relationship in the USD case as suggested by the deposit creation theory. Under the fractional reserve banking system, money and debts are the heads and tails of the same coin as they both emerge through bank loans. Who's debts have supplied how much of money, then? Having obtained a satisfactory result, we performed decomposition analyses to study the money-debt relationship systematically.

[17] Source of Nominal GDP; U.S. Bureau of Economic Analysis, Gross Domestic Product [GDP], seasonally-adjusted, in Billions, retrieved from FRED; https://fred.stlouisfed.org/series/GDP, December 10, 2021. The data starts from 1947 as shown in Figure 12 of the Appendix. Hence GDP-related analyses and diagrams elsewhere begin with 1947 at the earliest. Note the unit is similarly converted into millions from billions.

[18] Werner (1997) showed, by taking the traditional money aggregates (M) in the quantity equation (MV=PT) approximately equaling the total credit aggregate (C) and disaggregating it into 'real' (C_R) and 'financial' (C_F) portions, that the real velocity of credits for GDP-related transactions (V'_R) remained stable during 1982-1991 while the real velocity in terms of the broad money aggregates (V'_M) declined. The finding was indeed consistent with what Fisher (1945) had postulated as the proponent of the equation (see p.102 for instance). Mahmud et al. (2017, p.52) observes Friedman (1987) made a similar suggestion on the usefulness of dividing the money flows into "sub-categories". Having been influenced by the Chicago economists, most of whom were the proponents of full-reserve banking (the Chicago plan), Milton Friedman understood the mechanism of deposit creation.

Government Debts becomes M1 of the U.S.

By the definition of monetary aggregates, total money stock can be generally broken down into two sub-components according to types of instrument as follows:

$$\text{Total Money} = \text{M1} + \text{Time Deposits} \quad (4)$$

where Total Money is M2 or M3, depending on currency areas under study, and M1 is the sum of currency, demand and checkable deposits (Figure 1). Similarly, total debts can be divided into two sub-components according to the type of sectors as follows:

$$\text{Total Debts} = \text{Debts}_{\text{Private}} + \text{Debts}_{\text{Public}} \quad (5)$$

where private debts are the sum of debts from banks owed by private non-banking sectors, and public debts are total government bonds (treasury securities) held by the central and private banks. Yamaguchi & Yamaguchi (2021b) found that each sub-component of total money stock (M3) and total debts in Japan approximates one another, exhibiting two independent macro relationships as follows:

$$\text{M1} \approx \text{Government Debts} \quad (6)$$

$$\text{Time Deposits} \approx \text{Private Debts} \quad (7)$$

Specifically government debts held by central and private banks approximate M1, consisting of currency and checkable deposits, and private debts approximate time and savings deposits.[19]

Could the same breakdown relationship be observed in the USD case, then? With further analysis, we found, to our surprise, that M2 of the U.S. can be similarly decomposed into two sub-components according to private and public debts. Figure 6 (next page) shows the result of decomposition analysis on the money-debt relationship. The dotted blue (M2) and orange line (Total Debts) corresponds to figure 3. Since we defined total money stock from the FAUS, Checkable Deposits & Currency (L.204) held by Private Depository Institutions (110) is the appropriate indicator for M1 in the case of USD. As equation (6) suggests, it is observed that government debts shown in a red line approximates Checkable Deposits & Currency, which is shown by a blue line. Conversely the Private Debts (grey line) approximate Time and Savings Deposits shown by the yellow line as the equation (7) suggests.

Both relationships, however, are disturbed since 2008 when the financial crisis hit the economy. There was a sudden decline in the private debts (burst of the sub-prime mortgage loan bubble), which was followed by the increase in government debts, i.e. fiscal stimulus. Though it differs in timing and magnitude, similar monetary behaviors were observed during the post-bubble period in Japan, except the growth of private debts and GDP in Japan remained stagnant for almost 30 years while M3 continues to grow as a result of increasing public debts. By looking at the behavior of GDP together with the money-debt and its breakdown relationships, one can clearly observe contrasting outcomes of economic policy during the post-bubble period in Japan (1990 onwards) and the U.S. (2008 onwards). Such cross-national analysis, however, is beyond the scope of the current paper.

A visual inspection suggests that the breakdown components are correlated with each other. A simple linear regression analysis on the first breakdown relationship (equation 6) revealed a strong positive relationship (R^2 = 0.961) as shown in Figure 7 (next page), and a high correlation coefficient (R = 0.98012). Specifically the linear regression equation in the figure is determined as follows (in millions):

$$\text{M1} = 0.7435 * \text{Gov. Debts} + 132,723 \quad (R^2 = 0.9606) \quad (8)$$

As explained above, *Checkable Deposits & Currency* (L.204) held by Private Depository Institutions (110) is used as the M1 obtained from the FAUS (hereafter abbreviated as *M1-FAUS*). Note that *M1-FAUS* is different from

[19] From the approximation between money stock and total debts (equation 2), one can infer equation (6) must hold if the equation (7) holds. Conversely, if equation (7) holds, then, the equation (6) must also hold by definition.

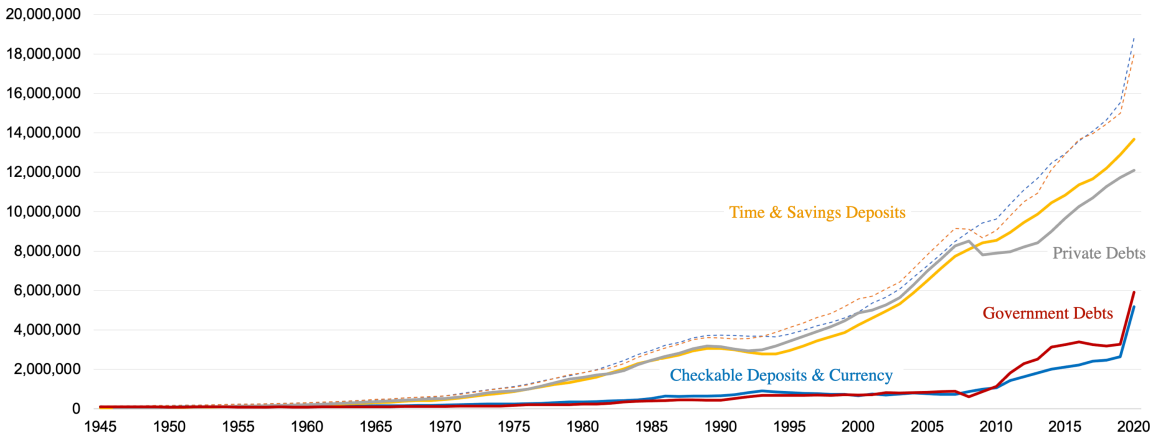

Figure 6: *Decomposition Analyses of Money ≈ Debts in the case of United States Dollar: 1945-2020*

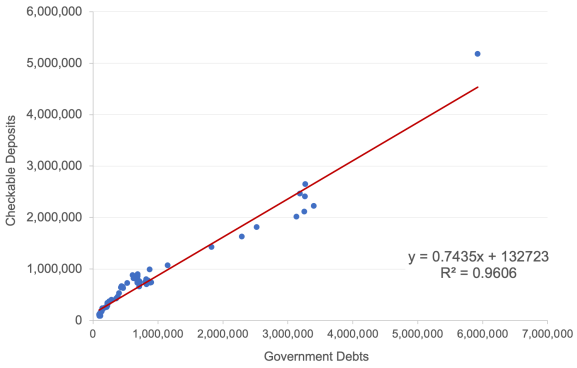

Figure 7: *A Simple Linear Regression on Checkable Deposits (M_1) & Government Debts: 1945-2020*

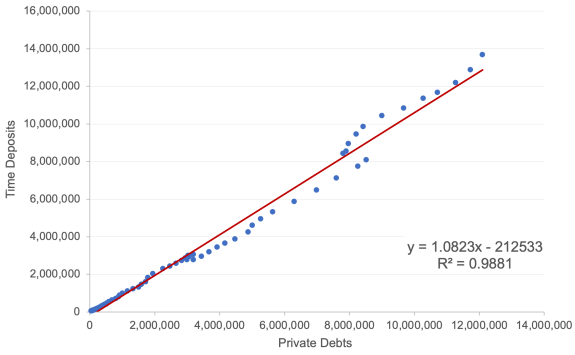

Figure 8: *A Simple Linear Regression on Time Deposits & Private Debts: 1946-2020*

M1-FRED as in the case of M2. The regression analysis with M1-FRED is also performed in the background for comparison. As a reference, a correlation coefficient of Government Debts and M1-FRED is also high (R = 0.97451), and the two time-series exhibit a strong positive linear relationship (R^2 = 0.9497).

Time Deposits ≈ Private Debts

The analysis on the second breakdown relationship (equation 7) revealed a high correlation coefficient between the two time series (R = 0.99401) and a strong linear relationship as shown in Figure 8 below. Specifically the regression equation is determined as follows (in millions):

$$\text{Time Deposits} = 1.0823 * \text{Private Debts} + 212,533 (R^2 = 0.9881) \quad (9)$$

Note that the analysis begins from 1946 instead of 1945 as data for Private Debts is available since 1946 (cf. Figure 12 in the Appendix). To compare results with the case of JPY during the overlapping period between 1980-2019, the correlation coefficient of Time Deposits and Private Debts (equation 7) is higher than that of M1 and Government Debts (equation 6) in the USD case (0.991 > 0.976), which is the opposite in the JPY case (0.928 < 0.992). Figure 9 summarizes results from both case studies.[20]

[20]Correlation coefficients from the JPY case are adopted from chapter 1 of Yamaguchi & Yamaguchi (2021b). Re-

VI. Discussion

Reliability of Flow-of-Funds Accounts Data

As empirically verified in USD and JPY cases, total debts from banks approximate total money stock of the economy. During a preparatory phase of the research, the author searched for flow-of-funds statistics in several economies including Canada (CAD), Mexico (MXN), China (CNY), Taiwan (TWD), United Kingdom (GBP) and the Euro area (EUR). In terms of data availability, however, the author faced with difficulties in finding data that are comprehensive and detail enough to examine the money-debt relationship in the above areas. For example, the European Central Bank publishes comprehensive data on monetary aggregates and sectoral balance sheets. However, they are somewhat aggregated and time periods are relatively short due to its length of existence. Although data availability and reliability affects accuracy and precision of analyses, similar relationships should be observed in other economies operating under the fractional reserve system. The more detail and accurate data becomes available, the more precise relationships can be observed.

Yamaguchi & Yamaguchi (2021a) found an intermediate divergence between M3 and total debts in JPY case during 1994-2014. The gap becomes widest at approximately 120 trillion Yen in 1999. They then offered three hypotheses on the observed gap, the first two of which point to inaccuracy of data analysis or possibility of mishandling data by the authors themselves. Given the accuracy and precision of the analyses demonstrated in USD case, however, the third hypothesis, which points to the possibility of incorrect values in the FAJP data published by the Bank of Japan, deserves more priority in the further examination. In this respect, the FAUS can be regarded as the benchmark for reliability demanded for flow-of-funds accounts data. Economists, therefore, should first examine the money-debt relationship against the flow of funds accounts as a separate reliability test in addition to the balance-sheets and flow-of-funds consistency tests implemented by the statistical framework. Readers are encouraged to perform analyses in their local areas.

sults from the USD case during 1980-2020 are obtained from regression analyses performed in the background.

Implications for Macroeconomic Theories

Although the flow-of-funds accounts is widely and extensively used in quantitative studies, the finding seems to mark the first exposition, to the best of author's knowledge, of the money-debt relationship observed in the USD case since Copeland (1947, 1949, 1952) initiated the seminal studies on moneyflows at the National Bureau of Economic Research with Wesley C. Mitchell, which was later carried on under the auspices of the Federal Reserve and transformed into what is now known as the Flow of Funds Account of the United States, and then the FAUS.[21] Its implication, however, goes beyond the empirical findings. What happens when the macroeconomics have been built upon the flawed assumption on money and finance? For instance, the findings from both U.S. and Japan demonstrate that money (M) is an endogenous variable directly linked to trade or transactions (T) in terms of the Fisher's simplified version of the quantity equation (MV=PT) (Fisher, 1920), as opposed to a control variable of policy makers. This is, however, incompatible with the exogenous money assumption presumed in the IS-LM analysis proposed initially by Hicks (1937), for instance, or oversimplifications of banks commonly made in the General Equilibrium family of models that became dominant since 1980s. These observations, though preliminary, are also in line with the growing number of empirical studies questioning the efficacy of monetary policy through interest rates control (Lee & Werner, 2018). Thus the current finding provides an additional evidence to the venue, reinforcing

[21] Whether Copeland himself or others had observed the money-debt relationship or proposed a similar hypotheses is yet unknown. It is an interesting research question in terms of literature review on the subject.

a need for revision of macroeconomic theory to account for bank lending and finacial constraints in the real world (Yamaguchi, 2019).

Money is not Debt nor IOU per se

The majority of money today exists as interest-bearing debts of non-banking sectors except the public money. Proponents of Modern Money Theory (MMT) argues that money "must be an IOU" (Wray, 2012, p.xi). This definition is correct as long as private bank money are concerned. When MMT also defines interest-free currency issued by the government as IOU, however, they are incorrect since public money are not IOU of anybody. To define money only as IOU is to confuse legal concepts, such as monetary claims and payment obligations, with money, which is a means of payment to settle the legal relationship of creditor-debtor. Thus MMT fails to distinguish 'public money' from 'debt money.

There is a fundamental difference between public money and debt money. As explained in the Introduction, public money are stable currencies as they continue to circulate unless destroyed by its owner or withdrawn by the issuer through tax. Debt money, on the other hand, are issued against loans and purchases of debt instruments. As such, the supply is inherently profit-driven. Deposit creations by banks drive speculative investments. Once the financial bubble bursts, deposits are then destroyed as loans are repaid, inducing boom-bust cycles (Yamaguchi & Yamguchi, 2016) while systematizing income inequality. Thus the definition of *money as debt* is slanted, at best, and inconsistent, at worst, with the history of money and the reality in which we live. To define money only as IOU ('debt money') is either a distortion of the reality or an over-simplification of the rather complex "modern money" system, which MMT purports to explain better than the mainstream economics.[22]

[22]The narrative by MMT becomes even obscuring when it confuses public money with debt money, and vice versa, in different contexts. Others have already criticized the MMT's peculiar definition of money and its obscurantism from historical and double-entry accounting perspectives. See Zarlenga (2002a,b) and Fiebiger (2011), for instance. Yamaguchi & Yamaguchi (2021b) criticizes in detail the flawed definition and unfounded claims of MMT in the Japanese context in chapter 3.

VII. Conclusion

To further investigate the money-debt relationship as suggested by the deposit creation theory, this paper examined the case of United States Dollar (USD). We found total debts from banks approximate M2 during 1945-2020 as previously observed in the case of Japanese Yen (JPY) during 1980-2019. The findings adds a second evidence to the growing number of empirical studies on the money-debt relationship. Furthermore the decomposition analyses show that the two economies exhibit similar behaviors as to which type of money-creating debts, either private or public, approximate M1 (consisting of currency and checkable deposits) and time deposits respectively. However the breakdown relationships in the USD case were disturbed in 2008 when the financial crisis hit the economy. Simple regression analyses, such as performed in the this paper, are insufficient to analyze how such disturbances are signaling any significant developments in the U.S. economy or future policy challenges. Thus more detail country-specific as well as cross-national analyses are proposed as the next research avenue.

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Appendix

Figure 11 through 14 shows time-series analyzed in this paper (in million dollars). Sources are indicated in footnotes of the main text. Figure 9 summarizes statistical results referenced in this paper. Results from JPY case are adopted from chapter 1 of Yamaguchi & Yamaguchi (2021b). Figure 10 shows the proof of data source and results as originally generated on the Federal Reserve Economic Data (FRED).

It should be noted that the money-debt relationship shown in Figure 10 is more precise than Figure 3. This is due to the difference in method of calculating Total Debts (both figures show the exact same value for M2). Total Debts in Figure 10 is calculated using the arithmetic operation (summation) available on the FRED ('Total Debts (FRED)'). Total Debts shown in Figure 3, on the other hand, is calculated by the author based on the exact same components retrieved from the FRED ('Total Debts (Self-Calculated)'). To our surprise, we found the former does not equal to the latter, although the difference is negligible. One hypothesis for such difference is that values stored in the FRED database contain units lower than millions whereas data retrieved from FRED are only available from above millions. This paper uses Total Debts (Self-Calculated) in order to maintain data consistency in all statistical analyses.

	United States Dollar (USD)				*Japanese Yen (JPY)*	
	1945-2020		1980-2020		1980-2019	
	r	r^2	*r*	r^2	*r*	r^2
(1) Total Money [1] - Total Debts [2]	0.998	0.996	0.996	0.993	0.987	0.974
(2) Nominal GDP - Total Money	0.980 [3]	0.960 [3]	0.967	0.935	N/A	N/A
(3) Nominal GDP - Total Debts	0.987 [3]	0.974 [3]	0.978	0.956	N/A	N/A
(4) M1 - Government Debts	0.980	0.961	0.976	0.953	0.992	0.985
(5) Time Deposits - Private Debts	0.994 [4]	0.988 [4]	0.991	0.982	0.928	0.861

[1] *Total Money* stands for *M2* ("*M2-FAUS*") in the USD and *M3* ("*M3-FAJP*") in the JPY case. [2] The data for *Treasury Securities held by Private Depository Institutions* as of 1945 (= 104606) is substituted for *Total Debts* as of 1945 since time series for other components of *Private Debts* start from 1946 (cf. Figure 12). [3] Analyses (2) and (3) in the USD case are performed for a period between 1947-2020 since time-series for Nominal GDP starts from 1947 (cf. Figure 12). [4] Analysis (5) is performed for a period between 1946-2020 (instead of starting from 1945) since the proxy data for *Private Debts*, i.e. Loans (L.214); Private Financial Institutions (110); Asset, starts from 1946 (cf. Figure 12). All correlation coefficients (r) and r^2 values are rounded off. Hence they do not always correspond with each other precisely.

Figure 9: *A Summary Table for Correlation Coefficients (r) and Coefficients of Determination (r^2)*

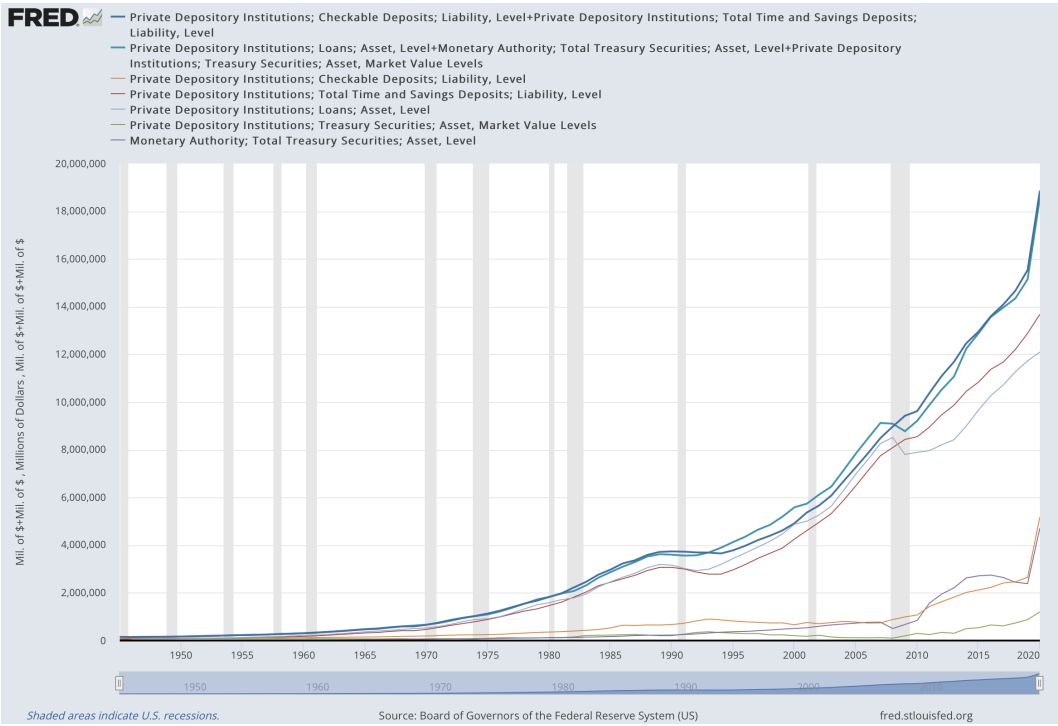

Figure 10: *Results of Money-Debt & Decomposition Analyses in the case of United States Dollar*

Observation Date (January 1st)	1 Total Money Stock ("*M2-FAUS*") (= 3 + 4)	2 Total Debts (= 5 + 6 + 7)	3 Checkable Deposits & Currency (L.204); Private Depository Institutions(110); Liability	4 Time & Savings Deposits (L.205); Private Depository Institutions (110); Liability
1945	156074	104606	102573	53501
1946	148769	153732	88733	60036
1947	154556	156838	90925	63631
1948	156454	157187	90280	66174
1949	160259	160319	91104	69155
1950	168644	170475	96746	71898
1951	180438	182125	103589	76849
1952	193820	194794	108779	85041
1953	203174	203437	108904	94270
1954	218275	217490	113456	104819
1955	228908	230674	115634	113274
1956	240234	243761	117532	122702
1957	252018	252942	117018	135000
1958	274567	275148	122705	151862
1959	285238	292467	123590	161648
1960	302647	310855	125710	176937
1961	328631	338169	130955	197676
1962	361967	367225	135649	226318
1963	393887	401671	138035	255852
1964	431169	439148	144898	286271
1965	469738	481019	150297	319441
1966	492164	508623	152379	339785
1967	545208	557459	164810	380398
1968	592119	596945	178376	413743
1969	596366	628004	183161	413205
1970	660910	666019	192844	468066
1971	756310	733502	206401	549909
1972	864892	833468	226515	638377
1973	956570	944979	239777	716793
1974	1035262	1026761	239790	795472
1975	1133205	1096725	248490	884715
1976	1255345	1218818	262975	992370
1977	1404457	1377013	288266	1116191
1978	1552115	1547511	314722	1237393
1979	1670498	1722877	343379	1327119

Figure 11: *Time Series during 1945-1979 – Columns 1 through 4 (1 of 4)*

Observation Date (January 1st)	5 Loans (L.214); Private Depository Institutions (110); Asset	6 Treasury Securities (L.210); Private Depository Institutions (110); Liability	7 Treasury Securities (L.210); Monetary Authority (110); Liability	8 Nominal GDP
1945	N/A	104606	N/A	N/A
1946	41043	89339	23350	N/A
1947	50681	83598	22559	249615.5
1948	57662	76192	23333	274467.75
1949	60872	80562	18885	272475.25
1950	74658	75092	20725	299827.25
1951	84800	73721	23604	346913.25
1952	95382	75378	22996	367340.75
1953	102755	75365	24342	389217.5
1954	111946	80656	24451	390549
1955	132963	73320	23676	425479.5
1956	148856	70295	23666	449352.5
1957	159626	69597	22943	474039.5
1958	171176	77720	24794	481228.5
1959	195898	69963	26134	521654.25
1960	212716	71155	26238	542382.25
1961	232100	77347	27249	562209.75
1962	259229	77518	29318	603921.5
1963	293067	75022	31938	637451.5
1964	327340	75302	34783	684461.5
1965	368396	72145	38885	742290.25
1966	396395	68573	41789	813413.75
1967	432219	76260	46432	859956.25
1968	465598	78410	51767	940646.5
1969	503896	66954	54298	1017615
1970	531258	72619	58852	1073310.5
1971	589117	75389	66109	1164849.75
1972	686371	77289	69553	1279112
1973	799557	66964	75605	1425376
1974	884839	61864	79656	1545242.5
1975	913741	96267	84794	1684905
1976	1006642	118908	91395	1873412.5
1977	1157548	118547	99290	2081825
1978	1328809	109224	107564	2351598.75
1979	1498950	107636	111645	2627326.25

Figure 12: *Time Series during 1945-1979 – Columns 5 through 8 (2 of 4)*

	1	2	3	4
1980	1826119	1830815	356049	1470070
1981	1981820	1972415	373192	1608628
1982	2222078	2074770	400804	1821274
1983	2459270	2308579	427274	2031996
1984	2759857	2631568	463912	2295945
1985	2975151	2869176	531110	2444041
1986	3234284	3097135	643181	2591103
1987	3365882	3294110	630424	2735458
1988	3591105	3522022	655061	2936044
1989	3716919	3620016	651867	3065052
1990	3737897	3602120	670294	3067603
1991	3727312	3563074	727422	2999890
1992	3695545	3572809	823352	2872193
1993	3689576	3690736	903514	2786062
1994	3650992	3891496	865964	2785028
1995	3784832	4130890	820203	2964629
1996	3976722	4357179	785947	3190775
1997	4207170	4643889	764934	3442236
1998	4396239	4850162	737012	3659227
1999	4614699	5188656	740760	3873939
2000	4918954	5587377	662407	4256547
2001	5367364	5738303	757034	4610330
2002	5664213	6117194	707266	4956947
2003	6079606	6453976	754391	5325215
2004	6682697	7136937	802015	5880682
2005	7266943	7841245	776383	6490560
2006	7859599	8487292	732910	7126689
2007	8487260	9122698	740818	7746442
2008	8969816	9093186	880981	8088835
2009	9423151	8776548	990671	8432480
2010	9620067	9212477	1071976	8548091
2011	10380838	9880373	1428633	8952205
2012	11095401	10523404	1630018	9465383
2013	11687766	11068467	1818713	9869053
2014	12464985	12235732	2017501	10447484
2015	12956896	12879642	2119999	10836897
2016	13598093	13563445	2226576	11371517
2017	14080634	13957438	2410196	11670438
2018	14666587	14344035	2466114	12200473
2019	15533316	15147009	2648717	12884599
2020	18862696	18553737	5182941	13679755

Figure 13: *Time Series during 1980-2020 – Columns 1 through 4 (3 of 4)*

	5	6	7	8
1980	1586146	125370	119627	2857308.5
1981	1716946	127731	122438	3207041.25
1982	1787454	151709	129299	3343789.25
1983	1944272	213749	143473	3634036.5
1984	2247830	224515	154479	4037614
1985	2462100	229278	169398	4338980.5
1986	2656477	243033	185633	4579632.5
1987	2822822	252382	209376	4855216.25
1988	3054549	233811	224295	5236438
1989	3189908	203333	227059	5641579.5
1990	3161228	205802	229686	5963144.5
1991	3026122	270466	253372	6158129.25
1992	2935649	342149	279351	6520327.25
1993	2991058	367663	315744	6858558.5
1994	3191964	335013	350608	7287236.5
1995	3440702	311991	370554	7639749.25
1996	3673680	292592	383947	8073121.75
1997	3916441	296712	412137	8577552.5
1998	4161517	236504	442786	9062816.75
1999	4470718	239975	479388	9631171.75
2000	4874945	200729	507444	10250952
2001	5006213	180415	536196	10581929
2002	5266204	221584	599909	10929108.25
2003	5636417	150894	654091	11456449.5
2004	6295622	123496	694909	12217195.75
2005	6980681	116349	730656	13039197
2006	7595820	112557	768186	13815583
2007	8259164	122923	772917	14474227
2008	8514920	102345	505656	14769861.5
2009	7802753	197207	673634	14478066.75
2010	7891348	299636	846714	15048970
2011	7964036	252891	1572023	15599731.75
2012	8206761	342328	1949664	16253970
2013	8421774	305357	2211395	16843195.75
2014	8996500	502939	2626803	17550687.75
2015	9666502	537231	2713067	18206023.5
2016	10268646	654093	2746147	18695105.75
2017	10708410	616020	2646199	19479622.5
2018	11269363	736678	2445975	20527158.75
2019	11726964	879315	2388088	21372582.25
2020	12095889	1203292	4718948	20893745.5

Figure 14: *Time Series during 1980-2020 – Columns 5 through 8 (4 of 4)*