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The role of debt in aggregate demand

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ABSTRACT

With the purpose of performing a simple and original analysis on the mechanisms through which money and debt affect aggregate demand, this paper presents a stock-flow-consistent model in which the role of credit creation of banks is emphasized. By conducting theoretical analysis on income determination in an alternative way, we demonstrate that the equilibrium national income can be expressed as flows generated from three sources, namely money circulation, private debt circulation, and total credit expansion.

1. Introduction

As is widely acknowledged, debt is to be blame for setting the stage for notorious crises including the 2008 financial crisis and the EU debt crisis, which share the common characteristics of soaring debt and high default rate Reinhart and Rogoff (2010). Through excessive lending, the profit-minded banking system pours money into the economy and blows up the financial bubble whereas the bubble bursts as over-indebted creditors sell assets at discount to make good on their loans or even announce bankruptcy to walk away from the unpayable debt when the economy wakes itself up from the booming illusion. Despite the significant role played by debt in the real economy, the understandings of debt are still far lagging behind among mainstream economists, as stated by Stiglitz, from the aspect that they not only fail to "predict" the crisis but also seem incapable of properly comprehend its mechanisms due to their common exclusion of debt and the banking system in macroeconomic models Stiglitz (2018).

Thanks to the proposal of debt-deflation theory and financial instability hypothesis in the early times, the essential role of debt has once been pointed out by Irving Fisher and Hyman Minsky Fisher (1933); Minsky (1982). Following their theoretical achievements on debt and macroeconomic activities, various attempts of both orthodox and heterodox economists have been made Blinder and Stiglitz (1983); Bernanke and Blinder (1988); Eggertsson and Krugman (2012); Keen (2012). Nevertheless, among these literatures, one fundamental yet perplexing question which is heatedly disputed time and again is how debt influences aggregate demand. As originally argued by Bernanke, investment could be financed by bank loans, based on which, the credit channel of monetary policy transmission was theoretically presented and later proved empirically Bernanke and Gertler (1995); Morris and Sellon (1995). However, rather than focusing on the positive impact of debt on real expenditure, debt is acknowledged to be a double-edged sword to the macroeconomy, which may advance economic growth at the beginning but later inhibit it due to the rising burden of repayment,

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thus facilitating the development of the crisis Palley (1994). The same logic can be applied to assessing the debt-based stimulus policies, that when the economy is in a debt-driven liquidity trap with depressed output, debt-financed stimulus boosts aggregate demand in the short-run while deepens future recession Mian et al. (2020). By distinguishing financial stocks and flows with respect to their different roles in the economy, another line of works naturally arises, aiming to answer the question whether levels of debt matter for aggregate demand. One group of economists led by Paul Krugman emphasizes on the distribution effect of debt on motivating expenditures including consumption, investment and government spending Eggertsson and Krugman (2012). While the major concern of another group among the Post-Keynesian economists is the impact of the increment of debt on the macroeconomy. To make it clear, the stock-flow consistent (SFC) modelling technique proposed by Godley is needed to perform the detailed analysis Godley and Lavoie (2007). Specifically, this strand of literature ends up with the conclusion that the variation in debt is equal to the difference between aggregate demand and aggregate income, and therefore the generation of debt would stimulate a continuous economic growth Keen (2012, 2014); Bernardo and Campiglio (2014).

This paper intends to contribute to the understandings of the role of debt in aggregate demand by presenting a relatively simple but original macroeconomic model from the financing-source perspective. By distinguishing the money-supported expenditure with the debt-supported one, we aim to unravel the intertwining roles of money and debt, and regard commercial banks as the credit creation proxy instead of pure redistribution center of funds in the economy as mentioned in the conventional view Mcleay et al. (2014); Werner (2014b,a). Based on the stock-flow consistency analyses, the separate channels of not only money and debt, but also the relevant stocks and flows, can be identified. The remainder of this paper is organized as follows. Section 2 describes the stock-flow consistent model. Section 3 presents the equilibrium analysis. Section 4 concludes.

2. Stock-flow consistent model

A cashless economy is assumed, consisting of five representative sectors: households, firms, the government, the central bank and commercial banks. We further assume that the expenditures of both households and firms can be financed by commercial banks while the expenditures of the government is financed by not only commercial banks but also the central bank. Fig. 1 presents the building blocks of the model displaying the monetary flows among the economic agents. We employ the SFC framework to describe the behavior of these sectors and their interactions. The SFC framework can be characterized by two matrices, namely the balance-sheet matrix and the transaction-flow matrix of the economy, where HHs represents households, FIs represents firms, Gov represents the government, CmBs represents commercial banks, and CB represents the central bank. Tab. 1 shows the balance-sheet matrix, where the corresponding assets and liabilities of each sector are presented respectively. In Tab. 1, the sum of each row of financial items is equal to zero, which indicates that the financial assets of a sector must be the financial liabilities of some other sectors, and vice versa. We define the net worth of each sector as its assets minus its liabilities, and it is usually placed on the liability side of the balance sheet with a negative sign. Consequently, the sum of each column in Tab. 1 is also zero. We specify the interactions among these sectors by various monetary flows, which we display as a transaction-flow matrix given by Tab. 2. From Tab. 2, we can see that the sum of each row is zero, where the entry with a positive sign is the inflow, and the entry with a negative sign is the outflow. Therefore, each monetary flow must come from somewhere and must go somewhere else. Since we only present monetary flows in Tab. 2, the sum of each column for the non-bank sectors corresponds to the changes in their deposits. All of these characteristics of rows and columns in both Tab. 1 and Tab. 2 indicate the stock-flow consistency in the economy. In the following subsections, we firstly describe the behavioral equations of the real sectors, and then demonstrate the relations between the behavior-based flows and the relevant stocks, thus the comovements of their balance sheets can be presented.

2.1. Behavioral equations

Households. Suppose the consumption of households is funded by their deposits M_H, wages paid by firms W and current loans issued by commercial banks BL_{BH}, thus the consumption C can be written as [1]

$$C = \alpha \cdot M_H + mpc \cdot W + BL_{BH}, \tag{1}$$

where α represents the marginal propensity to consume with respect to deposits, and mpc represents that with respect to income [2] In addition, households who hold bank loans have the obligations to repay their matured debts, presented by

$$RL_{BH} = \lambda_H \cdot L_{BH}, \tag{2}$$

where λ_H denotes the repayment rate of loans issued by commercial banks to households. In this model, We assume that the aggregate income Y follows a rule of allocation, so that the wages paid to households can be calculated as

$$W = Y - T - RL, \tag{3}$$

[1] Here, the expression of consumption of households is inferred from the life-cycle hypothesis in the microeconomic theory produced by Franco Modigliani, Richard Brumberg and Albert Ando.

[2] For the sake of simplicity, we specify deposits as the sole form of wealth, and we assume that households, firms and the government share the identical marginal propensity with respect to stocks. The value of α and mpc ranges from 0 to 1, and may differ across countries.

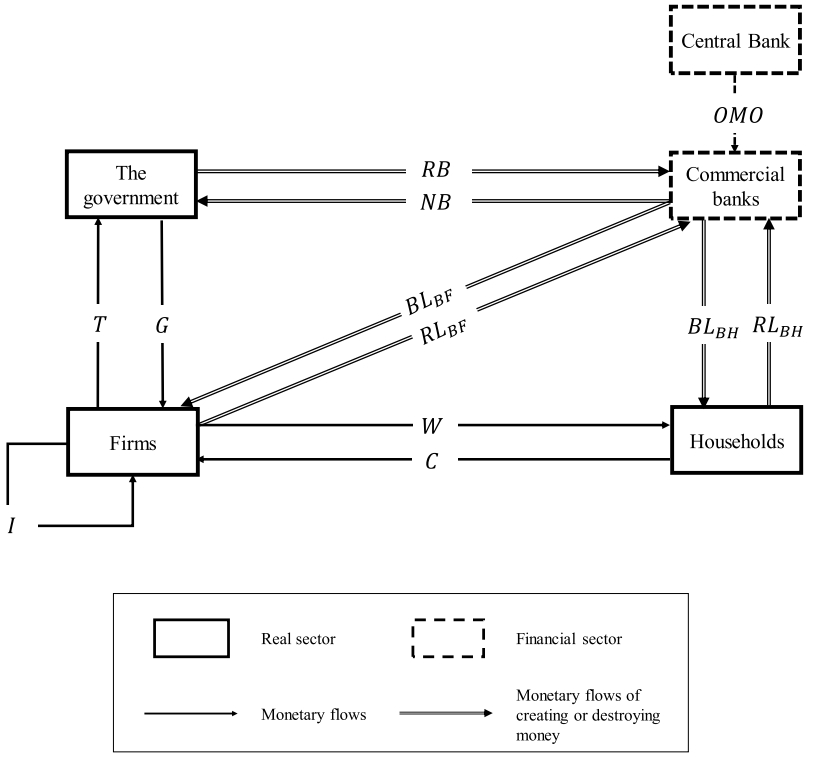

Fig. 1. The building blocks of the model.

Table 1
Balance-sheet matrix.

	HHs	FIs	Gov	CmBs	CB	Σ
Loans	$-L_H$	$-L_F$		$+L$		0
Reserves				$+R$	$-R$	0
Deposits	$+M_H$	$+M_F$	$+M_G$	$-M$		0
Gov. bonds			$-B$	$+B_B$	$+B_{CB}$	0
Tangible capital		$+K$				$+K$
Net worth	$-NW_H$	$-NW_F$	$-NW_G$	$-NW_B$	$-NW_{CB}$	$-K$
Σ	0	0	0	0	0	0

[a]*Notes*: A plus sign (+) before a variable denotes an asset, while a minus sign (-) denotes a liability.

where T represents the amount of tax and RL is the total repayment flows from both households and firms.

Firms. We assume that firms only spend for investment goods, so the production role of firms is not the consideration of this paper. The expenditure of firms (investment), is funded by both deposits of firms M_F and bank loans BL_F. Hence, investment I can be expressed as

$$I = \alpha \cdot M_F + BL_F. \tag{4}$$

Likewise, the obligations for firms to repay their debt can be given by

$$RL_{BF} = \lambda_F \cdot L_F, \tag{5}$$

where λ_F denotes the repayment rate of loans issued by commercial banks to firms.

The government. The financing sources for government spending are constituted by three components: public deposits M_G, taxes T

Table 2
Transaction-flow matrix.

	HHs	FIs	Gov	CmBs	CB	Σ
Consumption	$-C$	$+C$				0
Investment		$-I(+I)$				0
Gov. spending		$+G$	$-G$			0
Bank lending	$+BL_{BH}$	$+BL_{BF}$		$-BL$		0
Repayment of loans	$-RL_{BH}$	$-RL_{BF}$		$-BL$		0
Bond purchase			$+NB$	$-NB$		0
Redemption of bonds			$-RB$	$+RB$		0
Wages	$+W$	$-W$				0
Taxes		$-T$	$+T$			0
OMOs				$+OMO$	$-OMO$	0

[b]*Notes*: A plus sign (+) before a variable denotes a source of funds, while a minus sign (-) denotes a use of funds. [c]*Notes*: Here, we assume that the price of bonds is 1, which means all interests in transactions are assumed out.

and funds through issuing bonds. Because there is only one public sector in a country, the government mentioned here, we assume that the government is always in the circuit of borrowing new debt to pay the old ones. In other words, the debt-financed expenditure of the government should be the increment of bonds, represented by ΔB. Therefore, government spending G can be given by [3]

$$G = \alpha \cdot M_G + T + \Delta B. \tag{6}$$

In addition, the collection of tax is set to be based on a fixed tax rate τ [4], then we have

$$T = \tau \cdot (Y - RL) \tag{7}$$

According to the previous expositions, the expenditures of the three real sectors are consumption C, investment I, and government spending G respectively. Therefore, the aggregate expenditure E in this closed economy can be summed up as

$$E = C + I + G. \tag{8}$$

2.2. Dynamics of the stock variables

First, we present the dynamics of financial assets, namely bank loans and government bonds. The dynamical equation of households' outstanding loans L_H is given by

$$\Delta L_H = BL_{BH} - RL_{BH}. \tag{9}$$

Similarly, the dynamical equation of firms' outstanding loans L_F is

$$\Delta L_F = BL_{BF} - RL_{BF}. \tag{10}$$

By aggregating Eqs. 9 and 10, we have the dynamics of total outstanding loans L, which is expressed as

$$\Delta L = (BL_{BH} + BL_{BF}) - (RL_{BH} + RL_{BF}) = BL - RL, \tag{11}$$

where BL represents total bank lending from commercial banks while RL represents total repayment to banks. Eqs. 9–11 indicate that inflows add to the corresponding stocks, while outflows substract from them.

Since we assume that government bonds are directly purchased solely by commercial banks, the dynamical equation of commercial banks' holdings of bonds B_B is

$$\Delta B_B = NB - RB - OMO, \tag{12}$$

where NB represents the amount of new issued bonds and RB is that of the redemption of bonds which can be calculated as the product of total bonds and the redemption rate θ, given by

$$RB = \theta \cdot B. \tag{13}$$

Moreover, the central bank injects reserves into banks by conducting open market operations (OMOs). OMOs replace government

[3] This behavioral equation is also referred as the "government budget constraint" and interpreted by the mainstream economists as an *ex ante* financial constraint on government that needs to finance fiscal deficits Leeper and Nason (2010).

[4] In the United States, an individual has the obligation to pay income tax at a given bracket only for each dollar within that tax brackets range. For example, the tax rates prescribed in 2011 for each income quintile are respectively 10%, 15%, 25%, 28%, 33%, 35%.

bonds held by commercial banks with reserves via purchasing government bonds as demonstrated in Eq. 12. Simultaneously, the dynamical equation of the central bank's holdings of government bonds B_{CB} can be given by

$$\Delta B_{CB} = OMO. \tag{14}$$

By aggregating Eqs. 12 and 14, we may get the dynamics of total government bonds B, as follows,

$$\Delta B = (NB - RB - OMO) + OMO = NB - RB. \tag{15}$$

Since the creation of deposits takes place simultaneously with that of loans and bonds, next we show the dynamics of deposits in parallel with that of loans and bonds. The dynamical equation of the deposits of households M_H can be obtained from the first column of Tab. 2, given by

$$\Delta M_H = (W - C) + (BL_{BH} - RL_{BH}). \tag{16}$$

Similarly, the dynamical equation of the deposits of firms M_F can be deduced according to the second column of Tab. 2, that is,

$$\Delta M_F = (C - W) + (G - T) + (BL_{BF} - RL_{BF}). \tag{17}$$

Moreover, the dynamical equation of public deposits M_G can be derived as

$$\Delta M_G = (T - G) + (NB - RB). \tag{18}$$

Therefore, we can obtain the dynamics of the aggregate deposits M of the economy, in other words, money supply, which is the summation of that of the mentioned three real sectors, as follows,

$$\Delta M = \Delta M_H + \Delta M_F + \Delta M_G. \tag{19}$$

Substituting Eqs. 16–18 into Eq. 19, we may get

$$\Delta M = (BL - RL) + (NB - RB) \tag{20}$$

As shown by Eq. 20, we may conclude that as long as commercial banks lend to real sectors, there would be a matching increase in deposits. On the contrary, as long as commercial banks receive repayment from real sectors, there would be a matching decrease in deposits. Since money supply in a cashless economy is equal to the amount of total deposits, we may therefore reformulate the above conclusion that lending by commercial banks creates money; while repayment to commercial banks annihilates money.

3. Solving for equilibrium

In order to solve for the equilibrium state, we need to firstly make an assumption that the demand in all markets is insufficient, and the insufficient demand determines the quantity of all transactions of final goods and services. Thus aggregate income must equal to aggregate expenditure, i.e.

$$Y = E. \tag{21}$$

Substituting Eq. 3 into Eq. 1, we may have the expression of consumption, as follows,

$$C = \alpha \cdot M_H + mpc(1 - \tau) \cdot (Y - RL) + BL_{BH}. \tag{22}$$

Borrowing from Eq. 4, we have the expression of investment as

$$I = \alpha \cdot M_F + BL_F. \tag{23}$$

By substituting Eq. 7 into Eq. 6, we can get

$$G = \alpha \cdot M_G + \tau \cdot (Y - RL) + \Delta B. \tag{24}$$

Combining Eqs. 8, 21–24, the equilibrium national income $Y^\star$ can be obtained as follows

$$Y^\star = \frac{\alpha M}{(1 - \tau)(1 - mpc)} + RL + \frac{\Delta L + \Delta B}{(1 - \tau)(1 - mpc)}, \tag{25}$$

where the total repayment flows can be summed up as

$$RL = \lambda_H \cdot L_H + \lambda_F \cdot L_F. \tag{26}$$

We further denote β_H as the proportion of household debt to aggregate bank loans and β_F as that of firm debt to aggregate bank loans, given by

$$\beta_H = \frac{L_H}{L}, \tag{27}$$

$$\beta_F = \frac{L_F}{L}. \tag{28}$$

Then Eq. 25 can be rewritten as

$$Y^{\star} = \frac{\alpha}{(1-\tau)(1-mpc)} \cdot M + \lambda \cdot L + \frac{1}{(1-\tau)(1-mpc)} \cdot (\Delta L + \Delta B), \tag{29}$$

where $\lambda = \lambda_H \beta_H + \lambda_F \beta_F$, and λ represents the average-weighted repayment rate of bank loans [5]. In Eq. 29, we may conclude that the equilibrium income is composed by three parts of flows. We interpret the first term at the right side of Eq. 29 as the monetary flows generated by money circulation in a narrow sense, and then $\frac{\alpha}{(1-\tau)(1-mpc)}$ is the corresponding velocity. Likewise, the second term represents monetary flows generated by private debt circulation, and λ is the corresponding velocity of the circulation [6]. In the last term, $\Delta L + \Delta B$ is total credit expansion, including both the increments of private debt and public debt. It is worthy noting that $\frac{1}{(1-\tau)(1-mpc)}$ represents the Keynesian multiplier of this model, and we can draw the implication that the multiplier takes its effect on equilibrium income by promoting both money circulation and credit expansion, except private debt circulation.

According to the elaborations mentioned about the values of model parameters, we could safely predict that the value of each velocity of circulation is positive, and the impact of credit expansion on aggregate demand is also positive. Based on Eq. 29, we should be clearer about the separate impacts of money and debt on aggregate demand. Money circulation plays a central role in the determination of aggregate demand, as argued by the traditional quantity theory of money. Since money and debt are created at the same time, in parallel with that, debt would also influence aggregate demand through two channels, namely its circulation and expansion. It should be emphasized that private debt contributes to aggregate demand through both its circulation and expansion, while public debt has only positive effect when it expands.

The implication obtained in this paper echoes the empirical results in several recent literature that intends to figure out the impact of debt on aggregate demand as well as its transmission mechanisms Mian et al. (2019); Hall (2011); Mian and Sufi (2012). With the common knowledge that credit expansion exerts positive effect on aggregate demand, the productive capacity and household demand channels are found to be the major mechanisms considering the supply-side factors Mian et al. (2019). Moreover, the private debt overhang is always regarded as a signal for default crisis. As a result, household balance sheet is placed at the center of the analysis to account for the sharp and persistent decline in aggregate demand in the post-crisis era Hall (2011); Mian and Sufi (2012). The new understandings can be drawn from this paper that the negative impact of household debt should be attributed to the low level of circulation velocity, in other words, debtors' inability to repay the matured debt during economic downturns.

4. Conclusion

In this paper, in order to reexamine the income determination process, we put forward a simple macroeconomic model, in which commercial banks are at the core of the economy. Following stock-flow consistency principles, we demonstrate that the equilibrium national income can be decomposed into three parts, which are generated by money circulation, private debt circulation, and total credit expansion respectively. So we can see that the stock of private private debt contributes to the economy through both circulation-channel and expansion-channel, while the public debt promotes economic growth through only its expansion. Based on these new understandings, we believe that some new transmission channels of macroeconomic policies can be identified in the future.

CRediT authorship contribution statement

Xiaoyun Xing: Conceptualization, Methodology, Visualization, Writing - original draft. **Wanting Xiong:** Conceptualization, Writing - review & editing. **Jinzhong Guo:** Methodology, Visualization. **Yougui Wang:** Writing - review & editing, Project administration, Supervision, Funding acquisition.

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[5] The calibrated value of monthly repayment rate is found to be 0.0579 in 2009, 0.0813 in 2010 based on the historical data of average-weighted maturities for all commercial and industry loans for the U.S. commercial banks. *Source:* https://fred.stlouisfed.org/series/EDANQ

[6] The micro-foundations of both velocities of money circulation and debt circulation are depicted by holding times of money and debt respectively, see Xing et al. (2018)

Supplementary material

Supplementary material associated with this article can be found, in the online version, at 10.1016/j.frl.2020.101653

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