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Abstract

This paper assesses the theory of credit mechanics within the context of the current money supply debate. Credit mechanics and related approaches were developed by a group of German monetary economists during the 1920s-1960s. Credit mechanics overcomes a one-sided, bank-centric view of money creation, which is often encountered in monetary theory. We show that the money supply is influenced by the interplay of loan creation and repayment rates; the relative share of credit volume neutral debtor-to-debtor and creditor-to-creditor payments; the availability of loan security; and the behavior of non-banks and non-borrowing bank creditors . With the standard textbook models of money creation now discredited, we argue that a more general approach to money supply theory involving credit mechanics needs to be established.

JEL Classification: E40, E41, E50, E51

Keywords: credit creation, Bank credit, money supply theory, credit mechanics, balances mechanics

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Credit mechanics – a precursor to the current money supply debate

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1. Introduction

Central bank interventions during the 2007-8 Great Financial Crisis (GFC) and 2012 European sovereign debt crisis have led to a renewed theoretical interest in the role of banks and central banks in the money creation process[3]. A massive explosion in the monetary base did not promote an equivalent increase in the broader monetary aggregates, as would have been expected from the economic textbook money multiplier theory. This has discredited that standard academic approach and triggered a new debate about the determinants of the money supply (Goodhart 2017). The debate has included leading central banks, who felt compelled to educate the public about the impact of accommodative policies and the underlying mechanics of money creation (McLeay et al. 2014; Jakab and Kumhof 2015; Deutsche Bundesbank 2017). This has rightly put back into focus the money creating capacity of banks. Central banks and commercial banks create new money when they grant loans or purchase assets and pay in their own notes or credit the amount as a sight deposit. However, many interpretations of this money creation mechanism also make the assumption that because banks can create money they can also determine the money supply. Some theorists go even further and assert that this capacity at the hands of the private banking sector presents a fundamental institutional problem, which must be removed by establishing a fully nationalized money stock, (see Decker (2017) for a discussion of reform proposals).

Bank loans can be important money creating transactions. However, the assertion that central banks and commercial banks could unilaterally determine the money supply has been criticized. Goodhart

[3] For the purposes of this article the term 'money' refers to means of payment. This is normally defined as non-bank holdings of central bank notes and commercial bank deposits.

(2017, 41-42) has recently argued that the 'Bank Loans Create Deposits' theory, for instance as represented in McLeay et al. 2014 and Jakab and Kumhof 2015, is at best 'partially true' and 'exaggerates the role of banks in initiating private sector credit expansion'. By contrast, Goodhart has emphasized the role of private sector non-banks, with the banking industry in his view merely setting 'the terms and conditions whereby the private sector can create additional money for itself'. Heinsohn and Steiger, in their property-based money approach, have argued that a central bank 'cannot force its counterparties to become debtors' and that money creation requires solvent debtors with eligible collateral (Heinsohn and Steiger 2013, 85, 59).

Interestingly, the current money supply debate is not new and has strong parallels with a discourse that took place among German monetary economists during the 1920s-1960s. Of particular interest is the pioneering work of Wilhelm Lautenbach[4]. He developed a specific approach to explain changes in the aggregated bank credit volume, which became known as 'credit mechanics'. Lautenbach emphasized that no priority could be given to either side of the bank balance sheet and that bank creditors as well as bank debtors exerted an influence over the money supply, a process in which banks act as intermediaries. Lautenbach's credit mechanics became the basis of the theory of 'balances mechanics'

[4] Wilhelm Lautenbach (1891 - 1948) was a German economist and government official. He served with the German economics ministry from 1919 to 1934 and left the ministry after a conflict with Reichsbank president Hjalmar Schacht. Thereafter, Lautenbach joined the German Bureau of Statistics. He served from 1947 as the vice president of the regional central bank (Landeszentralbank) of Württemberg-Hohenzollern. Lautenbach proposed various recovery measures to combat the German 1930s depression, including what became known as the 'Lautenbach plan', which proposed a combination of wage cuts and credit-financed government investments in 1931 (Jaeger 1982; Borchardt and Schötz 1991).

by Wolfgang Stützel[5], who further developed and formalized Lautenbach's approach. Stützel rejected any one-sided, bank-centered view of the money supply determination. Credit mechanics is arguably one of the more original contributions to monetary theory and represents an important analytical framework that deserves reconsideration in the current money supply debate. Other notable authors in this context include Hans Gestrich[6], Leonard Gleske[7], Otto Pfleiderer [8] and Heinrich Rittershausen[9].

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[5] Wolfgang Stützel (1925 - 1987) was a German economist. From 1953-1957, he was deputy leader of the economics department at the Berliner Bank AG, in 1957/58 researcher at the Bank deutscher Länder (BdL, the predecessor of the German Bundesbank), and thereafter Professor for economics at the University of Saarbrücken. He served on German council of economic experts from 1966-68 (Bofinger 2013).

[6] Hans Gestrich (1895 - 1943) was a German economist and journalist. From 1927-1931, he was the editor-in-chief of one of the leading German business newspapers (Industrie- und Handelszeitung). Gestrich was press secretary at the German Reichsbank from 1931 and later served as an economic advisor to the Prussian state bank (Seehandlung) (Eucken 1947; Borchardt and Schötz 1991).

[7] Leonard Gleske (1921 -) is a German economist and central banker. He started his professional career as a researcher at the Bank deutscher Länder (1951-55) and served for more than 25 years on the Central Bank Council of the German Bundesbank (Deutsche Bundesbank 1976; Frankfurter Allgemeine Zeitung, 16 Sep 2011).

[8] Otto Pfleiderer (1904 - 1989) was a German economist and central banker. He obtained a Rockefeller foundation scholarship (1934/35) and was an economic researcher at the Reichs-Kredit-Gesellschaft AG, Berlin from 1937-45. He served from 1948-72 as president of the regional central bank (Landeszentralbank) of Baden-Württemberg and was a member of the central bank council of the German Bundesbank. He was one of the German experts advising the Allied military government on the German currency reform of 1948 and the establishment of the German central bank banking system after WWII (Kloten 2001).

While not forming a distinct school of economics, these authors are nevertheless connected. Lautenbach, Gestrich and Rittershausen attended the secret conference of the Friedrich List society in September 1931, a gathering of the leading German economists, government officials and Reichsbank officials to debate the possibilities and impact of Lautenbach's proposal to revive the German economy through a credit expansion. Lautenbach, Gleske, Pfleiderer and Stützel worked at predecessor organizations of the German Bundesbank. Gleske and Pfleiderer became high ranking Bundesbank officials.

The objective of this article is twofold. As this body of work has suffered from a long period of neglect and is largely available in German only, we make a summary of the approach accessible to the English speaking reader. Second, we assess the theory of credit mechanics in the context of the present money supply debate. The article is structured as follows. In Section 2 we outline Lautenbach's credit mechanics, including related approaches by Gestrich and Pfleiderer. Section 3 covers Stützel's balances mechanics and a brief discussion of Rittershausen's theory of debt repayment chains. Section 4 draws out some of the implications for the current money supply debate. This is followed by concluding remarks in Section 5.

2. Wilhelm Lautenbach's 'credit mechanics'

Lautenbach's key insight was that changes in the credit volume do not simply reflect economic transactions, such as those arising from commodity production and sales, but are also caused by purely

[9] Heinrich Rittershausen (1898 - 1984) was a German economist and Professor for Applied Economics at the University of Cologne.

financial processes related to the organization of credit (Lautenbach 1936a, 135 [1952, 80]). The latter, according to Lautenbach, were governed by their own operational rules unrelated to the economic process. Therefore, the make-up of aggregated bank balance sheets did not allow inferences about the circulation of goods, movements of inventories or the level of investment (Lautenbach 1952, 192). In Lautenbach's view, '*mastery of the pure mechanics of credit is a vital precondition for any analysis of the economic process*' and errors can be found in 'dozens of theoretical works' because the authors had not mastered the 'elementary mechanics' that determines the demand for bank credit (Lautenbach 1952, 192; emphasis in original, authors' translation). Lautenbach and other authors refer to this approach as 'credit mechanics' or the 'mechanics of the credit volume' (see, for example, Gleske 1954, 52). In the following, we provide an outline of Lautenbach's credit mechanics focusing first on his analysis of the formal arithmetic relationships between bank creditor and debtor accounts. We then cover Lautenbach's approach for analyzing the determinants of the volume of bank credit and related approaches by Hans Gestrich and Otto Pfleiderer.

The formal relationships between bank creditor and debtor accounts

What are the elements of credit mechanics? Lautenbach's starting point is Albert Hahn's[10] model of a cashless economy ('bargeldlose Wirtschaft'), where all payment transactions are conducted through the books of banks (Lautenbach 1952, 44; instructive is also Lautenbach's endorsement of Hahn in 1937, 512). This model was first formulated in Hahn (1919, 178) and then fully developed in Hahn's pioneering

[10] L. Albert Hahn (1889-1968) was a German private banker, economist and honorary professor at the Goethe University of Frankfurt am Main.

‘Economic Theory of Bank Credit’ (Hahn 1920, 25; 1930, 22; 2015, 23;)[11]. Hahn showed that ‘each credit granted in an economy generates a deposit and therefore the means of its own accommodation’ (Hahn 2015, 25; 1920, 27-28; 1930, 25) and that the ‘deposit business is nothing other than a reflex of the simultaneous act of granting credit’ (Hahn 1930, 26; authors’ translation)[12]. However, Hahn qualified this statement in his revised 3rd edition by noting that at an aggregate level not every credit grant generates a net increase in sight deposits. The volume of sight deposits could remain unchanged if the amount of new loans was offset by loan repayments or if the corresponding amount of new sight deposits was de-activated by their conversion into time deposits (Hahn 1930, 26-27). Moreover, Hahn recognized that a deposit entry could only exist because the deposit holder ‘leaves it standing at the bank until he makes a decision to use it for loan repayments, new acquisitions or simply “saves” it’ (Hahn 1930, 23; authors’ translation). In Hahn’s view, banks simultaneously create new debtors and creditors. This process reflects economic transactions, where creditors accept bank deposits in exchange for goods and services that they received from bank debtors. In this sense, Hahn regarded banks as ‘intermediaries’ (‘Zwischeninstanzen’, Hahn 1920, 35), which enable indirect credit relationships in an

[11] Hahn’s book is arguably one most important and influential books on monetary theory in the German-language area. Hahn is credited by Schumpeter (1954, 1114) as being the first to have succeeded in providing a complete theory of bank credit: ‘But it was not until 1924 [1920] that the theoretical job was done completely in a book by Hahn’.

[12] This crucial passage was changed from the first edition to emphasize that credit and deposit entries occur simultaneously and not one after the other. The first edition reads: ‘the deposit business of banks is nothing other than a reflex of the *prior* act of granting credit’ (Hahn 1920, 29; emphasis added, authors’ translation; see also Hahn 2015, 27 for the full context and an alternative translation of this passage from the 1st edition).

economic sense between bank deposit holding creditors and bank debtors. The latter can now remain anonymous to their creditors (Hahn 1920, 35).

Lautenbach further simplified Hahn's model of a cashless economy by consolidating all bank accounts into that of a single bank ('general deposit bank' / 'Generaldepositenbank') and assumed that bank credit is the only form of credit (Lautenbach's 1952, 44). In this model, the sum of bank creditor accounts must be equal to the sum of bank debtor accounts and 'loans and deposits appear and disappear simultaneously'. In other words, '[d]ebtors can only come into existence in the same volume that creditors emerge and vice versa.' On this basis, Lautenbach argued that nothing could be said about the 'priority of either side of the bank balance sheet' (Lautenbach 1952, 46, authors' translation). Lautenbach stressed that these attributes of bank credit made the interrelationships much more complex than they at first appeared. While the statement that 'the demand for credit can only be fulfilled to the degree that bank creditors are created and vice versa' was considered as common sense, the converse and equally true statement: 'the demand for credit *arises* only to the extent that bank creditors are created' would be perceived as paradoxical (Lautenbach 1952, 46, emphasis in original, authors' translation). Lautenbach (1952, 45) argued that it was a misconception to view a bank as a limitless source of credit. A bank was not the actual credit provider but 'merely an intermediary between debtors and creditors' (authors' translation).

Having established the principle that no priority can be given to either side of the bank balance sheet, Lautenbach (1952) considered the operational determinants of the volume of bank credit. His main argument was perhaps most forcefully expressed in a letter he wrote to Walter Eucken in 1944. Eucken (1944) had argued that changes in bank balance sheets could not be understood without the full knowledge of the associated commodity transactions. By contrast, Lautenbach (1952, 191) argued that

‘the associated commodity transactions are completely irrelevant and had nothing but nothing at all to do with the changes in bank balances’ (authors’ translation). Whether bank balances expand or contract was solely determined by a number of formal conditions, namely, as to whether the parties to the payment transaction were both creditors, both debtors or a combination of creditor and debtor (Lautenbach 1952, 48). Hence, the mechanics of bank balance sheet movements can be classified into four cases:

(i) Debtor to creditor – balance sheet expansion, if a payment is made by a debtor (A) to a creditor (B) (A requires a new loan, B receives a deposit – “bank money creation”);

(ii) Creditor to debtor – balance sheet contraction, if a payment is made by a creditor (A) to a debtor (B) (A’s deposits are reduced, B repays loan – “bank money destruction”);

(iii) Creditor to creditor – balance sheet unchanged, if a payment occurs between creditors (A and B) (decrease in A’s deposit balance and matching increase in B’s deposit balance); and

(iv) Debtor to debtor – balance sheet unchanged, if a payment occurs between debtors (A and B) (increase in A’s loan liabilities and matching decrease in B’ loan liabilities).[13]

Gleske (1954, 53), in his discussion of Lautenbach (1952), concludes on the basis, that it is not within the power of the banking system to created a pre-determined money volume . By contrast, Gleske argues that the volume of money is the result of innumerable dispositions of creditors and debtors. The statically determined money supply can therefore reflect vastly different real economic circumstances.

[13] Based on Lautenbach (1952, 48), Gleske (1954, 52) and Stützel’s commentary in footnote 3 in Lautenbach (1952, 45-46).

In Gleske's view, it is irrelevant for the production of economic income if an increase in credit activity manifests itself in the bank balance sheet or not. While Gleske notes that an increase in the employment of credit is often reflected in a corresponding increase in the bank money volume, he argues, in line with Lautenbach, that this is not necessarily always the case.

The determination of the volume of bank credit

The formal arithmetic relationships between bank creditor and debtor accounts have an important consequence for the functional relationship between credit and investment. As long as companies remain debtors, transactions between companies 'would only result in compensating changes in debtor accounts, and therefore would not increase the aggregated credit balance or the total demand for credit' (Lautenbach 1952, 48; authors' translation). From this Lautenbach concluded that '[t]he level of and the changes in *investment* are completely *without impact* on the volume of credit; they impact exclusively the account turnover rate' (Lautenbach 1939, 118, emphasis in original; authors' translation). In this case, firms are fully self-financing their investments. A different situation arises when the distribution of investments is unbalanced and some companies emerge as net creditors. Debtor to creditor payment flows then lead to an increase of the bank credit volume. Lautenbach argued that the required bank credit volume was therefore dependent on the degree companies reach uniformity in their pace of investment outlays and was lowest (i. e. near zero) when their investments were synchronized and occurred in lock-step. (Lautenbach 1952, 50-51). Hence, the bank credit volume could not be a function of investment (Lautenbach 1952, 51, 55; 1937, 519; 1949, 509).

A different situation presents itself in relation to wage payment. In Lautenbach's model, a wage payments typically triggers a transaction from a company debtor to a household creditor and thus leads to a net increase in the bank credit volume. The bank credit volume must therefore increase with the

amount of wage payments and decrease in line with the number of payment periods per year (Lautenbach 1939, 118; 1952, 47, 49). As a related scenario, Lautenbach considered household "savings", i.e. a situation where households spend less than the full amount of their wage money receipts (Lautenbach 1952, 48-49; 1939 117; 1949, 520). He argued that as a result of household savings the bank credit volume must increase. Lautenbach illustrated this important case with an example that he repeated in several of his publications (e.g. Lautenbach 1939, 117; 1949, 520). Here, firms are assumed to be net bank debtors with an aggregated debt balance of 10 billion. Firms periodically raise an additional 2 billion for wages payments (increasing their debt to 12 billion). If wage earners spend the full wage proceeds, bank balances return to their original position (assumed by Lautenbach at 10 billion) after the cycle. By contrast, if 5% of wage payments are saved, the credit balance before the next wage payment cycle increases to 10.1 billion (10 billion plus 5% of 2 billion). Hence, the total credit volume increases as a result of household savings.

Lautenbach (1939, 119) concluded on this basis that 'the employment of credit and the volume of credit are fundamentally different from each other' (authors' translation). Even the employment of credit on a very large scale need not necessarily trigger a change in the aggregated bank balance. Not the volume of company investments but the bank deposits required for wage payments and the deposits accumulated as part of savings from wage money receipts were the key determinants of the bank credit volume. Lautenbach stressed the importance of the deposit side of the bank balance sheet and concluded that in order to 'develop a picture of the future development of credit, we should and must be on the look-out for future depositors even more so than future creditors' (Lautenbach 1952, 46; authors' translation).

Lautenbach applied the principles of credit mechanics to explain the changes in the credit volume during the depression and subsequent upswing in Germany 1929-1936 (Lautenbach 1936a, 1936b, [1952, 80-108]). In both of his 1936 articles, Lautenbach stressed the seemingly paradoxical relationship between credit demand and volume of investment. He argued that at the onset of a crisis credit became scarce because there was a drop-off in investments. Employment and income in capital goods production decreased, which led to a reduction in the demand for consumption goods. As a result, loans could not be repaid and froze. Bank customers demanded more credit, while the turn-over in bank accounts decreased. As an important consequence, the credit volume did not shrink automatically when investments declined (Lautenbach 1936a, 135-136; [1952, 80-82]).

Lautenbach (1936a) employed a detailed bank balance sheet analysis to prove these relationships. His analysis is again based on the consolidation of the accounts of all commercial banks into a single aggregated entity (similar to Lautenbach's general deposit bank). However, unlike in Lautenbach (1952, 44) the central bank is considered as a separate entity. The essence of Lautenbach's method is to carry out an aggregation of bank balance sheets and then to generate insights by exploiting the formal, 'trivial- arithmetic relationships' (Stützel 1958 [1978], 2) between the different aggregated accounts, which must always hold due to accounting identities. On this basis, Lautenbach developed the following scheme to account for all possible aggregated balance sheet account movements, which are formally consistent with a reduction in the bank credit volume commonly expected during recessions

(Lautenbach 1936a, 139; [1952, 84-85]; authors' translation)[14], which is reproduced in summary form in Table 1.

Type	Description	Case	Underlying transactions
A. Reduction in credit volume with unchanged bank balances	Bank credit decreases while bank deposit holdings are unchanged	A.I Increase in bank's central bank cash or deposit offset decrease in loans to non-banks	Inflow of gold and foreign currency Reduced volume of central bank cash in circulation
		A.II Security holdings increase by the amount loans to non-banks decrease	Bank debtors issue securities that are bought by banks
B. Reduction in credit volume with contraction in bank balances	*Pari passu* decrease in bank credit and deposit holdings	B.I Bank creditors use deposit holdings to pay bank debtors for good and services, bank debtors reduce their lines of credit or redeem bills of exchange	Payments for goods and services (commodities, services, interest, rent etc.). On an irregular basis: conveyance of real estate and corporations
		B.II Bank creditors purchase securities from bank debtors	Purchase of stocks, bonds and asset backed securities

Table 1: Lautenbach's scheme for a credit contraction in a depression.

In Lautenbach's classification cases, A.I and B.I reflect account movements arising from transactions involving goods and services, while A.II and B.II represent changes due to financial restructuring only. Lautenbach (1936a, 137, 145; [1954, 82, 92]) concluded that the credit volume would not automatically shrink when production and turn-over declined. Bank loans froze, inventories could not be sold and the volume of credit that was directly tied into income producing activities was relatively small due to its high turn-over rates. In fact, Lautenbach concluded, with reference to the great depressions in the United States and England, that the bank credit volume was most strongly influenced by cases A.II and BII. These are cases where depositors increasingly employ their funds in capital markets, typically at the beginning of an expected upturn. Therefore, Lautenbach considered the 'consolidation' of bank deposits into bonds or stocks as the most important influence on the volume of bank credit. In this process, bank

[14] Lautenbach explicitly excludes the impact of the write-off of loan losses as a 'pathological case' from his considerations, although these can arguably have considerable balance sheet impacts in severe depressions.

creditors with excess deposit holdings purchase primary issues of bonds and shares from bank debtors, who make bank loan repayments with the proceeds. Bank balances contract (Lautenbach 1939, 118-119).

Lautenbach argued that the sluggish reaction of the credit volume in a recession was mirrored by a low visible increase in the bank credit volume during an upswing, even in an environment with large scale investments. His case in point is the credit expansion and upswing in Germany after 1933. Here, the aggregated balance of the banking system increased from 1932 to 1936 by only 15%, while the GDP increased by 50%. Loan repayments offset new loans as treasury bills issued to finance public employment programs (Öffa-Wechsel) started to displace private trade bills (Irmler 1976, 324-325; Lautenbach 1936b, 241, 244; [1952, 98, 101]). As Gleske (1954, 53), in his discussion of Lautenbach (1952) argues, the massive credit activity of the German banks after 1933 demonstrated that the employment of credit and not the volume of the money supply was the decisive factor. Or in Lautenbach's own words '[t]he effective credit volume is the credit sum times average turn-over coefficient' (Lautenbach 1939, 118; authors' translation).

In Lautenbach's view, the decisive factor determining the volume of central bank money was the level of employment and wage rates (the majority of wage payment were made in cash at the time). Without changing wage rates the volume of central bank money in circulation could only moderately increase. According to Lautenbach, rapidly increasing wage rates were the 'conditio sine qua non' for the 'paper money deluge' experienced during the years of the German hyperinflation (Lautenbach 1936b, 240; [1952, 96]).

Related approaches: Hans Gestrich and Otto Pfleiderer

In 1936 when Lautenbach published his articles in the journal “Wirtschaftskurve”, Hans Gestrich, a friend of Lautenbach’s, published his book ‘Neue Kreditpolitik’ (new credit policy) (Gestrich 1936 [2014]). Lautenbach noted that ‘Gestrich was the first who followed me’ in the realization that ‘credit volume and liquidity obey different laws’ from those governing economic transactions associated with commodity production and sales, long before Lautenbach had published his ideas (Lautenbach 1952, 188-189; authors’ translation). Similar to Lautenbach, Gestrich highlighted in his writings that errors and doubts could easily arise, when conclusions were drawn from the size of bank balance sheets. He emphasized that bank balances were stock variables and therefore only represent snapshots in time. It was therefore important to recognize that movements in bank balances could compensate each other and become invisible. Moreover, strong movements in previously static accounts could create phenomena, the significance of which were the opposite of what was expected (Gestrich 1936 [2014], 40-43). Gestrich provided three examples (Gestrich 1936 [2014],40-41). The first, and in Gestrich’s view, the most important example is the ‘invisibility of a credit expansion’. If there is a large number of impaired loans, newly credited sight deposits only temporarily appear in the sight deposit accounts and are shortly thereafter used by the recipients to repay their existing loans. While the credit expansion is effective, the process only creates a transfer of funds between debtor accounts and remains invisible in the aggregated bank balance. Similar to Lautenbach, Gestrich pointed to the financing of the German public employment programs in 1933/34. Gestrich’s second example concerns an even more counterintuitive or perhaps paradoxical case, where a credit expansion triggers the contraction of bank balance sheets. This can be due to the fact that bank creditors purchase shares and bonds and their issuers repay their bank loans from the proceeds (see Lautenbach’s bank loan consolidation case discussed above). Alternatively, creditors who hoard deposits during a crisis may reactivate these at the beginning of an economic upswing by carrying out commodity purchases, while the recipients of these

funds repay their bank loans. As a result, bank balances contract, while the employment of credit expands. The third example given by Gestrich is the paradoxical case, where bank balance sheets further expand during the transition from boom into recession. At the onset of a recession, Bank creditors begin to 'hoard' their deposits, which means that firms experience a decrease in their incoming payments. Hence, firms are forced to maintain or even expand the volume of bank credit as the result of depositor actions. The same topic is taken up again in Gestrich (1944 [1947], 115) where he concluded that 'debtor accounts in the main can only decrease when they receive flows from creditor accounts. On the other hand, new creditors are mostly created together with new debtors' (authors' translation). Gestrich noted that because bank balances were only snapshots in time these naturally could not provide insights into the underlying transactions. Gestrich therefore stressed, in line with Lautenbach, that the velocity of the turnover in the individual accounts was the key measure for bank management and an important indicator for the quality of a bank balance sheet.

Another important publications on credit mechanics is Otto Pfleiderer's (1943) 'The Mechanics of the Credit Volume [Die Mechanik des Kreditvolumes]'. He agued that a realistic and specific investigation of the 'mechanics of credit expansion and contraction' (Pfleiderer 1943, 265) was needed to clarify the theoretical debate as to whether the deposit or loan business of banks should be assigned priority as the determining factor for the credit volume. He argued that the credit volume could only increase if a new credit chain was created. This could either be a direct credit relationship between a creditor and a debtor or a more complicated relationship, where a bank acted as an intermediary between a creditor and a debtor involving multiple links in the credit chain. According to Pfleiderer, the bank credit volume was dependent on two factors: (1) the willingness of the bank to grant credit; and (2) the demand for credit by governments and entrepreneurs. However, the ultimate decision to grant

credit was with the bank (Pfleiderer 1943, 266). In Pfleiderer's view, the simple act of granting bank credit did not yet represent an expansion of the credit volume, as the debtor had not yet deployed the funds and creditor and debtor were still identical.

Pfleiderer argued that the potential credit volume of an individual bank was only limited by its liquidity, i.e. by the holdings of central bank money [Reichsbankgeld] or eligible central bank securities [reichsbankfähige Titel]. However, the way in which the a bank acquired those titles was of no consequence for the potential credit volume created by an individual bank. Consequently, Pfleiderer concluded that

> '[t]he experience of the bank practitioner that the limits of credit expansion are the larger the more customers make payments into their deposit accounts [Depositen- oder Girokonto] exists for a good reason; however, this experience has often been interpreted incorrectly. Not the *deposits* of the bank creditors are lent out, but it is *central bank money* [Reichsbankgeld] that is needed for every credit contract.' (emphasis in original; authors' translation)

Pfleiderer saw that banks could acquire central bank money in a number of 'fundamentally equivalent ways' (Pfleiderer 1943, 267): loans from other banks in the money market, rediscounting of bills of exchange with the central bank [Reichsbank], secured central bank loans and sales of securities in the open market. Banks were thus not solely reliant on the acquisition of deposits. Moreover, Pfleiderer stressed that the mechanics of the credit volume showed that the liquidity of the banking system as a whole was dependent on the behavior of the central bank. Credit expansion and contraction could occur with both increasing and decreasing system liquidity. For instance, the 'mechanics of war financing' in

Germany from 1939 used the direct monetization of state debt titles and hence the expansion of the credit volumes increased the liquidity of the system as a whole (Pfleiderer 1943, 267).

3. Wolfgang Stützel's 'balances mechanics'

Lautenbach's credit mechanics was taken up by Stützel (1953 [1979]) in his analysis of the determinants of the bank credit volume and forms a central part of his theory of 'Balances Mechanics' ('Saldenmechanik') (Stützel 1958 [1978]). Following Lautenbach, Stützel's balances mechanics carefully considers the 'elementary' arithmetic relationships between account variables. Moreover, he carefully distinguished between arithmetic relationships that strictly and always hold for the selected group of economic actors as a whole and those that hold for a sub-set of the chosen group only, and are special cases. One of Stützel's main concerns was to avoid fallacies of composition. It was this 'special approach to conducting macro economic theory' that he learned from his 'first macro economic teacher': Wilhelm Lautenbach (Stützel 1958 [1978], x; authors' translation). In this Section we describe the underlying principles of Stützel's balances mechanics. This includes a discussion of the relationships between an increase in new loans and the bank credit volume, paradoxes associated with changes in the bank credit volume and a related approach by Heinrich Rittershausen.

The principles of balances mechanics

Stützel's balances mechanics concerns a defined group (i.e. a mathematical set) of economic actors that carry out sales, payment and credit transactions with each other and are therefore interrelated. Transactions are reflected in the individual balance sheets and in the aggregated balance sheets of the group as a whole (see Stützel (1953 [1979], 41-44; 1958 [1978], 25, 43-56). In Stützel (1953 [1979]), 307) balances mechanics is applied to the determination of the volume of central bank money. The

mechanics ('Größenmechanik') governing the volume of central bank money in circulation was formulated by Stützel as follows:

> 'An effective increase in the volume of central bank money in circulation requires that the increase (decrease) of central bank purchases of claims against other parties [including new central bank loans] is greater than (smaller than) the simultaneous increase (decrease) in repurchases of claims held by the central bank in its asset portfolio against other parties [including loan repayments] by the latter.' (authors' translation)

Consequently, at a global level, considering the group of all economic actors, there can be no defined functional relationship between the flow variable "new central bank loans per period" and the stock variable "loan assets held by the central bank", i.e the volume of central bank money in circulation. This functional relationship is referred to by Stützel as the 'global theorem (Globalsatz)'.

A different viewpoint arises from the individual perspective of the central bank making asset purchases or granting loans. Without considering other parties that may repurchase their obligations with respect to the central bank or make central bank loan repayments, a direct functional relationship between an increase in central bank loans and an increase in the stock of central bank assets (increase in the volume of central bank money in circulation) may be assumed. A functional relationship that holds for a sub-group only was referred to by Stützel as a 'partial theorem (Partialsatz)'.

Hence, Stützel formalized Lautenbach's credit mechanics by explicitly articulating the mathematical relations between accounts including those that hold for the considered group in aggregate and those that hold for the associated sub-group only. Stützel (1953 [1979], 307) argued that within the context of 'these elementary relationships' there was a tendency to focus on the partial theorem and it was

therefore very easy to mistakenly assume that a change in a single flow variable (e.g. new central bank loans per period) was a necessary and sufficient condition for an increase in the associated stock variable (e.g. the central bank credit volume and volume of central bank money in circulation). Stützel concluded that it was a 'mistaken idea' to assume that

> 'central banks could "simply", i.e. unilaterally and without active participation of their customers, determine the volume of central bank money, especially increasing it' (Stützel 1953 [1979], 307; authors' translation),

and that this view was founded on a fallacy of composition, i. e. the formulation of an economic relationship based on a partial theorem (Stützel (1953 [1979], 307).[15]

[15] This is, of course, correct under the normal arrangement, which held until recently, whereby the central bank offered a zero-interest rate on commercial bank deposits held with it, while it tried to maintain a chosen official short-term money market rate. Under such conditions, if the commercial banks' demand for base money was such that money market rates deviated from the central bank's desired rate, the central bank would have to adjust the amount of base money it provided, in order to drive money market rates back into line with its desired official short-term rate.

However, more recently, especially with the adoption of Quantitative Easing, central banks have adopted a new operating technique of setting a non-zero, usually positive, interest rate on commercial bank deposits held with themselves. This has enabled them to fix the volume of central bank money at whatever level they wish. But, in turn, this results in changes in relative interest rates between that on deposits held by commercial banks with the central bank, and other assets held by commercial banks. And this has led, in turn, to a collapse in the previously reasonably stable relationships between commercial bank reserves and their total deposits and assets.

A second and equally problematic issue in monetary analysis, identified by Stützel, is implicit assumptions about the buyer-seller relationship between bank and non-bank. An important instance is the (incorrect) assumption that central bands and commercial banks could create new loans and associated deposits without active participation of the non-bank public (Stützel 1953 [1979], 214). By contrast, Stützel argued that there were always two parties to any credit contract. The initiative to enter into the contract could at times originate from the bank and at times from the non-bank customer. Hence, statements that '"central banks" could "pump" money into the economy' and commercial banks 'could create credit and respectively increase sight deposits (without "active" participation of the public)' made the critical but often unstated assumption that the market for central bank money and bank deposits was a seller's market. Here, the demand for means of payment was always greater then the supply and the banks 'asymmetrically' determined any increases in the volume of the supplied means of payment (Stützel 1953 [1979], 214; authors' translation). However, Stützel argued that this was not always the case. For instance, periods of booming capital markets and strong levels of consolidation of deposit holdings into security holdings could create a buyers market. In this situation the original initiative to enter into individual credit contracts had to be taken by banks, who faced strong pressure to maintain the volume of their lending business. The non-banks decided how much of the offered supply of bank loans was taken up (Stützel 1953 [1979], 214).

Stützel illustrated his case, as Lautenbach and Gestrich did before him, with reference to the German employment programs in 1933-37. These programs resulted in significant Reichsbank purchases of treasury bills, but did not result in a material increase in the money supply, as the private sector used the new inflow of liquidity to decrease their engagement with the central bank. Stützel contended that Lautenbach had already correctly predicted this outcome based on his credit mechanics in 1931 (see

Lautenbach 1952, 149-155). Hence, Lautenbach's monetary analysis was superior to that of the Reichsbank (including president Schacht), who had expected the opposite outcome and had supported the employment programs because a Reichsbank objective was to increase the money supply (Stützel (1953 [1979], 308-309).

Stützel also extended his balances mechanics to the group of all banks (excluding the central bank). He argued, that the view that new bank loans generally lead to an increase in the volume of bank credit also originated from a fallacy of composition. While for a subset of banks an increase in new lending could lead to an increase in their balance of loan assets, this not necessarily had to be the case for the group of banks as a whole. Stützel (1953 [1979], 311) concluded that

> 'there is absolutely no reason to assume that an increase in the number of new loans per period leads to an expansion rather than a contraction of the credit volume. And there are just as few reasons to assume that a reduction of the number of new loans per period leads to a contraction of the credit volume rather than to its expansion'. (authors' translation)

These relationships are formally developed in Stützel's balances mechanics for the functional relationship between new loans and the bank credit volume. Stützel's global theorem considering the group of all banks (excluding the central bank and non banks) states that there is 'absolutely no direct relationship between an increase in new loans per period and a change in the credit volume' (Stützel (1953 [1979], 310; authors' translation). Stützel proved this theorem by consideration of the associated aggregated account relationships. Assuming that new bank loans are paid out in the form of central bank money, the loan proceeds must either (1) increase the central bank money held directly by non-banks; (2) be paid into bank deposit or savings accounts; (3) used by non-banks to reduce their central

bank liabilities (e.g. repurchase of bills of exchange); (4) paid into foreign accounts; and (6) used to repay bank credits. Pathways (1), (3) and (4) concern uses of central bank funds outside the banks; pathway (2) represents the case where new loans create new deposits; and pathway (6) represents the case where the increase in the credit volume due to new loans is fully offset by loan repayments. It follows, when disregarding the use of central bank funds outside the banking system, that the flow of new bank loans will be divided between flows into repayments and new deposits. If repayments are already occurring at a higher rate than new loans are granted, a further increase in loans may not be sufficient to arrest the decline in the bank credit volume. In fact, new loans could increase the volume of repayments per period. In Stützel (1958 [1978], 216; 2017, 28), a similar relationship was derived for the banking system as a whole by combining the balance sheets of central bank and banks. The resulting functional relationship between new loans and the volume of bank credit (central bank and banks) were formulated by Stützel in the following global theorem: the increase in new loans (banks and central bank) per period must coincide with an equal amplification of the flow of loan repayments and/or increase in the flow of newly created deposits. This led Stützel (1967, 597) to a specific way to define money creation (Geldschöpfung):

> The volume of the aggregated stock of means of payment […*money volume*…] in an economy […] increases as soon as payments, through which the payer enlarges his bank debt or reduces his longer term claims on banks (savings deposits), go to recipients [payees], who neither use the funds for the repayment of bank debts nor invest them as long-term bank deposits. (emphasis in original; authors' translation).

Stützel regarded his statement as the 'shortest definition of the process that is commonly referred to as money creation'. He noted that '[i]t is not a requirement that payer and payee are separate individuals.'(Stützel (1967, 597) emphasis in original; authors' translation).

Paradoxes

The critical importance of considering new deposit creation and repayment flows simultaneously is demonstrated by Stützel's explanation of two important paradoxical cases, where (i) an increase in new loans supports the contraction of the credit volume; (ii) a restraint in new lending facilitates the expansion of the credit volume (Stützel 1953 [1979], 312-317). Both cases are similar to those paradoxical cases discussed in Lautenbach (1936a,b, 1952) and Gestrich (1936). In the first case, Stützel considered a scenario with favorable economic conditions characterized by high expected dividend payments and capital gains on equity investments, and with rates of return greatly exceeding interest rates on bank savings deposits. Stützel assumed that this investment climate would trigger a shift from bank savings deposits into shares, resulting in a decline in the size of bank balance sheets and a corresponding increase in bank liquidity. In this scenario, Stützel argued, that funds arising from new loans were used by their recipients for commodity or share purchases until they were received by someone who used the funds for loan repayments. As nobody wanted to increase their deposit holdings, even a strong increase in the volume of new loans per period would not lead to an increase in the bank credit volume (Stützel 1958 [1978], 217; 2017, 29). Indirect, bank intermediated, credit relationships were replaced by direct credit relationships in the process. An important role of bank credit was therefore to provide the underlying mechanism to create the necessary temporary funding flows between security issuers and purchasers. The latter flow from bank creditors to debtors triggered

loan repayments and a reduction of deposit holdings.[16] Stützel (1958 [1978], 217; 2017, 29) noted this as one of the 'obvious' situations, where the money-multiplier theory did very little to illuminate the interrelationships.

Stützel's second paradoxical case is concerned with the interpretation of an expansion of the bank credit volume. The latter was in his view often incorrectly interpreted as the 'cause or at the very least as a symptom of a demand increase' (Stützel 1960, 16; authors' translation). By contrast, Stützel argued that credit was not only required to fund increased expenditures but also performed a critical role as a buffer to compensate for a slow-down in sales proceeds. In this situation, an increase in the volume of outstanding bank credit was an indicator of a decrease in revenues rather than an increase in expenditures. Moreover, a slowing in the rate of new lending could be more than offset by an even greater slowing of credit repayments. In this case, an increase in the credit volume was an indicator for a tightening of conditions and a signal that bank loans had a tendency to 'freeze' (Stützel 1960, 17). Similarly, Stützel argued that restrictions imposed on new lending could lead to the hoarding of liquid funds in the form of bank deposits (see already Gestrich 1936 [2014], 42). The proceeds from the few remaining new loans were used to expand liquid holdings and were withheld from loan repayments (Stützel 1953 [1979], 315). Hence, the bank credit volume was dependent on the decisions of entrepreneurs and households. They determined what share of the new loan proceeds was held in central bank cash and short or long term bank deposits and what share was used for loan repayments or the purchase of newly issued securities (Stützel 1959, 73).

[16] See Rittershausen (1956, 84) on the role of banks as 'anticipators' of security issues.

Restrictive monetary and credit policies could thus facilitate an expansion of the bank credit volume. According to Stützel , as long as a tendency of bank deposits and central bank money holdings to contract was nowhere to be seen , the rules of credit mechanics implied that the credit volume could not decrease (Stützel 1953 [1979], 314). Similar to Lautenbach, Stützel argued that there was also no strict interrelationship between the expansion of the bank credit volume and the expansion of aggregated expenditures. Thus, a change of the credit volume was neither a necessary nor a sufficient condition for the successful implementation of monetary policies. By contrast, Stützel (1959, 71) argued that the borrowing capacity was the critical factor. He pointed out that the borrowing capacity of the individual entrepreneur was 'always limited'. The capacity to take on debt depended on both the credit rating required by the lender and the status of the borrower. Stützel highlighted that the latter was determined by the value of the borrower's assets and the degree to which an individual asset could be monetized and deployed as collateral. Hence, restrictive monetary policies could lead to a significant reduction of aggregate expenditures due to their limiting effects on the borrowing capacity of entrepreneurs and governments. In Stützel's view, restrictive policies could have an even stronger (moderating) impact on the ongoing rate of consolidation and repayment of bank loans than on the volume of new loans (Stützel 1959, 72-73).

A related approach: Heinrich Rittershausen

A related approach that emphasized the importance of loan repayments alongside bank deposit creation was developed by Heinrich Rittershausen (1956, 1962). His 'theory of debt repayment chains (Theorie der Entschuldungsreihen / Tilgungsreihen)' (Rittershausen 1962, 225) stresses the self-

liquidating nature of most credit relationships[17]. In Rittershausen's view, bank loans were in the first instance raised by debtors to settle payment obligations. In turn, payment recipients were often suppliers, who were also net debtors, that settled bank debts or supplier obligations with the payment proceeds. Hence, the creation of new bank credit typically triggered a 'chain' or 'wave' of payments and settlements that led to the subsequent destruction of the original credit (Rittershausen 1956, 22, 94). Consequently, Rittershausen criticized the simplistic view that interpreted every grant of bank credit as an expansion of the credit volume. By contrast, bank customers used their inflows and loan proceeds to repay debts. Rittershausen regarded 'only the excess of expansions (new grants of credits) over contractions (repayments of existing credits) as expansive' (Rittershausen 1962, 514). Rittershausen's reasoning therefore resembles that of Lautenbach, who had shown that payment flows between debtors leave the overall credit volume unchanged.

Rittershausen also discussed the relationship between banks and non-banks in the money creation process. He regarded this relationships as intrinsically 'bi-polar'. Both creditor and debtor created (bank) money (Rittershausen 1956, 49). A bank could not regulate whether their creditors withdrew (activate) or kept (neutralize) their deposits. The same principle held with respect to bank debtors. Not bank management but debtors decided when they utilized their lines of credit (Rittershausen 1956, 35). Hence, Rittershausen criticized the notion that banks would always strive to maximize the volume of short-term credit based on profitability considerations as 'illusionary' (Rittershausen 1962, 222). Any

[17] Rittershausen's prototype was the Scottish system of free banking. According to Rittershausen, the main feature of the Scottish system was that bank credit was provided on a short term basis and periodically sterilized at the end of the household / wage-earner to producer / retailer value chain. (Rittershausen 1954, 76-78).

attempt of an individual bank to rapidly expand would fail due a lack of solvent debtors. Any one-sided theory that assumed the always dangerous and cumulative nature of bank credit was mistaken (Rittershausen 1962, 224). Rittershausen argued that the formula of the money multiplier theory was silent about the availability of real debtors, loan conditions and loan security (Rittershausen 1962, 122-123). Consequently, Rittershausen's criticized Lutz (1936), who asserted that the reliance on private 'money' in the form of bank deposits represented a core institutional problem and proposed a prohibition of private deposit creation via a 100% money scheme[18]. In Ritterhausen's view, Lutz was 'overstepping the mark' and had overlooked that 'the great inflations and credit disruptions in world history have been created by states' (Rittershausen 1956, 123; authors' translation).

4. Assessment

In the previous sections we have outlined the elements of credit mechanics and related theoretical approaches. It should be evident by now that we believe that this theory is highly attractive, as it can

[18] Including i) the central bank obtains full control over the money supply; ii) 100% backing of bank cheque deposits by central bank money, iii) prohibition of private bank deposit creation. Bank credit only on the basis of own capital and deposit holdings (Lutz 1936, 89-90). Lutz's work was a response to the Chicago plan (Fisher 1935). However, Lutz considered as an alternative arrangement that the central bank would provide a guarantee to accept all commercial bank assets in a liquidity crisis, including assets that were under normal circumstances not considered eligible collateral. In addition, banks would be required to hold high levels of capital and dispose of high risk assets (Lutz 1936, 94). Note the similarity with the proposals made by Mervyn King, the recent Governor of the Bank of England, in Chapter 7 of his book, The End of Alchemy (King 2016).

integrate the perspective of the individual banker with the forces that drive the determination of the aggregated money stock. If we accept Hahn and Lautenbach's dictum that bank creditors and debtors appear and disappear simultaneously in the act of bank money creation and destruction, then the money supply must be determined by the individual dispositions of banks, bank debtors and bank creditors. The volume of new loans, loan repayment rates and the breakup of payment flows into debtor to debtor, creditor to creditor, creditor to debtor and debtor to creditor streams determine the volume of bank credit and thus the quantifiable, and statistically determinable, money supply in an economy. While it is true that each individual bank loan creates a new deposit, the impact on the overall money stock remains undetermined. The money supply is an aggregated stock variable and thus involves a summation over all other possible bank debtor / creditor actions, which include the destruction of bank money. A higher rate of loan repayments can offset an increased inflow of new loans. Conversely, repayment flows may slow down more quickly than the experienced decrease in the rate of new loans.

Credit mechanics brings into focus the role of the depositor and the impact of different types of payment flows. Bank deposit liabilities that are left standing due to liquidity, transactional and other considerations require a matching level of bank assets to be maintained. Payment flows where both parties are debtors or creditors leave the bank credit volume unchanged. Therefore, many payments across an economy's supply chain can be self-liquidating with very little impact on the volume of bank credit. This includes payment flows associated with investments. Similarly, the credit volume can remain unchanged, when new loans are fully offset by loan repayments, despite very high account turn-over rates. Hence, the employment of credit is the decisive economic variable.

The notion of banks as intermediaries also requires re-assessment . The story contained in many economic textbooks portraits banks as financial intermediaries that borrow funds from lender-savers

and then deploy these funds to borrower-spenders (for instance, Mishkin 2001, 33). This financial intermediation theory of banking firmly took hold in the 1960s (see Werner 2014, 9-12 for an overview). However, the theory that banks act simply as financial intermediaries has now been discredited. The Bank of England in its 2014 Quarterly Bulletin and the German Bundesbank in its April 2017 monthly report referred to the financial intermediation theory of banking as a 'popular misconception' (Deutsche Bundesbank 2017, 17; see also McLeay et al. 2014, 14). Instead, both publications stressed the role of banks as creators of money. This is seemingly at odds with the views of Hahn (1920), Lautenbach (1952) and Pfleiderer (1943), who stressed the role of banks as intermediaries. However, in their story a bank does *not* need to first gather deposits before it can lend these out. In contrast, it is precisely due to the deposit creating capacity of banks that they can insert themselves into a credit chain. Bank money creation can thus be interpreted as a 'monetization of assets and claims' (Veit 1969, 224), which enhances their liquidity (Pfleiderer 1943, 265). Intermediation within the context of 'credit mechanics' signifies that (i) often existing creditor-debtor claims are monetized; (ii) bank credit relies on non-banks being willing to hold bank deposits; and (iii) direct creditor-debtor relationships can be alternatives to bank intermediated credit chains.

Another aspect that deserves further consideration in the money supply debate is the role of collateral and bank capital. Both Stützel (1959) and Rittershausen (1962) make reference to the importance of loan security (see Section 3 above), but the full economic significance of such security has only more recently been asserted by the German economists Heinsohn and Steiger (2013). The premise of their approach is that genuine money creating transactions between banks and non-banks usually involve property assets. A borrowers' debt capacity critically depends on the available assets that she can furnish as loan collateral, while banks require sufficient capital as a buffer for unforeseen losses. The

availability of solvent debtors with suitable collateral together with bank capital requirements, therefore, impose constraints on the volume of money that banks can create. This holds even in a situation where property assets are being monetized at increasing asset values. Property assets and associated institutional arrangements such as loan collateral, rules for eligible central bank collateral, guarantees, sureties and minimum capital adequacy requirements facilitate the recovery of claims and create the foundations of a monetary system (Decker 2015, 931). Hence, the view that private banks could create money 'out of nothing' is unfounded. Equally problematic are proposals, which for this reason seek to prohibit the creation of sight deposit by the private sector (see Decker 2017, 352).

Goodhart (2017, 41-42) concludes in his review of the leading money supply theories that a 'Loans create Deposits' theory 'is now taking over as the consensus approach'. However, he argues that the 'new view' is only a partial approach and exaggerates the role of banks. Goodhart (2017) notes that loans to the non-bank private sector are commonly negotiated in advance in the form of overdraft and stand-by, or credit, limits. The subsequent activation of such arrangements, the actual drawing of the loan, is then left entirely in the hands of the borrower. Then the bank is forced to write up its loan book and, in those cases where the payment by the borrower ends up in another bank, face an outward net payment flow, after the event, which it does not control. Nor is the balance of power in the prior negotiation entirely in the hands of the bank. Competition and regulation constrain the power of each bank to fix loan terms, just as the availability of collateral security limits the ability of the borrower to obtain credit. Banks also hold claims on the public sector, which is, usually, a large bank debtor. The idea that banks unilaterally decide on the volume of bank credit to extend to the public sector is risible. More often, especially at times of crisis, such as wars, the public sector unilaterally determines the volume of

public sector debt, via regulation and repression, that the commercial banking sector is forced to take up.

Nevertheless, recent publications on money creation, for instance, McLeay et al. (2014), Jakab and Kumhof (2015) and Werner (2014, 2016) predominately focus on the money creating capacity of the individual bank. This recent theoretical debate has not taken much, or any, notice of the developments in German monetary economics since Hahn (1920). For instance, Werner's comprehensive review of the theories of banking, which covers a whole century, does not mention Lautenbach or Stützel (Werner 2016). Consequently, the current money supply debate has not yet fully recognized the 'elementary mechanics' of credit (Lautenbach 1952, 192), and the complexities and seemingly paradoxical cases that are associated with bank credit. This implies that the interplay of loan creation and repayment rates; the influence of credit volume neutral debtor-to-debtor and creditor-to-creditor transactions; the role of loan security; and the influence that non-banks and non-borrowing bank creditors (let alone the government as a bank debtor) exert over the money supply are currently not being recognized by too many economists.

A notable exception is, perhaps, the German Bundesbank. In a recent monthly report on '[t]he role of banks, non-banks and the central bank in the money creation process' (Deutsche Bundesbank 2017), the authors clearly recognize the role of non-banks in the determination of the money supply. The interactions between banks, non-banks and central bank that give rise to changes in the money supply are characterized by the Bundesbank as 'highly complex'. Rather than taking a bank centric view of money creation, the authors stress that '[bank] loans are normally granted on the initiative of non-banks'. Also 'credit and collateral quality standards' and lending constraints due to 'capital and liquidity regulation' are mentioned. These are seen to lead to constraints on bank lending and therefore money

supply constraints (Deutsche Bundesbank 2017, 15, 21, 22). Even the influence of non-bank deposit holders which are not borrowers on the money supply, which was a major focus of Lautenbach's, is mentioned (Deutsche Bundesbank 2017, 23). According to the Bundesbank, depositor decisions to use sight deposits for asset purchases or loan repayments can impact on the money supply. Although there are no references to 'credit mechanics' in the Bundesbank article, the differentiated view of the money supply determination, including the role of non-banks, perhaps suggests that some of the spirit of the generation that founded German central banking after WWII, which included Lautenbach, Gleske and Pfleiderer, still lives on.

5. Conclusions

Theoretical analysis of the determination of the money supply in the USA and UK has for too long been based on misleading partial equilibrium approaches. Until quite recently it was based on the money multiplier; which implied that the money stock was driven primarily by changes to the central bank's monetary base. This ignored the fact that, if the central bank wanted to fix a short-term interest rate, which it generally did, then the base had to adjust to commercial banks' need for base money, rather than the reverse.

Subsequently the divorce between the recent explosion in bank balances at the central bank and the sluggish growth in the broader money stock has scuppered the money multiplier approach. But this void is being filled by yet another partial equilibrium analysis, whereby the emphasis is focused entirely on the, supposedly unilateral, ability of the individual bank to create loans, and money, ex nihilo.

In contrast, we argue here that 'credit mechanics', originally developed by Wilhelm Lautenbach in the 1930s, should be an important contribution to monetary economics and money supply theory. The

theory overcomes a one-sided view of money creation, as often encountered in monetary theory, occurring when the analytical focus remains limited to the actions of an individual bank. By considering the arithmetic relationships amongst bank accounts and accounting identities that must hold between bank creditor and bank debtor accounts, credit mechanics provides an essential framework to consider systemically the many various forces that exert an influence over the money supply. Driving forces that must be recognized include the actions of banks, non-bank borrowers and non-bank deposit holders at an individual as well as an aggregate level. With the standard textbook models of money creation (monetary multiplier story) and banking (banks as financial intermediaries) now discredited, a more general approach to money supply theory involving credit mechanics and the influence of all those participating, bank debtors and creditors, both the non-bank private and the public sector, needs to be established.

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