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Abstract

Joseph A. Schumpeter is one of the most famous economists of the 20th century and the 'patron saint' of the finance and growth literature. We have discovered that the prevailing literature has, however, misinterpreted Schumpeter, which leads to puzzling empirical results and difficulties in explaining even fundamental relationships. We argue that this is due to a misrepresentation of the role of banks and liquidity creation and the role of household saving. After a critical discussion of the literature, we provide our own empirical analysis using a panel of 43 countries to explore the relationships between the important variables of the finance and growth literature. Our empirical analysis above all supports Schumpeter's view that credit growth supports GDP growth while saving is irrelevant for credit growth and GDP growth. In sum, a correct interpretation of Schumpeter helps to overcome the theoretical and empirical challenges which confront the prevailing literature.

Keywords: Finance-growth nexus; Finance; Financial development; Economic growth; Economic development; Financial intermediation; Bank credit; Liquidity creation; Saving.
JEL codes: B20; B22; C10; E44; F30; F43; G21; O11; O16; O40.

"Schumpeter is a sort of patron saint in this field. I may be alone in thinking that he should be treated like a patron saint: paraded around one day each year and more or less ignored the rest of the time."

- Solow (1994, p. 45)

1 Introduction

Joseph A. Schumpeter (1883-1950) is one of the most famous economists of the 20th century. He is famous above all for coining the expression of 'creative destruction' in his book 'Capitalism, Socialism and Democracy' (Schumpeter, 1942). But much more important for economic theory are his analyses of the relationship between the financial system and economic growth. Accordingly, the whole literature on the finance and growth nexus explicitly refers to Schumpeter as a theoretical pioneer in this field.

The motivation for our study is the discovery that the prevailing literature on this subject has misinterpreted Schumpeter. It presents Schumpeter as an advocate of a paradigm that he explicitly rejected. While Schumpeter advocated an approach in which money plays a dominant and independent role ('monetary analysis'), he is portrayed as a proponent of a school of thought in which the monetary sphere is merely a reflection of the goods sphere ('real analysis').

The price for this misinterpretation is high. We see it as an explanation for the fact that the prevailing literature must admit – after decades of research – that it has difficulties in explaining fundamental relationships, above all the liquidity creation of by banks. In addition, the literature has so far not been successful in providing convincing evidence of positive effects of the financial system on growth in advanced economies. It also has not been able to find evidence for the link between saving and credit growth, which is a central transmission channel of the real analysis.

Our paper shows that a correct interpretation of Schumpeter helps to overcome the theoretical and empirical challenges which confront the prevailing literature. Due to its monetary approach, the 'true Schumpeter' provides a more realistic framework for the analysis of the finance and growth nexus.

We first present Schumpeter's main insights on the role of the financial system that depend on his critical view of the 'real analysis'. He regards the financial system as an independent source of purchasing power that does not rely on a supply of saving. As producers of money and credit, banks have the unique power to finance innovative investors 'out of nothing'. Schumpeter explicitly refutes the view that saving is a source for financial funds. Instead, he calls it the 'economic

Disturber General' (Schumpeter, 1954, p. 280).

We then present the interpretation of Schumpeter especially in the publications by Robert G. King, Ross Levine and Thorsten Beck (e.g. King and Levine (1993a), Levine (2005), Levine (2021) and Beck, Levine, and Loayza (2000)), who are the leading authors in this field and on whose research almost all other authors in the finance and growth literature base their work. It is surprising to see how the authors present Schumpeter's work in the categories of the 'real analysis' by reducing the function of banks to the intermediation and mobilization of 'savings' from savers to investors. In this interpretation of Schumpeter, banks are not producers of purchasing power, they only contribute to the 'easing of frictions' in the flow of saving from private households to investors.

As Schumpeter did not elaborate the differences between the 'real analysis' and the 'monetary analysis' in detail, we present the 'critical assumptions' and the 'dominant causal mechanisms' (Rodrik, 2015) of the two approaches. We show that the cause-effect relationships go in opposite directions. Therefore, the misinterpretation of Schumpeter is problematic not only because it gives a flawed portrayal of the history of economic thought. It also puts into question the whole analytical apparatus of the prevailing literature on the finance and growth nexus as well as the standard models used in modern macroeconomic theory.

We then present the empirical evidence on the finance and growth nexus. First, we discuss the papers that analyse the relationship between 'financial development' and growth. Goldsmith (1969), a pioneer in this area, defines 'financial development' as a dynamic process. In contrast, the subsequent literature sees it as a static and qualitative concept which it tries to approximate by quantitative indicators. For large samples, there is evidence for a positive impact of the financial sphere on growth. However, these samples are biased by a large share of developing countries. For advanced economies with their large financial sectors, no such evidence has been provided so far. More recent studies even show a negative impact when a certain threshold of finance is reached - a result that is difficult to reconcile with the model world of the real analysis.

Second, we discuss the recent research on the liquidity creation by banks e.g. (Beck, Döttling, Lambert, & Van Dijk, 2020). While this approach seems to reflect the ideas of 'true Schumpeter', we show that it is only a different version of the standard static analysis. 'Liquidity creation' - as defined by Beck et al. (2020) - is not a dynamic, but a static concept. Conceptually it is a variant of a monetary aggregate that differs from existing definitions by a specific weighting scheme. Therefore, the relationship between 'liquidity creation' and nominal GDP per capita, which plays a decisive role in this analysis, can be interpreted as a variant of the quantity theory and it cannot be used as evidence for a positive effect of 'liquidity' creation on economic growth.

Third, we look at studies which analyse the interrelationship between saving and the financial system. Surprisingly, this transmission channel, which is crucial for the real analysis, has not attracted too much research interest. But the available studies show that there is no evidence for such relationships.

In Section 6 we test the hypotheses that can be derived from a correct interpretation of Schumpeter's thoughts. The main hypothesis is a positive effect of credit growth on GDP growth. But as Schumpeter also emphasized the use of credit for unproductive purposes, there is not necessarily a positive relationship. The second hypothesis is the independence of credit growth from saving. In addition, there should be also no effect of saving on GDP growth.

Based on credit data from the data base of the Bank for International Settlements (BIS) we test these hypotheses using panel estimations. For different specifications it always shows a strong positive link between credit growth and GDP growth in developed as well as in developing countries. For a static credit indicator, as it is used in the literature, we cannot find positive growth effects. In line with the literature, our analysis also cannot find effects of saving on GDP growth. To test the causality between credit growth and GDP growth we then use a structural vector-autoregressive model (VAR) for the United States, for which long time series with quarterly data are available. The impulse response functions suggest a positive impact of a credit supply shock on GDP growth, while for a saving shock we find negative and insignificant growth effects. Finally, we run Granger causality tests for 43 countries to analyse the interrelationship between GDP growth and credit growth. The data show that the causality runs in both directions which is compatible with Schumpeter's '*secondary wave*' approach. As robustness check we use Forecast Error Variance Decompositions (FEVD) that support our Granger test results. Countries with a Granger causality running from credit to GDP also show a strong contribution of credit shocks to GDP.

In section 7, we summarize our findings that support the '*True Schumpeter*' and that explain the flaws of the literature which we relate to the misinterpretation of Schumpeter.

2 Main insights from the 'true' Schumpeter:

In our view, Schumpeter's contributions to the finance and growth nexus contain five essential insights:

- The differentiation between **'real analysis'** and **'monetary analysis'**, as he calls it, as alternative theoretical strategies for modelling the financial system,

- the ability of banks to create **'new purchasing power of nothing'**,
- the decisive role of banks and the financial system in the **innovation process**,
- the potentially **adverse effects of credit on growth**, but also
- the **obstructing effect of saving** on the process of economic flows.

In order to highlight Schumpeter's true ideas and to contrast them with the misinterpretations in the literature we will provide relatively long quotes from his works in this section. We think that this is necessary as the misinterpretation can be related to abbreviated quotes that distort their true meaning.

'Real analysis' versus 'Monetary analysis'

In his opus magnum, 'History of Economic Analysis', Schumpeter makes a distinction between two different approaches for modeling the financial system, which he referres to as 'real analysis' and 'monetary analysis'. Schumpeter (1954, p. 264) describes the 'real analysis' as follows:

> *'Real Analysis proceeds from the principle that all the essential phenomena of economic life are capable of being described in terms of goods and services, of decisions about them, and of relations between them. Money enters the picture only in the modest role of a technical device that has been adopted in order to facilitate transactions. This device can no doubt get out of order, and if it does it will indeed produce phenomena that are specifically attributable to its modus operandi. But so long as it functions normally, it does not affect the economic process, which behaves in the same way as it would in a barter economy: this is essentially what the concept of Neutral Money implies. Thus, money has been called a 'garb' or 'veil' of the things that really matter, both to households or firms in their everyday practice and to the analyst who observes them. Not only can it be discarded whenever we are analysing the fundamental features of the economic process but it must be discarded just as a veil must be drawn aside if we are to see the face behind it. (...); saving and investment must be interpreted to mean saving of some real factors of production and their conversion into real capital goods, such as buildings, machines, raw materials; and, though 'in the form of money,' it is these physical capital goods that are 'really' lent when an industrial borrower arranges for a loan.'*

And he describes the 'monetary analysis' as follows:

> *'Monetary Analysis, in the first place, spells denial of the proposition that, with the exception of what may be called monetary disorders, the element of money is of secondary importance in the explanation of the economic process of reality. (...) Monetary Analysis introduces the element of money on the very ground floor of our analytic structure and abandons the idea that*

> *all essential features of economic life can be represented by a barter-economy model. Money prices, money incomes, and saving and investment decisions bearing upon these money incomes, no longer appear as expressions—sometimes convenient, sometimes misleading, but always nonessential—of quantities of commodities and services and of exchange ratios between them: they acquire a life and an importance of their own, and it has to be recognized that essential features of the capitalist process may depend upon the 'veil' and that the 'face behind it' is incomplete without it. It should be stated once for all that as a matter of fact this is almost universally recognized by modern economists, at least in principle, and that, taken in this sense, Monetary Analysis has established itself.' Schumpeter (1954, p. 265)*

Except for Keynes (1933), to our knowledge there are no other economists who made such an explicit differentiation between the two alternative economic paradigms. Unfortunately, Schumpeter never developed a comprehensive theory of the 'real analysis' and the 'monetary analysis'. But one can approximate the 'real analysis' with the classical theory, that is embedded in the loanable funds theory, as well as with modern macroeconomic theories like the Real Business Cycle theory and the New Keynesian Macroeconomics. A key feature of these theories is the total neglect of money or a subordinate role of money and banks in the economic process. As a result, the real sphere is identical with the financial sphere. The 'monetary analysis' can be approximated with the standard Keynesian theory as it is presented above all in the standard IS/LM-model. In this approach, the monetary sphere is independent from the real sphere. We present the critical assumptions and the dominant causal mechanisms of the two approaches in section 4.

Banks as producers of purchasing power

The view that banks are 'producers of purchasing power' is a direct consequence of the monetary analysis. Schumpeter presented this theory already in 1911 in his book 'Theorie der wirtschaftlichen Entwicklung' (engl.: 'The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle', published in 1934). In this book, Schumpeter (1934, p. 62) makes a clear statement on the role that bankers perform in the economy:

> *'The banker, therefore, is not so much primarily a middleman in the commodity 'purchasing power' as a producer of this commodity. (. . .) He is essentially a phenomenon of development, though only when no central authority directs the social process. He makes possible the carrying out of new combinations, authorizes people, in the name of society, as it were, to form them. He is the ephor[1] of the exchange economy.'*

In Schumpeter's view, this role derives from the ability of banks to create money 'out of nothing':

[1] Leader in ancient Sparta

'It is always a question, not of transforming purchasing power which already exists in someone's possession, but of the creation of new purchasing power out of nothing — out of nothing even if the credit contract by which the new purchasing power is created is supported by securities which are not themselves circulating media — which is added to the existing circulation' (Schumpeter, 1934, p. 61).

For Schumpeter (1934, p. 87), this view was nothing special:

'The creation of money by the banks establishing claims against themselves, which is described by Adam Smith, and indeed by still earlier authors in a way quite free form popular errors, has become a commonplace today (. . .).'

Indeed, as Werner (2014) shows, the so-called 'credit creation theory' appeared to have been widespread in the late 19th and early 20th century in English and German language academic publications. According to Werner (2014), by 1920 the theory had become so widespread that it was dubbed 'current view' or 'traditional theory'.

Bankers as innovators

The third element of Schumpeter's contribution to the finance and growth nexus is the insight that banks are not only able to create purchasing power out of nothing, but that bankers use this power to innovate the economy:

'The essential function of credit in our sense consists in enabling the entrepreneur to withdraw the producers' goods which he needs from their previous employments, by exercising demand for them, and thereby to force the economic system into new channels' (Schumpeter, 1934, p. 93).

Thus, for Schumpeter growth is not the outcome of consuming less, i.e., saving, and accumulating an all-purpose good as capital. Instead, growth is the outcome of investing differently by employing existing resources in an innovative way (*'Andersverwendung'*):

'That rudiment of a pure economic theory of development which is implied in the traditional doctrine of the formation of capital always refers merely to saving and to the investment of the small yearly increase attributable to it. (. . .) The slow and continuous increase in time of the national supply of productive means and of savings is obviously an important factor in explaining the course of economic history through the centuries, but it is completely overshadowed by the fact that development consists primarily in employing existing resources in a different way, in doing new things with them, irrespective of whether those resources increase or not. (. . .) Different methods of employment, and not saving and increases in the

available quantity of labor, have changed the face of the economic world in the last fifty years' (Schumpeter, 1934, p. 57).[2]

Adverse effects of credit

While Schumpeter is explicit about the role of bankers and credit creation for innovation and economic development, he is also aware of potential adverse effects of credit creation. A reaction to the initial employment of existing resources in different ways through credit creation is what Schumpeter refers to as a 'secondary wave' analogy:

> *'Speculation in the narrower sense will take the hint and [...] stage a boom even before prosperity in business has had time to develop. New borrowing will then be no longer confined to entrepreneurs, and 'deposits' will be created to finance general expansion, each loan tending to induce another loan, each rise in price another rise. [...] Indeed, the phenomena of this secondary wave may be and generally are quantitatively more important than those of the primary wave [...] the processes of the secondary wave, in fact, supply us with plenty of instances of unproductive loans'* (Schumpeter, 1939, p. 150-151).

Schumpeter then provides a description of the processes of the secondary wave:

> *'[T]he processes of the secondary wave, in fact, supply us with plenty of instances of unproductive loans. Once a prosperity has got under sail, households will borrow for purposes of consumption, in the expectation that actual incomes will permanently be what they are or that they will still increase; business will borrow merely to expand on old lines, on the expectation that this demand will persist or still increase; farms will be bought at prices at which they could pay only if the prices of agricultural products kept their level or increased. In these cases there is no increase in productivity at all, and it is this fact and this fact alone which is responsible for a fall in prices sometimes spelling disaster, even without speculation in the narrower sense of the word, which however never fails to add to the structure of debt'* (Schumpeter, 1939, p. 152-153).

What follows with respect to the finance and growth nexus is the importance of distinguishing between credit used for productive purposes and credit used for unproductive means. While the former should have a clear positive effect on economic growth, the latter could in fact even have adverse growth effects.

> *'[I]t should be pointed out that distinction between debts according to purpose, however difficult to carry out, is always relevant to diagnosis and may be relevant to preventive policy'* (Schumpeter, 1939, p. 153).[3]

[2] See also (Schumpeter, 1939, p. 110): 'But if innovation is financed by credit creation, the shifting of the factors is effected not by the withdrawal of funds—'canceling the old order'—from the old firms, but by the reduction of the purchasing power of existing funds which are left with the old firms while newly created funds are put at the disposal of entrepreneurs : the new 'order to the factors' comes, as it were, on top of the old one, which is not thereby canceled.'

[3] The distinction of credit in productive and unproductive means with respect to Schumpeter's theories has been further discussed by Bezemer (2014).

Saving as the 'economic Disturber General'

The ability of banks to create money out of nothing implies that there is no need for saving as an input for bank lending. Thus, Schumpeter (1954, p. 1080) argues that it is:

> *'(...) highly inadvisable to construe bank credit on the model of existing funds' being withdrawn from previous uses by an entirely imaginary act of saving and then lent out by their owners. It is much more realistic to say that the banks 'create credit,' that is, that they create deposits in their act of lending, than to say that they lend the deposits that have been entrusted to them. And the reason for insisting on this is that depositors should not be invested with the insignia of a role which they do not play. The theory to which economists clung so tenaciously (. . .) attributes to them an influence on the 'supply of credit' which they do not have. The theory of 'credit creation' not only recognizes patent facts without obscuring them by artificial constructions; it also brings out the peculiar mechanism of saving and investment that is characteristic of fullfledged capitalist society and the true role of banks in capitalist evolution. With less qualification than has to be added in most cases, this theory therefore constitutes definite advance in analysis.'*

While he rejects the view that saving is a source for funds, Schumpeter goes even further as to regard saving as detrimental for the financial streams of the economic system:

> *'In fact, so soon as we see the economic process—primarily or exclusively—as a system of streams of expenditures, we shall be tempted to expect all sorts of disturbances from any obstruction to the even flow of these streams and, vice versa, to attribute any disturbance we observe in the economic process to such obstructions—as at least its proximate cause. (. . .) In particular, we may be led to attach more importance to people's 'making full use of the income they receive from firms,' that is, to their spending it promptly on products of these firms than to the commodities they acquire in so doing and the prices at which they acquire them. By the same token, we may be led to identify Saving with obstruction to that flow of expenditure and, in the limiting case, to see it in the role of economic Disturber General'* (Schumpeter, 1954, p. 267).

Box 1: Saving or Savings?

In the literature on finance and growth, the term 'savings' plays a decisive role. In contrast, the term 'saving' is hardly used. This terminology raises the problem that 'savings' is not a concept of national account statistics or financial account statistics. 'Saving', however, is a clearly defined statistical concept. It is a flow variable measuring the increase in net wealth of private households, corporations and the government that is not attributable to valuation changes.

Thus, 'savings' cannot be considered a scientific concept. In common parlance, 'savings' means *'the money one has saved, especially at a bank or public institution'*.[a] Interpreting 'savings' in this way it could be considered a stock variable which is reflected, e.g., in the term 'savings accounts' in monetary statistics.

The use of 'savings' in the literature therefore confuses stocks with flows. For example, it is not clear, whether the 'pooling' or the 'mobilization of savings' (Levine, 2005) implies more saving (flow) or a more effective use of existing stocks of financial funds (stock). If it implies a stock of funds, it would be necessary to clarify whether these are bank deposits or cash holdings.

The stock character of 'savings' in the literature becomes obvious in an example provided by Levine (1997, p. 702):

> *'Production requires capital. Even if Fred had the savings, he would not wish to put all of his savings in one risky investment. Also, he wants ready access to savings for unplanned events; he is reluctant to tie up his savings in the truck project, which will not yield profits, if it does yield profits, for a long time.'*

Thus, the literature on the finance and growth nexus suffers from using 'savings' as a key concept for which no clear statistical definition is available and which unavoidably leads to a confusion between stocks and flows.

It is interesting to note that Schumpeter tries to make such a differentiation. In the German version (Schumpeter, 1911), he uses 'Sparen' (saving) if he has flows in mind and terms like 'Sparfonds' (saving funds) or 'Sparsumme' (sum of saving) if he has stocks in mind. In the English translation (Schumpeter, 1934), a differentiation between 'saving' for flows and 'savings' for stocks is made. But this can also lead to confusion and the differentiation is not always made in a consistent way.

This confusion was already identified by Kalecki: *'I have found out what economics is; it is the science of confusing stocks with flows'* (quoted in Robinson (1982, p. 295).

The incorrect usage of the term 'savings' is not only a semantic problem. It blurs the main deficiency of the Classical interest-rate theory that in reality 'saving' as a flow is not a supply of funds. Speaking of 'savings' creates the association that a stock of existing funds is provided.

[a] https://www.lexico.com/definition/saving.

3 The misinterpretation of Schumpeter in the finance and growth literature

Since the 1990s, a vast literature on the finance and growth nexus has developed. The main contributors are above all Robert G. King, Ross Levine and Thorsten Beck with numerous and widely cited papers and contributions to handbooks (e.g. King and Levine (1993a), Levine (2005), Levine (2021) and Beck et al. (2000)). We will therefore focus on the work by these three authors. In almost all their papers they quote Schumpeter as a theoretical pioneer for their research. The title of one of the first papers by King and Levine (1993a) is 'Finance and Growth: Schumpeter might be right'. In this paper, the authors assert:

> *'(. . .) we are developing a more complete Schumpeterian vision of development by incorporating key roles for financial intermediaries'* (King & Levine, 1993a, p. 735).

As a proof King and Levine quote Schumpeter (1934), but in a strongly abbreviated and misleading form:[4]

> *'Yet, an integral part of the Schumpeterian story is that financial intermediaries make possible technological innovation and economic development. 'The banker ... authorizes people, in the name of society as it were, to ... [innovate]' Schumpeter(1911, p. 74)'* (King & Levine, 1993a, p. 735).

Comparing this quote with the full text shows that from the very beginning the authors present Schumpeter's crucial statement in a reduced and distorted way, which omits the key message that banks are producers of purchasing power. The fact that Schumpeter puts 'producer' in italics in his book underlines the importance he attaches to this statement. For better comparison we have underlined the omitted parts of the full quote:

> *The banker , therefore, is not so much primarily a middleman in the commodity 'purchasing power' as a* ***producer*** *of this commodity. However, since all reserve funds and savings to-day usually flow to him, and the total demand for free purchasing power, whether existing or to be created, concentrates on him, he has either replaced private capitalists or become their agent; he has himself become the capitalist par excellence. He stands between those who wish to form new combinations and the possessors of productive means. He is essentially a phenomenon of development, though only when no central authority directs the social process. He makes possible the carrying out of new combinations, authorises people, in the name of society as it were, to form them* (Schumpeter, 1934, p. 62).

[4] Additionally, King and Levine (1993a, p. 735) erroneously refer to Schumpeter (1911), whereas in Levine (2021) it is quoted as Schumpeter (1912).

Confronting this literature with the insights that we have attributed to Schumpeter leads to interesting results. First, in their theoretical analyses, the authors do not pay any importance to Schumpeter's fundamental distinction between 'real analysis' and 'monetary analysis'. Instead, without any discussion they base their whole research program on the paradigm of the 'real analysis' which is the opposite of Schumpeter's approach.

In the same vein, the authors never discussed the credit creation theory, i.e., the ability of banks to create money out of nothing. Instead, they follow the 'financial intermediation theory' (Werner, 2014), according to which banks are intermediaries ('middlemen') channelling savings (see Box 2) between savers and investors. The authors do not hesitate to present Schumpeter as an adherent of the financial intermediation theory, even though it is diametrically opposed to Schumpeter's approach. E.g., Levine (2021, p. 13) writes:[5]

> *'Schumpeter was stressing that one of the key functions of the financial system is deciding which firms and individuals get to use society's savings.'*

King and Levine (1993a, p. 717) state:

> *'In 1911 Joseph Schumpeter argued that the services provided by financial intermediaries - mobilizing savings, evaluating projects, managing risk, monitoring managers, and facilitating transactions - are essential for technological innovation and economic development.'*

By misinterpreting Schumpeter as an adherent of the intermediation view, the literature also misses his point that the banker is the decisive actor ('ephor') in the innovation process. Instead, the papers emphasize the key role of entrepreneurs and also the decisions of savers which are irrelevant for credit creation in Schumpeter's world. E.g., Aghion, Howitt, and Levine (2018, p. 5) present the 'Schumpeterian growth paradigm' as follows:

> *'In this paradigm, growth reflects the decisions of profit-maximizing entrepreneurs, who determine how much to invest in the costly, risky – and potentially lucrative – process of innovation. That is, the primary determinants of long-run growth are the entrepreneurs' incentives and abilities to identify, fund, and commercialize quality-improving innovations. Since entrepreneurs may lack the wealth to self-finance their innovative ideas or may be reluctant to bear all the risks, there is a role for the financial system to help (1) entrepreneurs mobilize funds from savers; (2) savers identify, fund, and monitor entrepreneurs; and (3) savers and entrepreneurs to trade, hedge, and pool risks.'*

From this view it is not far to an interpretation of Schumpeter where his emphasis on the decisive role of banks and the financial system for innovation is totally neglected. In the 'Schumpeterian

[5] Also Beck et al. (2000, p. 262) state: *'Joseph Schumpeter argued in 1911 that financial intermediaries play a pivotal role in economic development because they choose which firms get to use society's savings (see Schumpeter, 1934).'*

Growth Theory' presented by Aghion, Akcigit, and Howitt (2014) money and the financial system do not play a role at all. E.g., Aghion et al. (2014, p. 517) in their paper 'What do we learn from Schumpeterian Growth Theory?' explain the Schumpeterian character of their model with only one final good as follows:

> *'This model is Schumpeterian in that: (i) it is about growth generated by innovations; (ii) innovations result from entrepreneurial investments that are themselves motivated by the prospects of monopoly rents; (iii) new innovations replace old technologies: in other words, growth involves creative destruction.'*

Thus, in the so-called 'Schumpeterian Growth Theory' (see e.g. also Aghion and Howitt (1990), Aghion, Akcigit, and Howitt (2015) or He, Luo, and Zou (2020)) no room is left for the banker which Schumpeter regarded as the decisive actor in the innovation process.

In sum, the publications by King, Levine, Beck and other scholars in this field present Schumpeter as a representative of a theoretical approach that he explicitly criticized.[6] They turn his central insights on the finance and growth nexus into their exact opposite. Schumpeter, who promoted monetary analysis, thus appears as a supporter of real analysis. To this end, the authors insinuate statements, especially on saving that he never made.

4 The mechanics of the real analysis and the monetary analysis

Although Schumpeter (1954) highlighted the differences between 'real analysis' and 'monetary analysis', he never explicitly elaborated their paradigms. This also applies to Keynes (1933), who advocated a similar differentiation under the labels 'real-exchange economy' and 'monetary economy'.[7] As these terms are also not common in the economic terminology, we give a short presentation of the model design of the two concepts, their 'critical assumptions' and their 'dominant causal mechanisms' (Rodrik, 2015). We will see that these mechanisms are diametrically opposed. This underlines the importance of Schumpeter's differentiation among the two concepts. It also shows that the misinterpretation of his work is not only relevant for a correct

[6] The same applies to Gerschenkron, a student of Schumpeter. Beck (2012, p. 184) writes: *'Government-owned banks have often been seen as critical in helping overcome market failures and funnel domestic savings to strategically important projects (Gerschenkron, 1962).'* But Gerschenkron (1962, p. 45) emphasizes the credit creation theory: *'The focal role in capital provision in a country like Germany must be assigned not to any original capital accumulation but to the role of credit-creation policies on the part of the banking system. It is true that the banks also collected and passed on to entrepreneurs both current savings and some previously created assets that could be converted into claims on current output, but this is much less significant.'*

[7] Keynes (1933, p. 408): *'Most treatises on the principles of economics are concerned mainly, if not entirely, with a real exchange economy; and – which is more peculiar – the same thing is also true of most treatises on the theory of money. ... The theory which I desiderate would deal, in contradistinction to this, with an economy in which money plays a part of its own and affects motives and decisions and is, in short, one of the operative factors in the situation, so that the course of events cannot be predicted, either in the long period or in the short, without a knowledge of the behaviour of money between the first state and the last. And it is this which we ought to mean when we speak of a monetary economy. ... Everyone would, of course, agree that it is in a monetary economy in my sense of the term that we actually live. ... The idea that it is comparatively easy to adapt the hypothetical conclusions of a real wage economics to the real world of monetary economics is a mistake.'*

representation of the history of economic theory. It also matters for the empirical relevance of models that try to analyse the role of the financial system and its contribution to economic development.

4.1 Real analysis: 'The banker as middleman of purchasing power'

The theoretical core of the real analysis is the classical theory of the financial market (or loanable funds theory) as it is presented in standard macroeconomic textbooks (e.g. Mankiw (2019)). The theory was shaped by Böhm-Bawerk (1890) and Fisher (1930). It uses the analytical framework for the **intratemporal exchange** of two goods to analyse the **intertemporal exchange**, where a good today is exchanged for the same good tomorrow. In the words of Fisher (1930, p. II.IV.3):

> *'The theory of interest bears a close resemblance to the theory of prices, of which, in fact, it is a special aspect. The rate of interest expresses a price in the exchange between present and future goods.'*

This model is based on the *'critical assumption'* (Rodrik, 2015) of a general purpose good (GPG), that can be used interchangeably as a

- consumption good,
- financial asset ('savings'), if it is saved by private households and becomes available as a supply of 'funds',
- investment good ('capital'), which increases the capital stock, and
- sole output of the production process for consumption in the future.

Barro and Sala-i Martin (2004, p. 25) illustrate the assumption of the general purpose good as follows:

> *'One way to think about the one-sector technology is to draw an analogy with farm animals, which can be eaten or used as inputs to produce more farm animals. The literature on economic growth has used more inventive examples – with such terms as shmoos, putty or ectoplasm – to reflect the easy transmutation of capital goods into consumables, and vice versa.'*[8]

As the GPG is a hermaphrodite of a real and a financial asset, the model can be presented as model for the goods market or the financial market although it leaves no role for money, i.e., bank deposits

[8] See also Obstfeld and Rogoff (1996, p. 15): *'A unit of capital is created from a unit of the consumption good. This process is reversible, so that a unit of capital, after having been used to produce output, can be 'eaten.' You may find these assumptions unrealistic, but they help us sidestep some technical issues that aren't really central here.'*. This assumption also dominates the neoclassical growth theory: *'Probably the best method of exposition is to think of the neoclassical growth model as being a story about an imaginary economy that has only one produced good that can be consumed directly or stockpiled for use as a capital good. It is then an exact theory of that economy; and it becomes a difficult practical matter whether it provides a useful analogy of a multi-commodity economy'* (Solow, 2000, p. 351).

or cash. This is the reason why Schumpeter speaks of a 'real analysis'.

The assumption of a GPG has far-reaching implications. As the only financial asset is at the same time a real asset, financial transactions and flows are identical with real transactions and flows: Financial decisions are identical with consumption or investment decisions:

- The supply of the GPG, i.e., the **supply of 'savings'** on the capital market, is identical with the saving decision which is identical with the consumption decision,
- The demand for the GPG, i.e., the **demand for 'savings'** on the capital market, is identical with the investment decision.

Thus, real analysis leaves no room for financial decisions that are not identical with consumption decisions (=saving decisions) or investment decisions that increase the capital stock. The financial sphere is identical with the real sphere (Bertocco, 2007). Borio (2016, p. 268) speaks of 'real economies disguised as monetary ones'. Or as Schumpeter (1954, p. 265) puts it, financial transactions cannot 'acquire a life and an importance of their own'.

In this model world, private households and their saving decisions play a decisive role for the financing of investments. Only if consumers are willing to give up consumption, the GPG becomes available as a supply of funds or 'savings' which investors can borrow on the capital market and then use as 'capital' in the production process. Correspondingly, the role of banks and other financial institutions is limited. As they are unable to produce the GPG, they can only operate as 'resource-trading intermediaries that, wholly or primarily, store, borrow and lend physical commodities' (Jakab & Kumhof, 2019, p. 1). Thus, the 'financial intermediation theory' is a logical outflow of the real analysis.

As the quotes from the finance and growth literature make clear, this line of research is based unreservedly on the 'real analysis'. Accordingly, for these authors, the contribution of banks can only consist in the intermediary function of 'easing market frictions' between savers and investors. Levine (1997, p. 699) describes the functions of financial intermediaries as follows:

> *'Mobilizing the savings of many disparate savers is costly, however. It involves (a) overcoming the transaction costs associated with collecting savings from different individuals and (b) overcoming the informational asymmetries associated with making savers feel comfortable in relinquishing control of their savings.'*

The difference to Schumpeter's views is obvious. While he emphasized the role of the banker as a producer of purchasing power, the real analysis reduces the banker to a virtual 'middleman' collecting the savings of private households and transferring them to investors.

A closer look, e.g. at the function 'mobilizing of savings' even casts doubt on the role of banks in the real analysis. Levine (1997, p. 699) describes this function as follows:

> *'Furthermore, mobilization involves the creation of small denomination instruments. These instruments provide opportunities for households to hold diversified portfolios, invest in efficient scale firms, and to increase asset liquidity. Without pooling, households would have to buy and sell entire firms. By enhancing risk diversification, liquidity, and the size of feasible firms, therefore, mobilization improves resource allocation.'*

These functions are typically not performed by banks but by stock markets that provide small denomination instruments and make it possible for households to invest in firms without the need to buy and sell entire firms.

4.2 Monetary analysis: The banker as producer of purchasing power

The monetary analysis is based on a more complex model of the economy and the financial system. The IS/LM-model provides a simple analytical framework for this approach. An obvious contrast to the real analysis are the more realistic critical assumptions: There is an explicit role for money, i.e., bank deposits, as a means of payment and a store of value. There are also other financial assets such as bonds and central bank reserves. On the real side of the model, there are a consumption good and an investment good which are not interchangeable and cannot be used as a financial asset. In fact, these critical assumptions produce a substantive difference in the conclusions of the model.

Above all, the financial market is no longer identical with the goods market. The IS/LM model nicely shows this feature of the monetary analysis. While the IS-curve represents the equilibrium on the goods market which is determined by consumption/saving and investment decisions, the LM-curve represents the equilibrium on the financial market which is determined by

- **the monetary policy of the central bank** which controls the interest rate or the supply of the monetary base,
- the **lending of commercial banks**, which is independent of saving but controlled by the central bank. The control of bank lending can be either performed with the policy rate of the central bank (Bofinger, Reischle, & Schächter, 2001) or with the supply of the monetary base. The letter is presented with the flawed multiplier approach (Bofinger et al., 2001; Ihrig, Weinbach, & Wolla, 2021; Werner, 2014)
- the **portfolio decisions of money holders** who can decide to hold either bank deposits ('speculative demand for money') or long-term bonds as a store of value.

In this model, saving provides no supply of funds and it has therefore no direct impact on the financial sphere. Changes in the propensity to save only affect the slope of the IS-curve.

Instead of providing a source of funds, in the monetary analysis saving becomes the *'economic Disturber General'* (Schumpeter, 1954, p. 267). This can be explained with a simple example that analyses the economic process as a *'stream of expenditures'* (Schumpeter, 1954, p. 267).

We split up the economy in the business sector and the household sector. As a default case, let us assume, Jane normally spends her whole monthly income of 3,000 USD. In this case at the end of the month, Jane has nothing on her bank account and her net wealth is zero. The business sector has 3,000 USD on its bank account and its net wealth is 3,000 (assuming no costs for inputs). Thus in the default case, the money flow which started with wage payments returns to the business sector.

What happens, if Jane decides to save 3,000 USD by reducing her consumption? In this case, the money flow that started with the wage payment to Jane stops. At the end of the month, Jane has 3,000 USD on her bank account and her net wealth has increased by 3,000 USD. The business sector has 3,000 USD less on its bank account and its net wealth is 3,000 USD lower. Thus, saving does not increase the amount of funds in the economy. Compared with the default situation, it simply redistributes the existing funds from the business sector to the household sector. But instead of stimulating investment by lowering interest rates, saving discourages investment by a lower cash-flow and lower profits of the business sector.

Accordingly, in the monetary analysis, banks are the sole producers of financial funds, i.e., money. While the finance and growth literature has neglected this mechanism since decades, in recent years the Bundesbank (2017) and the Bank of England (McLeay, Radia, & Thomas, 2014) have supported this key insight of the monetary analysis. E.g., the Bundesbank (2017, p. 17) argues:

> *'(. . .) a bank can grant loans without any prior inflows of customer deposits. In fact, book money is created as a result of an accounting entry: when a bank grants a loan, it posts the associated credit entry for the customer as a sight deposit by the latter and therefore as a liability on the liability side of its own balance sheet. This refutes a popular misconception that banks act simply as intermediaries at the time of lending – ie that banks can only grant loans using funds placed with them previously as deposits by other customers.'*

With the dominant role of banks in the monetary analysis, the need for an 'easing of financial frictions' which the finance and growth literature regards as the key role of banks, is less obvious. This applies above all to the 'mobilization of savings' (Levine, 2021). While in the real analysis, more saving implies more investment, in the monetary analysis, more saving is detrimental to

investment. In addition, as the example shows, the saving of households automatically leads to an increase of their bank deposits so there is no need for banks to 'mobilize savings'.

In the same way, the role of banks to *'(1) screen investments and choose where to allocate resources—and hence economic opportunities, (2) exert corporate governance over the resources that they provide to firms and individuals (...)'* (Levine, 2021, p. 6) is not an 'easing of frictions' between savers and investors. It is the core function of banks in a monetary economy as they cannot lend without screening investments.

Finally, monetary analysis opens the perspective for transactions for which there is no room in the real analysis:

- A household borrows to finance consumption expenditure
- An investor borrows to finance the purchase of an asset that already exists, i.e., a house or a company.

Thus, in contrast to the logic of real analysis there is no necessary link between finance and investments that increase the capital stock. The perspective of the monetary analysis provides explanations for **negative effects** of finance on growth that were already addressed by Schumpeter, but which, according to Levine (2021), have so far not been explained by researchers.

4.3 The incompatibility of the two paradigms

The description of the two paradigms highlights the differences in their critical assumptions and their dominant causal mechanisms. Following Rodrik (2015), one can say that the empirical relevance of a model depends on the realism of its critical assumptions:

> *'For a model to be useful in the sense of tracking reality, its critical assumptions also have to track reality sufficiently closely'* (Rodrik, 2015, p. 27).

There is no doubt that the critical assumptions of the monetary analysis approximate the real world better than the real analysis. One can even go so far as to argue that the critical assumptions of the real analysis *'grossly violate reality'* (Rodrik, 2015, p. 29). Comparing real and monetary analysis, we have shown that the GPG-assumption is 'critical' in the sense of Rodrik as a *'modification in an arguably more realistic direction would produce a substantive difference in the conclusions provided by the model'*. (Rodrik, 2015, p. 27). Thus, one can argue that the whole literature on the finance and growth nexus is built upon a model which violates Rodrik's fourth commandment for economists:

> *'Unrealistic assumptions are OK; unrealistic critical assumptions are not OK'* (Rodrik, 2015, p. 116).

As we have shown, the critical assumptions matter for the direction of 'dominant causal mechanisms' (Rodrik, 2015, p. 51) in the financial system.

- In the real analysis, saving causes investment by releasing financial funds. In the monetary analysis, investment increases national income via the investment multiplier which allows the households to save more.
- In the real analysis, bank deposits create bank credit. In the monetary analysis, bank credit creates deposits.

Due to the opposite causal mechanisms, it is also not possible to build a synthesis of these two approaches. This puts into question above all the so-called neoclassical synthesis. Bofinger (2020) shows the problems that are associated with such attempts.

5 Empirical evidence

The misinterpretation of Joseph Schumpeter's theoretical framework shapes the orientation of the countless empirical studies on the finance and growth nexus. Following Schumpeter's concept of the banker as a producer of purchasing power and thus as an engine of innovation, one would expect that the empirical research focuses on the relationship between credit growth and economic growth. But as the literature regards the banker as an intermediary of funds between savers and investors easing credit frictions, the focus is on the relationship between the quality of the financial system and economic growth. With very little information on the quality of the financial system, empirical studies take the size of the financial system as a not unproblematic proxy for its quality.

Thus, in the literature, the effects of the financial system on GDP growth are not analysed with a dynamic variable, but with a static variable.[9] This even applies to the more recent analyses on the so-called 'liquidity creation' by banks (Beck et al., 2020) which seem to catch the true Schumpeterian spirit. But at closer look, one can see that the authors do not analyse the dynamic process of liquidity creation but static balance sheet structures.

While the effects of credit variables on GDP growth have been extensively scrutinized, there are surprisingly few empirical studies that have looked at the main transmission channel in the real analysis which runs from household saving to bank credits and then to growth.

In this section, we will discuss those three strands of the empirical literature, namely

- studies on 'financial development' and growth

[9] In this regard it is confusing that e.g., King and Levine (1993a) speak of the effects of *'financial development'*.

- studies on the 'liquidity creation' by banks.
- studies on the links between saving, the financial system and economic growth

5.1 'Financial development' and growth

Most of the empirical literature is devoted to the relationship between 'financial development' and economic growth. One of the first analyses was carried out by Goldsmith (1969). It is important to note that, in line with Schumpeter's approach, Goldsmith defines **'financial development'** as a dynamic process:

> *'Financial development is change in financial structure. Hence, the study of financial development essentially requires information on changes in financial structure over shorter or longer periods of time. This can be provided either by information on the flows of financial transactions over continuous periods of time or by the comparison of financial structure at different points of time'* (Goldsmith, 1969, p. 37).

In Chart 9-3 of his book, Goldsmith graphically analyses the relation between the *'new issue rate of financial institutions'*, which is defined as the change in the assets of financial institutions, and the average growth rate of GDP per capita for the years 1949-1963 for 27 countries.[10] He points out that the relationship is *'not a close one'* (Goldsmith, 1969, p. 379). But he identifies *'undoubtedly a tendency for the ratio to be positively associated with the rate of growth of real income per head during the postwar period, but the scatter is wide (. . .).'* (Goldsmith, 1969, p. 379)

In Chart 9-5, Goldsmith also analyses the correlation between the average level of GDP per capita of the years 1948 and 1963 for 35 countries with the new issue rate of financial institutions. Here he finds a significant positive correlation for the group of less developed countries and a significant negative correlation for the group of developed countries. While he avoids making statements on causality, he seems to be mainly interested in the *'causal relationship running from the level of income per head to the level of the issue rate of financial institutions'* (Goldsmith, 1969, p. 387).

[10] It is therefore interesting to see how King and Levine (1993a, p. 717) interpret Goldsmith's analysis: *'Empirical work by Goldsmith [1969] and McKinnon [1973] illustrates the close ties between financial and economic development for a few countries.'*. Another misinterpretation of Goldsmith can be found in Beck (2012, p. 166) where he states: *Goldsmith (1969) was the first to empirically show the positive correlation between financial development and GDP per capita, using data on the assets of financial intermediaries relative to GNP and data on the sum of net issues of bonds and securities plus changes in loans relative to GNP for 35 countries over the period 1860 to 1963. Such a correlation, however, does not control for other factors that are associated with economic growth and might thus be driven by other country characteristics correlated with both finance and growth.'* First, Goldsmith's analyses over the period from 1860 to 1963 were for four countries only. The analysis for 35 countries was from 1948 to 1963. Second, while Beck creates the impression that Goldsmith analysis for the 35 countries was on the correlation between finance and economic growth, the correlation was between the level of GDP and finance.

The seminal paper by King and Levine (1993a)

In 1993, King and Levine (1993a) published a seminal empirical paper with the title *'Finance and Growth: Schumpeter might be right'*. Until today, this study is regarded as important evidence for *'large, positive, and statistically significant relationships between economic growth and financial development'* (Levine, 2021, p. 25).

It is important to note that the authors define *'financial development'* differently than Goldsmith. They understand *'financial development'* as a static variable. This interpretation of financial development reflects the logic of the real analysis according to which the *'easing of financial frictions'* is regarded as the main function of the financial system. Thus, the quality of the financial system is decisive for GDP growth. As there are no indicators for the quality of the financial system, the literature approximates quality with indicators for the size of the financial system relative to GDP. King and Levine (1993a) use four indicators for the size of the financial sector:

- *DEPTH*: the relation of liquid liabilities (currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries) to GDP,
- *BANK*: ratio of deposit bank domestic assets to deposit bank domestic assets plus central bank domestic assets,
- *PRIVATE*: Claims on the non-financial private sector to total domestic credit excluding credit to money banks,[11],
- *PRIVY*: Gross claims on the non-financial private sector to GDP

The authors find a strong positive relationship between each of the four indicators and indicators of economic growth (rates of economic growth, physical capital accumulation, and economic efficiency improvements). They also find that the predetermined component of financial development is a good predictor for long-run growth over the next 10 to 30 years (King & Levine, 1993a).

Similar conclusions were reached by King and Levine (1993b), Levine (2000), and Méndez-Heras and Ongena (2020), among many others. These findings are also robust at the industry- or even firm-level (see, among others, Rajan and Zingales (1998) or Beck et al. (2000)) and also hold for emerging markets (e.g. Garcia-Escribano, Goes, and Karpowicz (2015)).

Almost 30 years later, Levine (2021, p. 2) summarizes the evidence as follows:

[11] A problem in the analyses of King, Levine and Beck is the inaccurate terminology which confuses credit to the private sector with credit to the corporate sector. In King and Levine (1993a, p. 718), they authors speak of *'credit issued to nonfinancial private firms divided by total credit'*. On page 721, they write: *'Thus, we compute the proportion of credit allocated to private enterprises by the financial system. This measure equals the ratio of claims on the nonfinancial private sector to total domestic credit (excluding credit to money banks), and we call this indicator PRIVATE.'*

> *'While subject to ample qualifications, the preponderance of evidence suggests that (1) financial development—both the development of banks and stock markets—spurs economic growth and (2) better functioning financial systems foster growth primarily by improving resource allocation and technological change, not by increasing saving rates.'*

Levine (2021) also draws some strong conclusions from this evidence as in his joint paper with King (King & Levine, 1993a):

> *'(. . .) that if Bolivia had the average value of financial development in 1960, then, holding other things constant, it would have grown about 0.4 percent faster per annum, so that by 1990 real per capita GDP would have been about 13 percent larger than it was'* (Levine, 2021, p. 25).

Weaknesses of the approach by King and Levine (1993a)

At first sight, King, Levine and others seem to provide a broad confirmation for the real analysis. But at a closer look, the result is not so clear cut.

Ram (1999), for example, shows with data for 95 individual countries that at the national level the predominant correlation between financial development and economic growth is negligible or weakly negative. The average **individual-country correlations** show a sharp contrast to the cross-country correlations between the same variables, and indicate that the cross-country estimates, which have been used in most studies, might be spurious. Due to the huge parametric heterogeneity across the sample countries Ram (1999, p. 172) points to *'the illegitimacy of statements being made about the subgroups on the basis of the full-sample estimates.'*

A meta-analysis based on 68 empirical surveys and over 500 estimates (Bijlsma, Kool, & Non, 2018, p. 6144) identifies **a significant publication bias** and comes to a more nuanced assessment:

> *'All in all, our analysis supports recent research that argues that pre-crisis estimates of a sizeable positive effect of more developed financial markets on economic growth were biased upward. In turn, this implies that the idea that growth can be stimulated by increasing the financial sector is overly optimistic, especially for well-developed countries.'*

Causality is another problem of the cross-sectional studies by King, Levine and Beck who do not only claim that finance is correlated with growth, but also that finance causes growth. Already in 1996, Demetriades and Hussein (1996, p. 391) argued that the results of King and Levine (1993a) were indicative, but *'they cannot be seen as substitutes for standard causality tests using time-series data.'* In their own time-series analysis they come to the result that there *'can be no 'wholesale' acceptance of the view that 'finance leads growth' as there can be no 'wholesale' acceptance of the view that 'finance follows growth.'*(Demetriades & Hussein, 1996, p. 407) Shan and Morris (2002) come to similar results.

Levine (2005, p. 892) admits that *'while KL [King and Levine] show that finance predicts growth, they do not deal formally with the issue of causality.'*

A more fundamental problem is the lack of **evidence for advanced economies**, which are underrepresented in the analyses of King, Levine and Beck. This country group typically accounts for only about one fourth or one fifth of the samples. The analyses are therefore dominated by many relatively small developing countries. As the size of the developing countries' financial systems is and was dwarfed by that of the developed countries, especially in the years 1960 to 1990, it is surprising that Beck, King and Levine never presented exclusive evidence for the finance and growth nexus in advanced economies.

As already mentioned, Goldsmith (1969) recognized that the patterns of finance and GDP differ between developed and less developed countries. A study by De Gregorio and Guidotti (1995, p. 441)[12] with cross-country growth regressions for a sample of 98 countries during the years 1960-85 concludes:

> *'Compared to the rest of the sample, the effect of financial development on growth in high-income countries is relatively small. In particular, the effect in 1970-85 is not significantly different from zero (...).'*

Leahy, Schich, Wehinger, Pelgrin, and Thorgeirsson (2001, p. 14) come to a similar assessment:

> *'Drawing lessons for OECD countries from these studies is difficult, however, as strong results are obtained only when low- and middle-income economies are included in the sample (...) Studies focused on OECD countries have typically failed to find significant links between financial development and growth (...)'*

Similar results can be found in Neusser and Kugler (1998) and Andrés, Hernando, and López-Salido (1999). A more recent study by Pagano and Pica (2012) for a subsample of OECD countries concludes that financial development appears to have no significant impact on the growth of value added, employment or wages.

After the financial crisis, there was a systematic shift in empirical results. The more recent literature even finds a negative relationship between finance and growth. Rousseau and Wachtel (2011) were the first to observe a so-called 'vanishing effect' of the impact of financial depth on GDP growth over time. While this effect had been statistically significant and positive in the subperiod 1960-1989, it became insignificant and negative in the subperiod 1990-2004. Cecchetti and Kharroubi (2012) find for 20 OECD countries the 'unambiguous' evidence that faster growth in finance is bad

[12] They even present evidence of a negative effect on growth in a sample of twelve Latin American countries during 1960-85.

for aggregate real growth. Berkes, Panizza, and Arcand (2012) show that positive effect of finance on real growth vanishes over time and is no longer significant with more recent data. The positive effect is reversed when the amount of private credit relative to GDP reaches a threshold of around 100 % to GDP. A study by Denk and Cournède (2015, p. 8) for 32 OECD countries between 1970 and 2011 concludes:

> *'Financial sector value added and credit to the non-financial private sector (. . .) both exhibit a tight negative link with GDP growth, on average across countries at the levels observed over the past decades.'*

These results are a puzzle for the mainstream literature on the nexus between finance and growth. First, how is it possible that there is no evidence for a positive effect of the financial system on GDP growth in developed countries, which is the central hypothesis of this literature? Second, if the financial system eases frictions, how can one explain a negative impact of financial development on growth?

Beck (2013) admits the problems of this evidence for the literature:

> *'The findings of this literature, however, sit uncomfortably with the recent experience of many developed countries.'*

The indicator quality of the private credit to GDP measure

In the analyses of King, Beck and Levine, private credit to GDP is the preferred indicator of the financial development. An important assumption underlying most analyses on the finance and growth nexus is a positive correlation between size and quality of financial system. Without evidence Levine (2021, p. 24) explains this as follows:

> *'The assumption underlying this measure is that financial systems that allocate more credit to private firms are more engaged in screening firms, exerting corporate control over the firms that they fund, providing risk management services, mobilizing savings, and facilitating transactions than financial systems that play less of role in funding private firms.'*

The problem of approximating quality with size becomes obvious if one looks at the values of private credit to GDP in e.g. 1960 (in the World Bank Financial Structure Database). It would imply that at that time the quality of the financial systems in Congo (22.2 %) and Senegal (19.2 %) was higher than that of the Netherlands (18.6 %) and the UK (17.1 %). Already Goldsmith (1969, p. 45) argued that there are important factors explaining the **level of financial intermediation** that are not necessarily related to the quality of a financial system:

> *'The level of the financial interrelations ratio thus can be traced back to fundamental features in a country's economic structure, such as the concentration of production, the distribution of*

wealth, the incentive to invest, the propensity to save, and the extent to which business activities are legally separated from household activities by devices such as incorporation.'

A possible explanation for intercountry differences in the value of private credit to GDP in advanced economies is the **role of the capital markets**. While Levine (1998) analyses the effect of stock markets on growth, there are no analyses of the effects of the corporate bond market on growth. In the words of Levine (2005, p. 897):

'Demirgüç-Kunt and Levine (2001) show that in many countries private bond market capitalization is more than half the capitalization of national equity markets and public bond markets are frequently larger than stock markets. Furthermore, over the period 1980–1995, new issuances of private bonds were greater than public offerings of stock in many countries. (. . .) Thus, more work remains on incorporating bond markets and nonbank institutions into finance-growth literature.'

Another explanation for differences in the level of credit to GDP is the growing importance of **mortgage lending** which is included in the preferred indictor 'private credit to GDP'. Jordà, Schularick, and Taylor (2014) show that already in 1970, the share of mortgage lending to total bank lending was rather high in some advanced countries (Sweden, United States, Denmark). This has significant implications for credit to GDP as indicator for the functions which the literature attributes to them. Beck, Büyükkarabacak, Rioja, and Valev (2012) for example, show that enterprise credit has a significantly stronger effect on GDP growth than household credit. This means that studies without a differentiated look at the recipients of credit tend to underestimate the effect of credit on growth.

Thus, indicators focusing on the size of the banking sector are necessarily *'crude proxies'* (Beck et al., 2020, p. 4). For example, Andrés et al. (1999) argue that weakness of the finance-growth relationship that they found in their sample of OECD could be attributed to the shortcomings of a quantitative credit indicator.

Ito and Kawai (2018) construct composite indices for quantity and **quality of financial development**. They find that the quantity and quality measures are highly correlated with each other for advanced economies and Asian emerging economies, while this is not the case for many of the other emerging and developing economies. But the authors also obtained the **'puzzling result'** that for advanced economies greater financial development tends to be associated with lower GDP growth.

Using credit to GDP as an indicator for the quality of the financial system is also difficult to reconcile with the literature on **financial crises** where a rapid increase in the debt to GDP ratio

is not regarded as an indication for a better quality of the financial system but on contrary as important warning signal for a crisis. In other words, high levels of credit to GDP are an indication that the financial system's screening and control mechanisms have failed (Borio & Drehmann, 2016; Borio & Lowe, 2002; Kaminsky, 1998).

5.2 Liquidity creation by banks

While the literature emphasizes the importance of liquidity creation as a key function of banks, there is little research focusing on whether and how liquidity creation contributes to growth. In a recent paper Beck et al. (2020, p. 4) try to *'provide[s] a unified framework that features liquidity creation by banks as a key mechanism to help understand a number of important findings in the finance and growth literature.'* The authors develop a measure of liquidity creation, which incorporates the contributions of all bank assets, liabilities, equity, and off-balance sheet activities. They explain the rationale of this indicator as follows:

> *'As it is recognized that banks create liquidity when they engage in certain activities but reduce liquidity when they engage in other activities, the measure classifies and weights all bank activities based on the liquidity they create or destroy'* (Beck et al., 2020, p. 6)

The authors use three liquidity weights: liquid, semiliquid, and illiquid. They argue that since liquidity is created when illiquid assets are transformed into liquid liabilities, both illiquid assets and liquid liabilities are given a positive weight. Following a similar logic, a negative liquidity weight is given to liquid assets, illiquid liabilities, and equity. Liquidity is destroyed when liquid assets are transformed into illiquid liabilities or equity. Because liquidity creation is only half determined by the source or use of funds alone, the study assigns weights of +1/2 and -1/2.

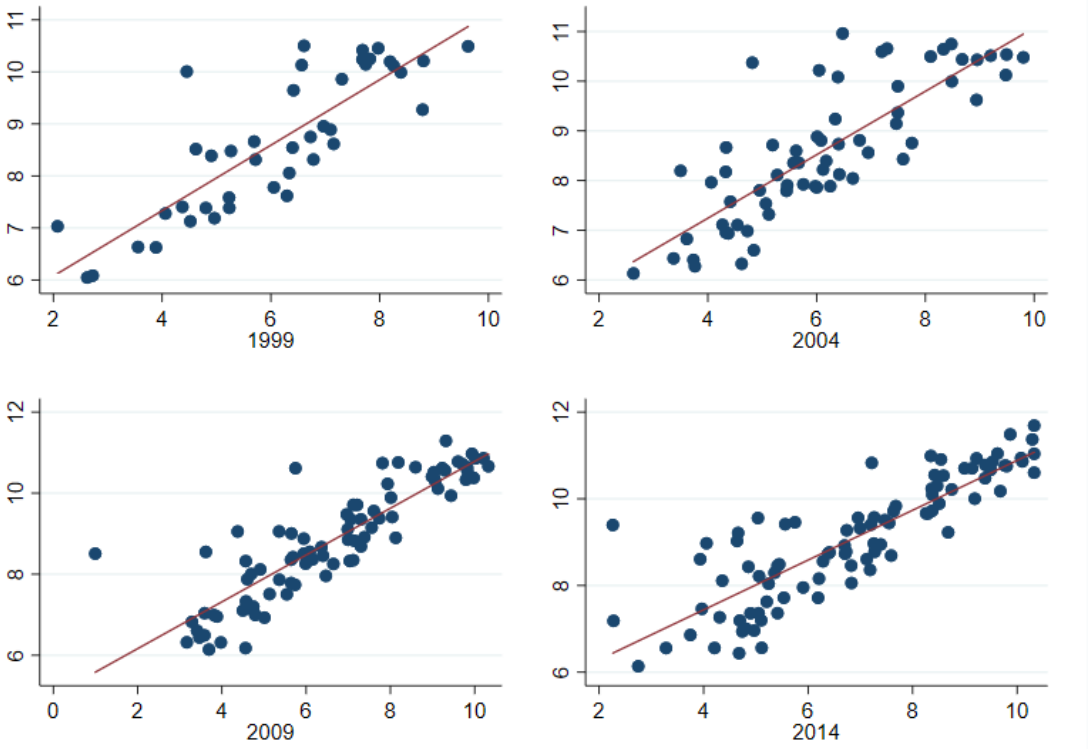
The logic of this indicator can be explained as follows: If a bank lends 1.000 Euro to a borrower, the bank balance sheet shows 1.000 Euro as credit on its asset side and 1.000 Euro as a deposit on its liability side. With a positive weight of 0.5 on the illiquid credit and on the liquid deposit, 'liquidity creation' is 1.000 Euro. In the 'monetary analysis' this transaction would be recorded as an increase of the **money stock M1** of 1.000 Euro. Thus, in the balance sheet of the bank there is no conceptual difference between 'liquidity creation' and the money stock M1. While 'liquidity creation' seems to be a flow variable, b it is a weighted sum of balance sheet items and therefore a **stock variable** like the money stock.

Thus, 'liquidity creation' as defined by Beck et al. (2020) is a confusing concept. E.g., one can read on page 8:

> *'Total liquidity created by the US banking sector has clearly increased over time –though not monotonically – and reached almost $4.8 trillion in 2014'* (Beck et al., 2020, p. 9).

Assume there is country A with only one bank, which gives a credit of 1.000 Euro each year over a period of ten years. On the liability side, the deposits grow in tandem. After ten years, the indicator 'liquidity creation' would reach a value of 10.000 Euro. According to the logic of Beck et al. (2020) this would imply that liquidity creation in year one has been 1,000 Euro and 10,000 Euro in year 10.

Thus, with 'liquidity creation', Beck et al. (2020) have not developed a new indicator for financial development. Instead, they have created a **specific variant of a money stock aggregate**, which is conceptually not different from the 1990s estimates where such indicators were widely used in the literature on the finance and growth nexus. But in contrast to this literature, Beck et al. (2020) do not analyse the relation between a financial variable and **real GDP growth**. Instead, they focus on the relationship between 'liquidity creation' and the **level of nominal GDP**. Interpreting 'liquidity creation' as a money stock aggregate, one can explain the positive correlation between nominal GDP per capita and 'liquidity creation per capita' in the charts presented by Beck et al. (2020) as a variant of the **quantity theory of money**. It postulates a positive correlation between the money stock and nominal GDP, but it does not provide an argument that a higher money stock leads to a higher real GDP.



The figure shows the relation between log GDP per capita on the y-axis and log on-balance sheet liquidity creation per capita on the x-axis for the whole sample comprising 100 countries in 1999, 2004, 2009 and 2014.

Figure 1: On-balance sheet liquidity creation and GDP per capita.
Source: Beck et al. (2020, p. 37).

While liquidity creation is a simple concept in the monetary analysis, it requires unrealistic critical assumptions to explain it within the framework of the real analysis (see Box 2).

Box 2: 'Liquidity Creation'

The limitations of the real analysis become especially obvious in the analysis of **liquidity creation**. For the monetary analysis, liquidity creation is a central and simple concept. Whenever a bank gives a credit, it creates money and thus liquidity: on the asset side, the bank holds a new credit with a longer maturity than the newly created sight deposit on the liability side of its balance sheet. Money creation, credit creation and liquidity creation are all the same. For the real analysis with only a general purpose good, liquidity creation is a difficult concept as banks can only intermediate the GPG submitted by households to investors without changing its substance.

This conceptual difficulty explains the popularity of the seminal paper by Diamond and Dybvig (1983). In this two-period model, consumers do not know whether they die at the end of period 1 or of period 2. If the GPG is invested, it does not generate a return in period 1, but only in period 2. Thus, without banks, consumers who die in period 1 will not receive a return on their investment. The Diamond/Dybvig bank functions de facto as an insurance company protecting consumers against the (unobservable) risk to die in the first period. It pays them an interest rate already in period 1 although the GPG has not yet generated a return. This payment reduces the return for consumers who survive until period 2. They receive a return which is lower than the full return of the GPG in period 2. The difference can be regarded as an insurance premium.

Following Rodrik (2017), one can identify three *'unrealistic critical assumptions'*:

- First, the bank offers a fixed interest rate contract for period 1 without knowing the mortality probability of people dying in period 1. But under such conditions, an **insurance contract** would not be impossible.
- Second, by paying interest in period 1 before receiving a return of the invested GPGs, the Diamond/Dybvig bank would be **insolvent** in period 1.
- Third, the model assumes without any explanation that the return of the GPG is zero in the first period and positive in the second period. With the more realistic assumption of **identical returns** in both periods, the model collapses as there is no longer a need to insure consumers that might die at the end of the first period.

5.3 Saving and the financial system

While the literature has intensively analysed the nexus between the private credit to GDP and growth, it has not payed much attention to the transmission channels between saving and the financial system and between saving and growth. This is surprising as the main hypotheses of the real analysis are the identity of the flow of saving with the flow of credit and the positive contribution of saving to investment and thus to growth. In fact, the literature emphasizes the 'mobilization of saving' as a key function of the financial system. Levine (2005) states that

- *'Each of these financial functions may influence savings and investment decisions and hence economic growth'* Levine (2005, p. 870).
- *'(. . .) Financial systems that are more effective at pooling the savings of individuals can profoundly affect economic development by increasing savings (. . .)'* Levine (2005, p. 879).
- *'The financial system's ability to provide risk diversification services can affect long-run economic growth by altering resource allocation and savings rates.'* Levine (2005, p. 875).

The research interest in the relationship between the financial system and investment has been similarly weak, even though this transmission channel is equally central to real analysis.

Financial depth and saving

One of the few empirical analyses on the relationship between financial development on the one hand and saving and investment on the other hand is from Beck et al. (2000, p. 266) who use private credit to GDP as explanatory variable. The outcome of their analysis is a major challenge for the real analysis and thus for the theoretical basis of the literature.

> *'The data do not confidently suggest that higher levels of financial intermediary development promote economic growth by boosting the long-run rate of physical capital accumulation. We find similarly conflicting results on savings.'*

Loayza, Schmidt-Hebbel, and Servén (2000, p. 180) even find a negative effect of financial liberalisation on saving:

> *'The direct effects of financial liberalization are largely detrimental to private saving rates. First, enhanced credit availability reduces the private saving rate. Second, larger financial depth does not raise saving, and nor do higher real interest rates.'*

The authors also identify a negative and significant coefficient between saving and credit flows which contradicts the main assumption of the real analysis that credit and saving flows are identical.

> *'When the flow of private credit rises by 1 percent of income, the private saving rate decreases by 0.32 percentage points on impact'* (Loayza et al., 2000, p. 174).

Grigoli, Herman, and Schmidt-Hebbel (2014) analyse the impact of financial depth, measured by deposit money bank assets as a share of GDP on saving. Their estimates show that the effect of financial deepening on private saving is zero, on household saving it is even negative but also insignificant.

In sum, there is no evidence for the key hypothesis of the literature according to which the quality of the financial system, represented by level of financial assets, has a positive impact on private saving or household saving. Levine (2021, p. 2) who regards the 'mobilization of savings' as a key function of banks, admits this quite frankly:

> *'While subject to ample qualifications, the preponderance of evidence suggests that (1) financial development—both the development of banks and stock markets—spurs economic growth and (2) better functioning financial systems foster growth primarily by improving resource allocation and technological change, not by increasing saving rates.'*

As a justification for this finding, Levine (2021, p. 22) refers to Bagehot (1873):

> *'Bagehot was very explicit in noting that the crucial mechanism through which mobilization shapes growth is not by changing the savings rate; rather, enhancing mobilization shapes growth by improving the ability of an economy to pool society's resources and allocate those savings toward the most productive ends.'*

But in the pages of Bagehot's book to which Levine refers no mention of saving can be found and therefore also no statement concerning the saving rate. In fact, in Bagehot's time the concept of GDP which is required to express the saving rate did not exist.

The causality between saving and growth

According to the logic of the real analysis and also to standard growth models, higher saving should lead to more economic growth. Again, the literature has paid little attention to this central transmission channel. One of the few analyses is by Saltz (1999) using data from 18 Latin American and East Asian developing or Newly Industrialized Countries from 1960-1991. His findings do not lend support to the hypothesis that higher growth rates of saving cause higher growth rates of real GDP. He concludes:

> *'If any conclusion can be drawn, it should be that a higher rate of growth of real GDP causes a faster growth of savings'* (Saltz, 1999, p. 93).

A study by Mohan (2006, p. 6) for 25 countries comes to a similar result:

> *'(. . .), in most countries under investigation, the empirical results show that the causality is from economic growth rate to growth rate of savings.'*

These results, in turn, pose a fundamental problem for real analysis where saving is regarded as the main source for bank credits, investment, and thus for growth. However, they are compatible with the dominant causal mechanism of the monetary analysis, where economic growth and higher incomes create room for higher saving rates.

5.4 Summary of the empirical review

Our review of the **empirical studies** on the relationship between finance and growth shows that they are all characterized by the paradigm of real analysis (and thus a misinterpretation of Schumpeter's views).

The first hypothesis of real analysis is that the **quality of the financial system**, which is regarded as a pure intermediary, is decisive for its effect on economic growth. Quality is approximated by the ratio of the credit level to the gross domestic product. For the group of advanced economies, which make up the bulk of the global financial system, no convincing evidence for positive growth effects can be found. In recent studies, there is even evidence for negative growth effects.

The second hypothesis of the real analysis is that **household saving** is the source of funds and thus bank lending, which in turn is crucial for investment and economic growth. The available studies show no evidence for these correlations either.

Recent studies that attempt to depict the contribution of the financial system to growth via the concept of **'liquidity creation'** give the impression that a dynamic approach is being pursued that seems to correspond to Schumpeter's ideas. On closer inspection, however, it turns out that this is also a static concept that in principle does not differ from the stock concepts of the standard approaches. Thus, the correlation between 'liquidity creation' and the level of nominal GDP, which this approach presents as evidence of the growth effects of the financial system, is identical with the quantity theory that postulates a relationship between a monetary aggregate and nominal GDP.

In sum we identify the following shortcomings in the literature:

- **Indicator choice:** While household saving is the decisive variable in the real analysis, the literature almost never uses saving as an explanatory variable. Instead, the authors predominantly use indicators like private credit to GDP that are subject to the above stated criticisms.

Moreover, as the indicators are static indicators, they are unable to capture the dynamics of bank lending.

- **Sample choice:** In the analysis by Beck et al., developing countries are over-represented although most of them have typically very small financial sectors.
- **Puzzling results:** The importance of a correct choice of theory becomes obvious, when the literature finds 'puzzling results' for the finance and growth nexus after the financial crisis. Negative effects of finance on growth are difficult to reconcile with the real analysis. In this framework, funds are created by household saving(s) cannot be used for unproductive investment and thus always leads to economic growth.

6 Testing the 'True Schumpeter' and the Monetary Analysis

Because of the dominance of real analysis, there have been hardly any studies so far that have empirically looked at the interrelationships that are central to Schumpeter's theory of the financial system (exceptions are e.g. Bezemer, Grydaki, and Zhang (2016)). The core of his approach is the ability of the financial system to create credit out of thin air. From this, the following hypotheses can be derived for Schumpeter's theory (and thus at the same time the monetary analysis):

- The effects of the financial system on economic growth result primarily from the growth of the volume of credit. Thus, there should be a positive effect of credit growth on GDP growth. This dynamic approach differs from the real analysis, which tries to capture these effects on the basis of static variables.
- Since credit creation by the banking system is independent of household saving, there should be no correlation between the change in saving and credit growth.
- Since saving is thus not a prerequisite for investment, there should also be no correlation between saving and economic growth.
- As credit can also be used for unproductive purposes there is not necessarily a relationship between credit and growth and even if, it is not always positive.

As the second and the third hypothesis are directly opposed to the real analysis, testing these hypotheses of Schumpeter is identical with testing the related hypotheses of the real analysis.

For these tests, we use different **panel estimations**, where we compare the relationship of both saving and credit indicators with economic growth. Since panel analyses cannot shed light on the direction of causality, and do not provide an individual country perspective we then examine the relationship of bank credit, household saving and growth in a **structural vector autoregressive**

model (SVAR) by comparing the dynamics of a saving shock versus a credit shock. Finally, we apply **Granger Causalities (GC)** and **Forecast Error Variance Decomposition methods (FEVD)** for an examination of Schumpeter's theory of the nexus between credit creation and economic growth in individual countries.

6.1 Data set

For our analysis we use the credit database of the Bank for International Settlements which was established in 2013 and which is updated on a quarterly basis. This database has important advantages (Dembiermont, Drehmann, & Muksakunratana, 2013). The data cover much longer periods and more countries than other total credit series. In addition, the series account for credit from all sources, not only credit that is extended by domestic banks. Another advantage of the BIS database is the differentiation between the household sector and the sector of non-financial corporations. In other databases (as e.g. by the World Bank) this differentiation is not available. As the BIS consulted national central banks to ensure the best possible coverage, the international comparability and consistency across time are also quite high.

For our analyses we draw on a large, unbalanced panel of 43 countries over a period from 1940 to 2019. Of these, 25 are considered developed and 18 are developing countries (see table 12 and figure 10 in the Appendix).

Following Schumpeter's idea that banks play a central role in this process, we thus primarily use data on the annual growth of bank credit to the private non-financial sector ($\Delta\text{CREDIT}_{Bank}$). In addition, we will perform robustness checks based on total private credit growth which also includes credits provided by non-banks ($\Delta\text{CREDIT}_{Total}$), growth of total private credit to households ($\Delta\text{CREDIT}_{Household}$) and growth of total private credit to non-financial corporations ($\Delta\text{CREDIT}_{Corporate}$). A more detailed description of our credit data can be found in the Appendix (section 8.1.1).

In line with the literature, we mainly consider the growth impact of bank credit to the private non-financial sector, but also that of 'other credit' to the private non-financial sector. We derive this indicator by taking the difference between total credit to the private non-financial sector and bank credit to the private non-financial sector. We refer to this variable as 'alternative credit' (CREDIT_{Alt}). In detail, CREDIT_{Bank} includes domestic bank credit and debt securities (bonds and short-term paper) held by domestic banks (e.g. commercial banks, savings banks, money-market funds and credit unions). CREDIT_{Alt} on the other hand includes non-bank credit and debt securities that are held by non-banks (e.g. domestic financial and non-financial institutions, general government

or households, including non-profit institutions serving households, as well as non-residents) (Dembiermont et al., 2013). We therefore consider CREDIT$_{Alt}$ as a proxy for capital market-lending, as opposed to bank lending.

As shown in figure 2, the relative importance of bank credit and capital market lending varies among countries and time periods. Developed countries tend to be stronger market-based than developing countries. On average, the share of alternative credit to total credit is 27.7 percent in developing countries and 41.1 percent in more developed countries - however, we can observe major differences within the country groups. Among the developed economies, the United States (56.7 percent), Canada (66.9 percent) and Luxembourg (73.7 percent) have high shares of CREDIT$_{Alt}$, while Germany (36.5 percent), Italy (25.5 percent) and Greece (14.1 percent) are well below average. Among the less developed economies, Argentina (60.9 percent), Mexico (51.7 percent) and Russia (42.0 percent) differ significantly from countries with a dominant role of bank credit, such as Malaysia (CREDIT$_{Alt}$ / CREDIT$_{Total}$ is at 1.4 percent), China (3.3 percent) and India (4.5 percent).

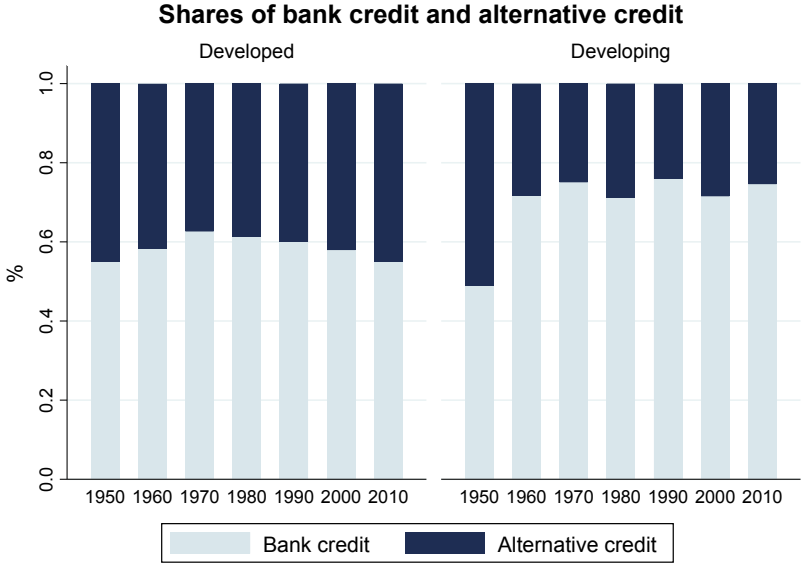


Figure 2: Decade averages for bank credit and alternative credit, defined as total credit minus bank credit. Based on the BIS total credit statistics

Note: The high share of alternative credit in the 1950s for developing countries is due to the fact that there are substantially fewer countries that report data for this period. As we have few observations for developing countries in the 1940s we have excluded these data in the graph.

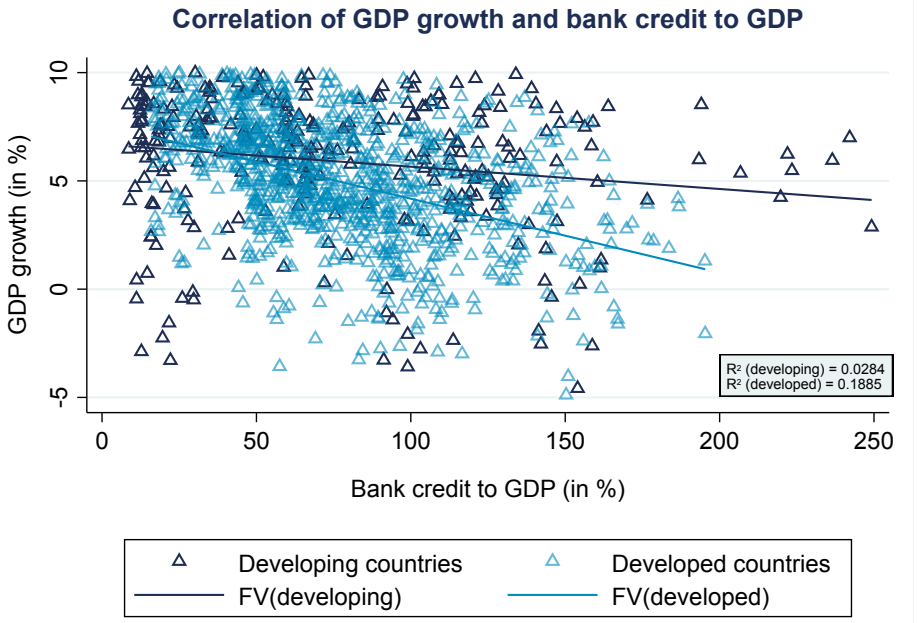
For our analysis, in line with the literature, GDP growth (*GROWTH*) is measured in terms of the annual growth rate of GDP per capita; data is taken from the World Bank's World Development Indicators Database.

For saving we use the growth rate of net household saving (ΔNHS), and percentage changes in the net saving rates at the household level ($\Delta NHSR$). Our preferred indicator is the former (ΔNHS), as it indicates the isolated effect of saving, whereas changes in the saving rate may also be due to changes in household income. Since the availability of data on net saving (rates) is limited, we have created a large-scale database on saving rates at the household level, which is based on national accounts data from national statistical authorities and supplemented by data from the UN, AMECO and the OECD. This allows us to test the saving channel for a broad number of countries and points in time. A more detailed description of our saving data can be found in the Appendix (section 8.1.2).

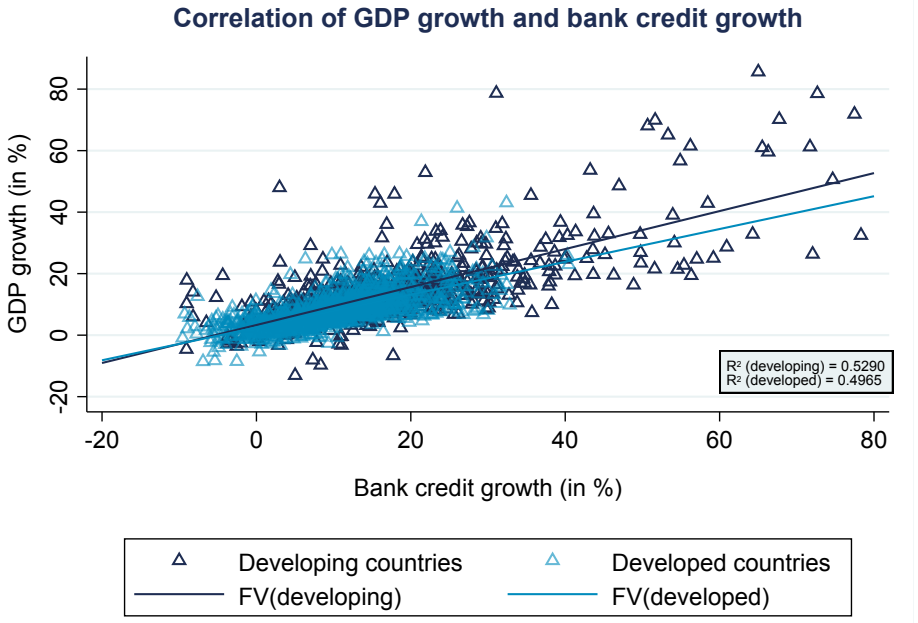
6.2 A first glance at the data

We start our analysis with graphical descriptions for the main hypotheses using our data set. First we compare the correlation between GDP growth and the level of private bank credit to GDP ('real analysis') and between GDP growth and the growth rate of bank credit to the private sector ('monetary analysis'). As figure 3a shows there is very weak negative correlation between the level of bank credit and GDP growth for developing countries and a more pronounced negative correlation for developed countries.[13] In contrast, Figure 3b shows a pronounced positive correlation between credit growth and GDP growth for developing and developed countries alike.

[13]The same applies to the correlation between private credit to GDP and GDP growth, the standard indicator of the literature (see Figure 3a in the Appendix).



(a) Correlation of bank credit to the non-financial private sector as share of GDP and GDP growth



(b) Correlation of growth of bank credit to the non-financial private sector and GDP growth

Figure 3: Correlation of credit and GDP

Note: Based on the BIS total credit statistics.

In the literature on finance and growth, household saving plays a decisive role as source for bank credit. Only very few studies have focused on this key transmission channel of the real analysis and the evidence contradicts this hypothesis. These findings are supported by figure 4. It shows for developed and developing countries alike no correlation between net households saving growth and the growth of bank credit to the private sector.

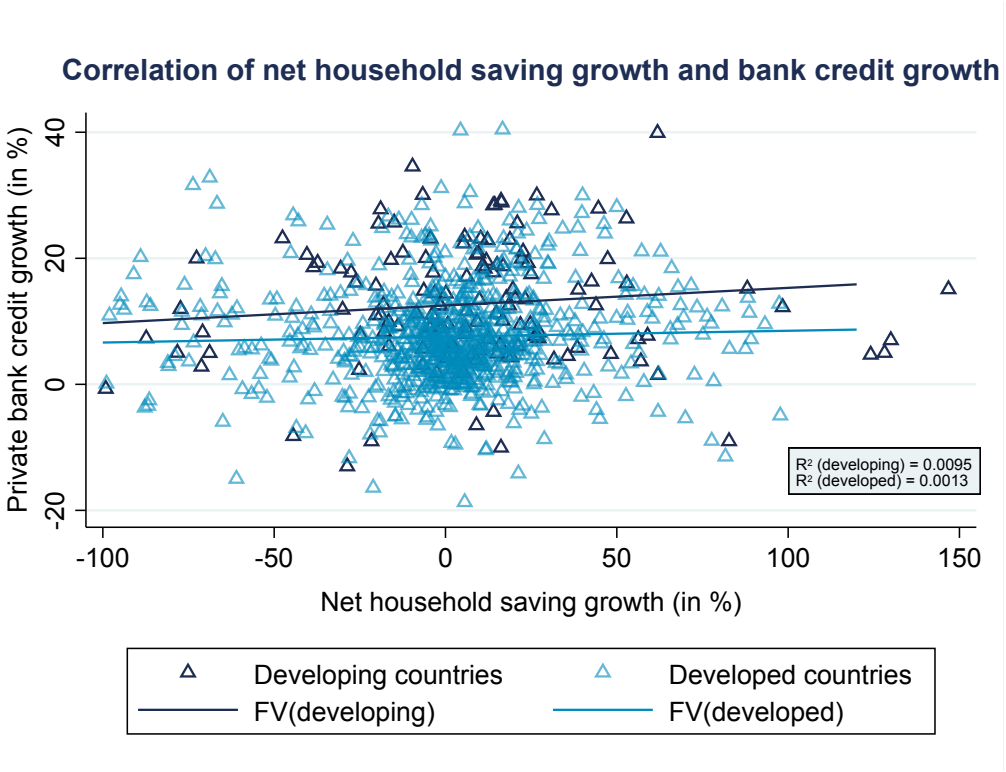


Figure 4: Correlation of net household saving growth and bank credit growth
Note: Based on the BIS total credit statistics and household saving data from our saving data set (see chapter 6.1 for detailed description).

For the whole transmission channel from household saving to GDP growth the scatter plot shows a similar picture.

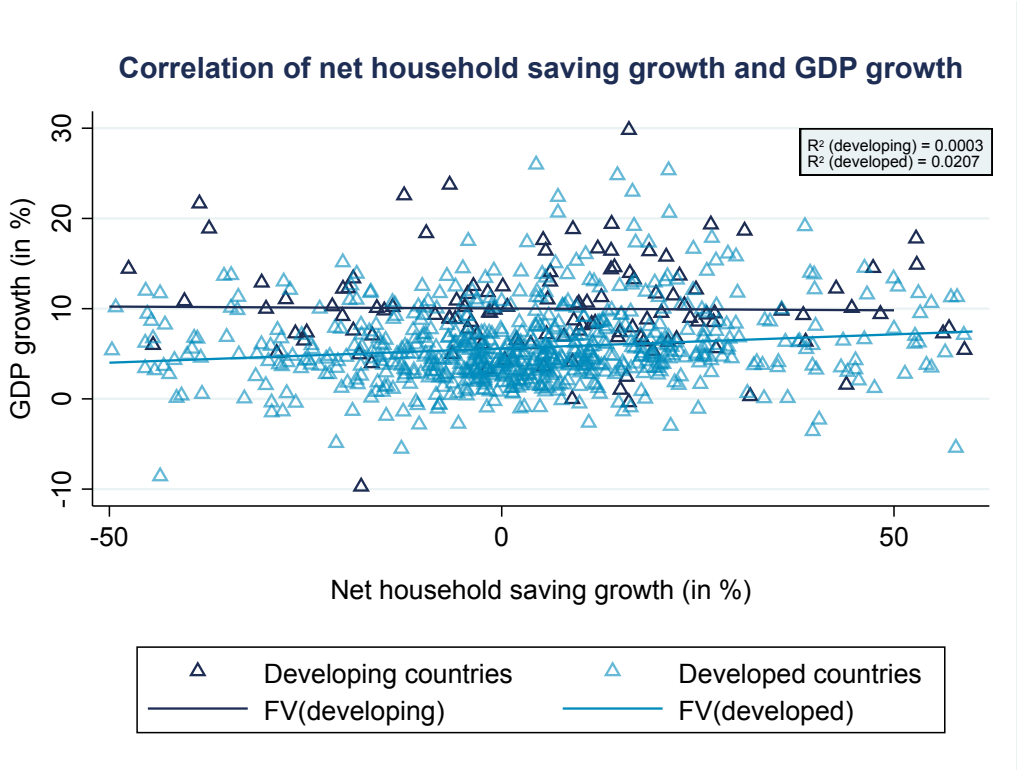


Figure 5: Correlation of net household saving growth and GDP growth
Note: Based on the BIS total credit statistics and household saving data from our saving data set (see chapter 6.1 for detailed description).

Thus, the descriptive analysis of the data does not suggest that a higher level of credit is associated with higher GDP growth rates. It suggests that a dynamic concept is more suitable to analyse the relationship between finance and growth (see also Dullien (2009)). At the same time, there is no relationship between household saving growth and private credit growth, and household saving growth and GDP growth. This is in line with the most recent findings of the empirical literature.

6.3 Panel approach testing the impact of credit growth and saving growth on economic growth

For our panel analysis we use a representation of the growth process as it is often found in literature. We differ from the literature as we use the growth rates of the financial variables.

To ensure a high degree of transparency (and to put the empirical underpinning of our criticisms at the heart of the analysis), we limit ourselves to basic panel analysis methods, i.e., fixed effects (FE), as well as random effects (RE) and instrumental variables (IV) estimations as robustness checks. As we assume for our data set that the explanatory variables correlate with the unobservable characteristics of the observations, i.e. that these are not random, we mainly focus on fixed effects

regressions. This approach is also consistent with the results of the Hausman test and offers several advantages. First, we have a large number of data points due to the time and country components of our panel data set. This increases the precision of our analysis and allows us to restrict the country and year selection in the context of robustness checks, e.g. with respect to different country development levels. On the other hand, FE panel analyses control for unobserved, systematic properties of the observation units, which may even be correlated with the variables included in the analysis (Wooldridge, 2020). In a cross-sectional approach these unobserved country or time specific characteristics would evoke biases in the estimated coefficients as they would be included in the error term. Since our data set contains a large number of highly heterogeneous countries and time spans, this approach is highly suitable.

We therefore estimate the following model, in which we essentially follow King and Levine (1993a) in line with Barro (1991):

$$GROWTH_{it} = \beta \cdot FINANCE_{it} + \boldsymbol{\gamma} \cdot \mathbf{X_{it}} + \delta_t + \eta_i + u_{it} \tag{1}$$

where i denotes the country, t refers to the time period and X_{it} includes various control variables. By including δ_t, we account for time fixed (macroeconomic) effects, and by η_i, we control for country fixed effects. u_{it} is the random error term. $FINANCE$ represents factors that drive financial development. $GROWTH$ indicates the annual growth rate of per capita GDP. To conduct the panel analysis, we converted the BIS credit data to annual figures and calculated their year-on-year percentage growth rates on this basis. This is necessary because most saving data are only available on an annual basis.

Following the finance and growth literature (i.e. King and Levine (1993a), Beck et al. (2000), Levine and Zervos (1998), and Rousseau and Wachtel (2011), amongst many others) we assume that education, trade, government consumption and inflation are key factors that, along with financial variables, influence economic growth. In addition to the $FINANCE$ variables (ΔNHS, $\Delta NHSR$ and $\Delta CREDIT_{Bank}$) that we already discussed, we therefore apply the following control variables to our analysis:

- Log(INITIAL GDP) from Penn World Table 10.0 to control for convergence (as seen in Barro and Sala-i Martin (1995); Barro and Sala-i Martin (1992)),
- Secondary school enrollment rate (SCHOOL) from the World Bank World Development Indicators dataset as measure for human capital accumulation (see Solow (1956); Barro and Sala-i Martin (1995))

as well as macroeconomic indicators, like

- General government final consumption expenditure (GOV),

- A logarithmic measure for trade (OPENNESS), given as the sum of exports and imports relative to GDP,
- Consumer price inflation (INFL),

from the World Development Indicators Database to take into account findings by Easterly and Rebelo (1993), Fischer (1993) and Bruno and Easterly (1998) that underline negative growth effects of macroeconomic instability and budgetary deficits. Surveys by Balassa (1978) and Krueger (1998) indicate that trade could be positively associated with economic growth.

Below is a brief overview of the descriptive statistics.

Variable	n	Mean	Median	Standard devation	Min. value	Max. value
GROWTH	2,368	2.6358	2.5109	3.8545	-26.5277	52.2191
log(INITIAL GDP)	1,988	9.7065	10.0184	1.1331	5.4724	11.6260
SCHOOL	1,681	88.9921	93.2488	25.6868	18.1250	163.9347
GOV	2,273	16.3563	16.7626	5.4321	2.9755	41.9658
OPENNESS	2,024	4.1024	4.0699	0.7124	1.5935	6.0927
INFL	2,323	13.9405	3.7330	98.5185	-7.6339	2,947.7330
$\Delta CREDIT_{Total}$	2,203	17.6703	10.8591	90.0385	-44.6452	3,803.5930
$\Delta CREDIT_{Bank}$	2,172	17.7141	10.9186	92.2051	-47.9853	3,803.5930
$\Delta CREDIT_{Alt}$	2,117	19.4107	11.0156	94.5019	-168.0629	3,803.5930
$\Delta CREDIT_{Household}$	1,406	13.5758	9.3729	36.0276	-32.9417	1,207.1120
$\Delta CREDIT_{Corporate}$	1,383	10.5261	8.2606	12.8185	-21.6168	134.1271
ΔNHS	1,020	-137.9257	2.4805	9,157.4160	-254,268.9000	132676.4000
$\Delta NHSR$	1,163	2.2889	-2.1110	345.8389	-3,571.1220	8,204.8710

Note: Initial GDP is in million 2017 US Dollar. All other figures are given in percent.

Table 1: Descriptive statistics

6.3.1 Credit growth versus saving growth

Tables 2 and 3 show the results of our panel analysis. In each estimation (1), the baseline scenario is shown, and in steps (2) to (4), the *FINANCE* variables are then introduced step by step and in an isolated way. Steps (5) and (6) control for a simultaneous consideration of credit and saving growth.

The results of the baseline estimations are largely as expected from the empirical literature and do not differ widely among the three panel methods applied. While human capital accumulation (*SCHOOL*) and openness to trade (*log(OPENNESS)*) consistently suggest positive and mostly significant effects on growth, inflation (*INFL*) and general government consumption expenditure (*GOV*) are negatively correlated with per capita GDP growth. The initial level of GDP (*log(INITIAL GDP)*) has a negative and highly significant link with per capita GDP growth, which underlines the convergence theory as shown by Barro and Sala-i Martin (1992) and Barro and Sala-i Martin (1995).

Adding the growth rate of bank credit to the non-financial private sector ($\Delta\text{CREDIT}_{Bank}$), that serves as our indicator for financial development, confirms the positive relationship between finance and growth, which is a key hypothesis of Schumpeter's theory but which cannot be found for the static credit variables of the literature. Across all three estimation methods in table 2 and 3, we find a positive and strongly significant link with the GDP growth rate. Even at the 95% confidence interval, the $\Delta\text{CREDIT}_{Bank}$ coefficient is always positive. The GDP growth effect of a percentage point higher bank credit growth ranges from 0.053 to 0.104 percentage points, depending on the empirical method applied. This is particularly noteworthy because our panel includes almost equal numbers of developed and less developed countries, and the existing literature often fails to find significant positive effects of 'finance' on growth, as we have already shown in chapter 5.1. This shows that the use of dynamic credit variables leads to a much more positive impact of bank credit on GDP growth than the results of the empirical literature suggest.

	FE					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-1.531**	-1.860***	-3.084**	-2.354***	-3.332**	-2.108***
	(0.630)	(0.514)	(1.294)	(0.565)	(1.244)	(0.583)
SCHOOL	0.013	0.019**	0.015*	0.019**	0.017*	0.020**
	(0.010)	(0.008)	(0.009)	(0.007)	(0.009)	(0.007)
GOV	-0.311***	-0.422***	-0.596***	-0.645***	-0.548***	-0.593***
	(0.090)	(0.063)	(0.140)	(0.106)	(0.145)	(0.109)
log(OPENNESS)	2.404**	2.287**	2.118**	1.660**	2.601***	2.067***
	(0.927)	(0.846)	(0.787)	(0.706)	(0.749)	(0.702)
INFL	-0.018***	-0.102***	-0.099***	-0.118***	-0.137***	-0.161***
	(0.003)	(0.016)	(0.032)	(0.042)	(0.035)	(0.049)
$\Delta CREDIT_{Bank}$		0.098***			0.075***	0.067***
		(0.016)			(0.023)	(0.021)
ΔNHS			0.000**		0.000***	
			(0.000)		(0.000)	
$\Delta NHSR$				0.000		0.000
				(0.000)		(0.000)
Constant	13.579**	17.022***	34.522**	30.285***	33.021**	24.657***
	(6.578)	(5.777)	(12.592)	(6.061)	(11.952)	(5.887)
Observations	1,509	1,399	842	936	834	928
Countries	41	41	31	34	31	34
Adj. R-squared	0.3172	0.4183	0.4504	0.4481	0.4863	0.4764

	RE					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-1.014***	-0.830***	-0.871***	-1.299***	-0.726***	-1.078***
	(0.252)	(0.244)	(0.217)	(0.402)	(0.212)	(0.301)
SCHOOL	0.018	0.021*	0.007	0.019***	0.008	0.015*
	(0.012)	(0.011)	(0.008)	(0.007)	(0.007)	(0.009)
GOV	-0.096*	-0.107**	-0.113*	-0.439***	-0.104*	-0.146**
	(0.049)	(0.048)	(0.066)	(0.083)	(0.063)	(0.066)
log(OPENNESS)	0.917***	0.727***	0.956***	1.513***	0.873**	0.767**
	(0.216)	(0.252)	(0.306)	(0.469)	(0.364)	(0.362)
INFL	-0.020***	-0.114***	-0.113***	-0.119***	-0.166***	-0.198***
	(0.003)	(0.014)	(0.039)	(0.042)	(0.030)	(0.035)
$\Delta CREDIT_{Bank}$		0.104***			0.086***	0.098***
		(0.015)			(0.021)	(0.020)
ΔNHS			0.000		0.000	
			(0.000)		(0.000)	
$\Delta NHSR$				0.000		0.000
				(0.000)		(0.000)
Constant	10.655***	8.580***	10.454***	17.235***	7.906***	12.468***
	(2.080)	(2.093)	(1.922)	(4.360)	(2.138)	(3.019)
Observations	1,509	1,399	842	936	834	928
Countries	41	41	31	34	31	34
Adj. R-squared	0.4285	0.5318	0.5178	0.5928	0.5503	0.6153

Notes: Heteroskedasticiy-consistent standard errors are indicated in parentheses. GROWTH=growth of GDP per capita in %; log(INITIAL GDP)=logarithm of current expenditure side GDP from previous period at current PPPs; SCHOOL=secondary school enrollment rate (% of population in secondary school age); GOV=general government final consumption expenditure (% of GDP); log(OPENNESS)=logarithm of trade as sum of exports and imports of goods and services (% of GDP); INFL=inflation in consumer prices (% change); $\Delta CREDIT_{Bank}$ = annual growth rate of domestic bank credit to non-financial private sector (%); ΔNHS=annual growth in household sector net saving (%); $\Delta NHSR$ = annual growth in share of net saving to net disposable income (household sector, %).

Table 2: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Fixed Effects and Random Effects

	IV					
Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)
log(INITIAL GDP)	-0.824***	-0.802***	-0.675***	-1.089***	-0.668***	-1.039***
	(0.104)	(0.106)	(0.119)	(0.129)	(0.118)	(0.125)
SCHOOL	0.001	0.008*	0.002	0.007	0.005	0.011**
	(0.004)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)
GOV	-0.091***	-0.103***	-0.119***	0.162***	-0.114***	-0.152***
	(0.020)	(0.022)	(0.032)	(0.030)	(0.033)	(0.031)
log(OPENNESS)	0.702***	0.564***	0.739***	0.590***	0.663***	0.483**
	(0.148)	(0.153)	(0.210)	(0.194)	(0.223)	(0.204)
INFL	-0.019***	-0.065***	0.033	-0.047	-0.060	-0.088*
	(0.004)	(0.018)	(0.043)	(0.042)	(0.047)	(0.045)
$\Delta CREDIT_{Bank}$		0.053***			0.033*	0.050***
		(0.018)			(0.020)	(0.019)
ΔNHS			0.000		0.000	
			(0.000)		(0.000)	
$\Delta NHSR$				-0.001***		-0.001***
				(0.000)		(0.000)
Constant	9.173***	8.725***	7.776***	13.181***	7.442***	12.273***
	(0.878)	(1.018)	(1.365)	(1.415)	(1.389)	(1.396)
Observations	1,509	1,387	842	936	832	926
Countries	41	41	31	34	31	34
Adj. R-squared	0.1582	0.2351	0.1066	0.2058	0.1585	0.2695

Notes: Heteroskedasticiy-consistent standard errors are indicated in parentheses. Instrumented variable: $\Delta CREDIT_{Bank}$ (instrumented by annual growth rate of domestic bank credit to non-financial private sector (%) of previous period (t-1)). GROWTH=growth of GDP per capita in %; log(INITIAL GDP)=logarithm of current expenditure side GDP from previous period at current PPPs; SCHOOL=secondary school enollment rate (% of population in secondary school age); GOV=general government final consumption expenditure (% of GDP); log(OPENNESS)=logarithm of trade as sum of exports and imports of goods and services (% of GDP); INFL=inflation in consumper prices (% change); ΔNHS=annual growth in household sector net saving (%); ΔNHSR=annual growth in share of net saving to net disposable income (household sector, %).

Table 3: Growth effects of credit growth, household saving growth and household saving rate growth, estimated with Instrumental Variables

To check the alternative hypothesis that saving is a driver of economic growth we use saving variables instead of credit variables. In the logic of the 'real analysis' where saving is identical with credit, the result should be rather similar.

We use the percentage change in household net saving rates ($\Delta NHSR$) on the one hand, as the use of saving ratios (albeit often as percentage of GDP) is more common in the empirical literature than the use of absolute saving, if saving is part of the empirical estimation at all. On the other hand, we also analyse the impact of the growth rates of household saving volumes (ΔNHS), which, unlike changes in relative saving rates, do not depend on changes in the denominator (i.e. in disposable income). Thus, ΔNHS can provide a better picture of the actual effect of household saving. This indicator has, however, slightly fewer data points than $\Delta NHSR$.

The results in table 2 and 3 show that in contrast to $\Delta\text{CREDIT}_{Bank}$, both saving variables have no link with GDP growth, regardless of the estimation methodology used and whether considered in an isolated way or simultaneously with our bank credit indicator.

One could argue that household saving has a delayed effect on credit and growth, as banks first

mobilize and pool savings to subsequently pass them on as credit to investors.[14] To test whether household saving activities have a delayed relationship with per capita GDP growth, we therefore repeat the fixed effects estimation for both saving variables with up to 3 lags (i.e., t-1 to t-3), which equals three years. Our results indicate that this is not the case. Again, we find an effect size of 0.000 for both saving variables, regardless of the number of lags (table 4).

Dependent: GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(INITIAL GDP)	-3.084**	-2.354***	-3.180**	-2.616**	-2.447**	-2.021***	-1.546**	-1.558**
	(1.294)	(0.565)	(1.308)	(1.157)	(1.078)	(0.611)	(0.641)	(0.680)
SCHOOL	0.015*	0.019**	0.014	0.013	0.013	0.020***	0.019**	0.019**
	(0.009)	(0.007)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.007)
GOV	-0.596***	-0.645***	-0.606***	-0.670***	-0.671***	-0.673***	-0.732***	-0.745***
	(0.140)	(0.106)	(0.144)	(0.145)	(0.150)	(0.111)	(0.116)	(0.123)
log(OPENNESS)	2.118**	1.660**	2.027**	2.032**	1.951**	1.495*	1.549**	1.752**
	(0.787)	(0.706)	(0.858)	(0.890)	(0.829)	(0.749)	(0.736)	(0.675)
INFL	-0.099***	-0.118***	-0.105***	-0.057	-0.104*	-0.138***	-0.118	-0.172**
	(0.032)	(0.042)	(0.030)	(0.059)	(0.059)	(0.044)	(0.070)	(0.067)
ΔNHS	0.000**							
	(0.000)							
ΔNHSR		0.000						
		(0.000)						
ΔNHS_{t-1}			0.000*					
			(0.000)					
ΔNHS_{t-2}				0.000*				
				(0.000)				
ΔNHS_{t-3}					0.000**			
					(0.000)			
$\Delta NHSR_{t-1}$						0.000*		
						(0.000)		
$\Delta NHSR_{t-2}$							0.000**	
							(0.000)	
$\Delta NHSR_{t-3}$								0.000
								(0.000)
Observations	842	936	820	797	770	912	887	858
Countries	31	34	31	31	31	34	34	34
Adj. R-squared	0.4504	0.4481	0.4524	0.4674	0.4780	0.4499	0.4640	0.4790

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses.

Table 4: Growth effects of household saving growth and household saving rate growth incl. lagged variables, estimated with Fixed Effects

In sum, our analysis shows that there is no evidence for a relationship between saving and per capita GDP growth. This result is also supported by other empirical studies, e.g. by Levine and Zervos (1998), Carroll and Weil (1993) and Mohan (2006). Even Beck et al. (2000) conclude that the relationship between financial development and private saving is poorly established empirically.

6.3.2 A closer look at the credit variables

After we have shown the fundamental difference between saving and credit, we now take a closer look at the different credit variables. We start with a comparison of the GDP effects of credit levels, which is the standard approach in the literature, and credit growth, which is the Schumpeterian approach.

[14] With respect to the credit variable, we see no reason to consider lags, since the relationship between credit and growth is observable in the fairly short run (see chapter 6.4).

To illustrate the key differences between the two approaches, we re-estimate the model we used in the previous section. To avoid endogeneity, we now exclusively resort to IV estimation with 2SLS estimators, where we estimate the two credit variables ($\Delta\text{CREDIT}_{Bank}$ and CREDIT_{Bank}) each by their own value in the previous period (t-1) (see table 5).

The results support our findings from the previous estimations. While the growth rate of bank credit ($\Delta\text{CREDIT}_{Bank}$) is strongly significantly and positively related to GDP per capita growth, the absolute level of bank credit to GDP has neither significant nor positive effects.

Dependent Variable: GROWTH	(1)	(2)
log(INITIAL GDP)	-0.883***	-0.802***
	(0.107)	(0.106)
SCHOOL	0.004	0.008*
	(0.005)	(0.005)
GOV	-0.104***	-0.103***
	(0.023)	(0.022)
log(OPENNESS)	0.603***	0.564***
	(0.158)	(0.153)
INFL	-0.017**	-0.065***
	(0.008)	(0.018)
CREDIT_{Bank}	0.000	
	(0.000)	
$\Delta\text{CREDIT}_{Bank}$		0.053***
		(0.018)
Constant	10.066***	8.725***
	(0.960)	(1.018)
Observations	1,399	1,387
Countries	41	41
Adj. R-squared	0.1483	0.2351

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses.

Table 5: Growth effects of dynamic and static bank credit, estimated with Instrumental Variables

6.3.3 Bank credit versus non-bank finance

We now also take a look at the role of bank credit compared to credit from other sources. Table 6 provides an overview on the correlations of credit variables, that are available from the BIS statistics, and per capita GDP growth. Bank credit growth is the indicator which is most strongly associated with GDP growth. This can be regarded as an indication for the special importance of banks as an engine of economic growth, as it is postulated by Schumpeter. However, all other credit indicators are also positively and in most cases very significantly related to growth. $\Delta\text{CREDIT}_{Alt}$ has the lowest coefficient.

Credit to households versus credit to firms

Differentiating credit by the borrowing sectors, we find that both the growth rates of credit to households and credit to the corporate sector have a significant effect on per capita GDP growth.[15] An important result is that credit to non-financial corporations is stronger related to GDP growth

[15] As we do not have a breakdown of bank credit by borrower group, these figures refer to total credit to the non-financial private sector.

than household credit. This is not surprising as households often use credit for consumption and for the purchases of existing houses and apartments.

Dependent: GROWTH	Total credit	Bank credit	Alternative credit	Credit to Households	Credit to Corporations
log(INITIAL GDP)	-1.822***	-1.860***	-1.837***	-2.290***	-2.126***
	(0.501)	(0.514)	(0.581)	(0.579)	(0.744)
SCHOOL	0.018**	0.019**	0.016*	0.015**	0.012
	(0.009)	(0.008)	(0.009)	(0.007)	(0.008)
GOV	-0.415***	-0.422***	-0.439***	-0.548***	-0.524***
	(0.062)	(0.063)	(0.083)	(0.096)	(0.090)
log(OPENNESS)	2.278**	2.287**	2.413**	1.941**	2.134***
	(0.893)	(0.846)	(1.005)	(0.891)	(0.778)
INFL	-0.098***	-0.102***	-0.022	-0.095***	-0.133***
	(0.018)	(0.016)	(0.015)	(0.012)	(0.017)
ΔCREDIT	0.089***	0.098***	0.005*	0.010***	0.068***
	(0.016)	(0.016)	(0.003)	(0.002)	(0.019)
Observations	1,411	1,399	1,370	1,034	1,021
Countries	41	41	41	41	41
Adj. R-squared	0.3921	0.4183	0.3307	0.4745	0.4905

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses.

Table 6: Growth effects of dynamic credit indicators, estimated with Fixed Effects

Credit to developing countries vs. credit to developed countries

Our review of the empirical literature shows that the growth effects of 'financial development' are different for advanced economies and developing market economies. We therefore divide our panel according to these country groups (see table 7). We find that the coefficient for bank credit growth is roughly the same for both country groups, with a slightly higher value for the less developed countries. The growth effect of alternative credit, however, differs significantly between developed and less developed economies: it is more than 10 times higher in developed countries than in less developed countries. This reflects the importance of capital market financing for developed countries.

	Bank credit		Alternative credit	
Dependent: GROWTH	Developed countries	Less developed countries	Developed countries	Less developed countries
log(INITIAL GDP)	-4.375***	-2.023*	-3.798***	-2.169
	(0.644)	(1.024)	(0.791)	(1.455)
SCHOOL	0.007	0.023	0.003	0.019
	(0.006)	(0.022)	(0.006)	(0.031)
GOV	-0.468***	-0.332***	-0.473***	-0.296*
	(0.106)	(0.103)	(0.101)	(0.147)
log(OPENNESS)	2.435**	1.670	2.325**	1.953
	(1.040)	(1.182)	(1.080)	(1.435)
INFL	-0.156***	-0.088***	-0.129***	-0.014
	(0.034)	(0.018)	(0.035)	(0.012)
ΔCREDIT	0.086***	0.090***	0.026*	0.002
	(0.020)	(0.021)	(0.015)	(0.003)
Observations	918	481	918	452
Countries	24	17	24	17
Adj. R-squared	0.5295	0.4154	0.5000	0.3277

Note: Heteroskedasticity-consistent standard errors are indicated in parentheses.

Table 7: Growth effects of bank credit and alternative credit by development level, estimated with Fixed Effects

After differentiating our sample by level of development, we check whether the effect of finance on growth has changed over time. To do so, we analyse three sub-periods (see table 8):

- the period including all data points until 1999,
- the period from 2000 until 2019,
- the period from 2010 until 2019.

We find for the **advanced economies** that the impact of bank credit on GDP growth has declined in the past two decades. Since the year 2000 it is still positive but no longer significant. In contrast, the positive effect of alternative credit has increased and it has become significant since 2010. On the other hand, for **less developed countries**, since 2010 the growth effect of bank lending has increased, while there are low and not significant effects of non-bank lending in all three sub-periods. Although the number of available data points decreases sharply in this approach, these findings indicate that the relative importance of bank credit and capital market financing for growth changes during the development process.

While private bank credit seems to have become more important for GDP growth in less developed countries, there is a shift in the importance of bank credit for GDP growth toward non-bank credit in developed countries. This is also reflected in the relatively high share of non-bank credit in total credit in advanced economies that we have shown in figure 8.

	Bank credit						Alternative credit					
	Developed countries			Less developed countries			Developed countries			Less developed countries		
Dependent: GROWTH	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010	<2000	>2000	>2010
ΔCREDIT	0.135***	0.060	0.074	0.078**	0.075**	0.143***	0.019	0.043	0.105*	0.001	0.003	-0.002
	(0.017)	(0.041)	(0.064)	(0.027)	(0.034)	(0.047)	(0.013)	(0.037)	(0.060)	(0.003)	(0.004)	(0.004)
Observations	493	403	183	213	257	116	493	403	183	184	257	116
Countries	23	24	24	14	17	16	23	24	24	14	17	16
Adj. R-squared	0.5031	0.5520	0.5206	0.3066	0.5561	0.4106	0.4278	0.5526	0.6002	0.2221	0.5132	0.2932

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses. For better clarity, the growth estimators other than the credit variables are not included in this table. The variables not included correspond to those from the other panel estimates from this paper.

Table 8: Growth effects of bank credit and alternative credit by development level and decade, estimated with Fixed Effects

Finally, we analyse the effects of credit to the household sector and to the corporate sector for advanced and developing countries (see table 9). While the relationship between credit to the corporate sector and GDP growth is relatively similar in both country groups, credit to the household sector shows a more pronounced effect for the group of advanced economies. This finding emphasizes the importance of distinguishing corporate credit and household credit (Beck et al., 2012).

	Total credit to household sector		Total credit to corporate sector	
	Developed countries	Less developed countries	Developed countries	Less developed countries
ΔCREDIT	0.044***	0.007***	0.071*	0.063**
	(0.014)	(0.002)	(0.036)	(0.022)
Observations	739	295	726	295
Countries	24	17	24	17
Adj. R-squared	0.5516	0.4725	0.5727	0.4820

Note: Heteroskedasticiy-consistent standard errors are indicated in parentheses. For better clarity, the growth estimators other than the credit variables are not included in this table. The variables not included correspond to those from the other panel estimates from this paper.

Table 9: Growth effects of bank credit to households and corporate sector by development level, estimated with Fixed Effects

To sum up our panel analysis we can conclude that there seems to be a highly significant link between dynamic credit variables, especially private bank credit growth, and per capita GDP growth. This relationship can be observed for both developed and less developed economies. The evidence suggests that in the past two decades bank credit has lost influence in developed economies while non-bank credit has gained in importance.

Our panel analysis also shows that there is no effect of static indicators for financial development on economic growth. In the same vein, the analysis provides also no evidence for an effect of saving either on credit growth or on GDP growth.

All in all, one can argue that the evidence is supportive for the hypotheses that one can derive from the 'true Schumpeter', i.e. the paradigm of the 'monetary analysis'. At the same time, our analysis confirms the results of the existing studies which shows for advanced economies that there are no significant positive effects of credit levels on economic growth and that the same applies to the effects of saving on growth.

6.4 Dynamic analysis of credit supply shocks

So far we have not analysed whether more bank credit leads to more growth or whether more GDP growth does not rather lead to more bank lending. The same applies to household saving and growth. We therefore extend our analysis to include a causality-driven account of our data. In addition, after providing a cross-country analysis with averaging effects, we will now focus

on the dynamics between key variables in individual countries. We focus on the United States, where quarterly data especially on household saving are available for a long time horizon. In the appendix (section 15), we also provide country-individual results.

We use a structural vector-autoregressive model (VAR) to assess the effects of an exogenous credit supply shock on growth compared to an exogenous saving shock. Following the logic of the real analysis, the shock-responses should be rather similar.

For the assessment of qualitative differences between credit and saving shocks, we estimate two structural VARs. Equation 2 provides a structural representation of the relevant variables:

$$A_0 x_t = c + \sum_{i=1}^{k} A_i x_{t-i} + \varepsilon_t \tag{2}$$

A_i is an $n\ x\ n$ matrix including autoregressive coefficients at lag, i = 1, . . . , k , and A_0 captures contemporaneous impact coefficients. k is the lag length, and ε_t is a vector of i.i.d. structural shocks. The constant is represented by the variable c. The $n\ x\ 1$ vector x_t includes the following $n\ =\ 3$ variables in this order, $x = [y\ cr\ int]'$. For our second structural VAR, we substitute bank credit with household saving and thus the $n\ x\ 1$ vector x_t comprises the following $n = 3$ variables in this order, $x = [y\ sav\ int]'$. The data for bank credit are still taken from the BIS credit statistics, data for GDP, policy rate and household saving are now uniformly taken from the database of the Federal Reserve Bank of St. Louis. Compared with the analyses in section 6.3 and in line with the existing literature we now estimate the model at a quarterly frequency to have a larger sample size. Data at the quarterly frequency is not available for the previous analyses due to limited data availability at quarterly frequency. Our data for the U.S. cover the period from 1954Q4 to 2019Q4. Data for economic growth (*y*), credit (*cr*) and saving (*sav*) are in log difference to be consistent with the preceding panel analysis and to draw on dynamic indicators. The policy rate is represented by *int*. Due to better data availability for quarterly time series we limit our VAR analysis with household saving data to the United States.

We estimate the reduced-form VAR representation of Equation 2 using the respectively suggested lag length of several information criteria. To recover the structural VAR representation we impose restrictions on elements in A_0. Thereby we segregate exogenous credit supply changes from endogenous reactions to other variables in the model.

We follow the literature (e.g. Gilchrist and Zakrajšek (2013)) by assuming that shocks in macroeconomic variables impact financial variables contemporaneously, whereas shocks in financial

variables affect the real economy with a time lag. For the identification strategy we apply a Cholesky factorization to the variance–covariance matrix of the reduced-form regression residuals, u_t. Then we use the Cholesky factor for A_0, which provides $u_t = A_0^{-1}\varepsilon_t$ and recovers the structural representation. We allow the policy rate to contemporaneously react to credit shocks within the recursive identification scheme (Sims, 1992). This recursive SVAR framework is in line with previous studies on credit shocks, e.g. Bassett, Chosak, Driscoll, and Zakrajšek (2014); Lown and Morgan (2006) and Boivin, Giannoni, and Stevanović (2020). While other studies employed alternative identification strategies such as sign restrictions, the results remain similar. As Littlejohn (2019, p. 5) states: *'Despite the variation across identification methods, a procyclic relationship between credit shocks and output growth is consistent across these studies, especially in the short-run.'*

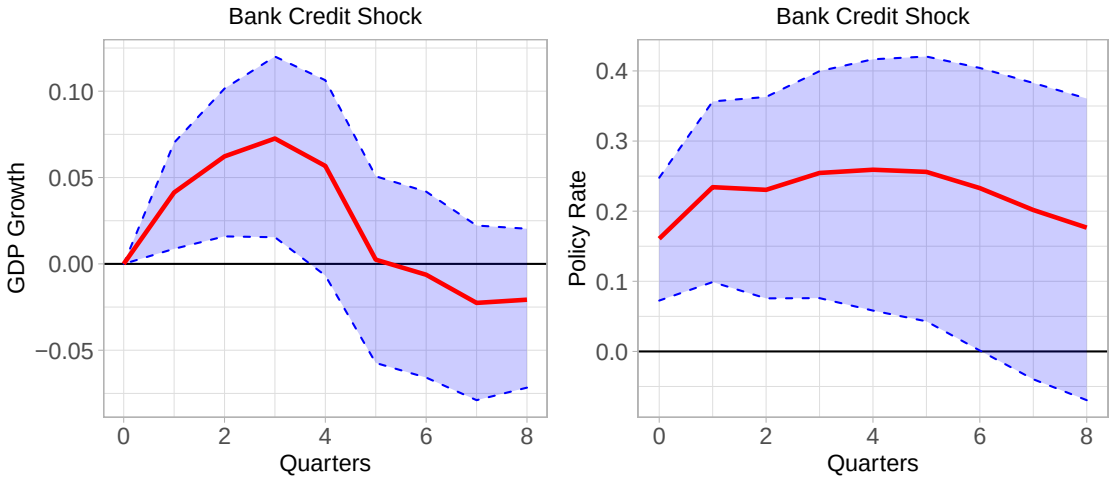


Figure 6: Impulse-Response Functions of a bank credit supply shock on GDP and the policy rate
Note: Based on the BIS total credit statistics and FRED. The red line denotes the estimated response, while the blue area represents 90 percent confidence bands derived from 5,000 bootstrap runs.

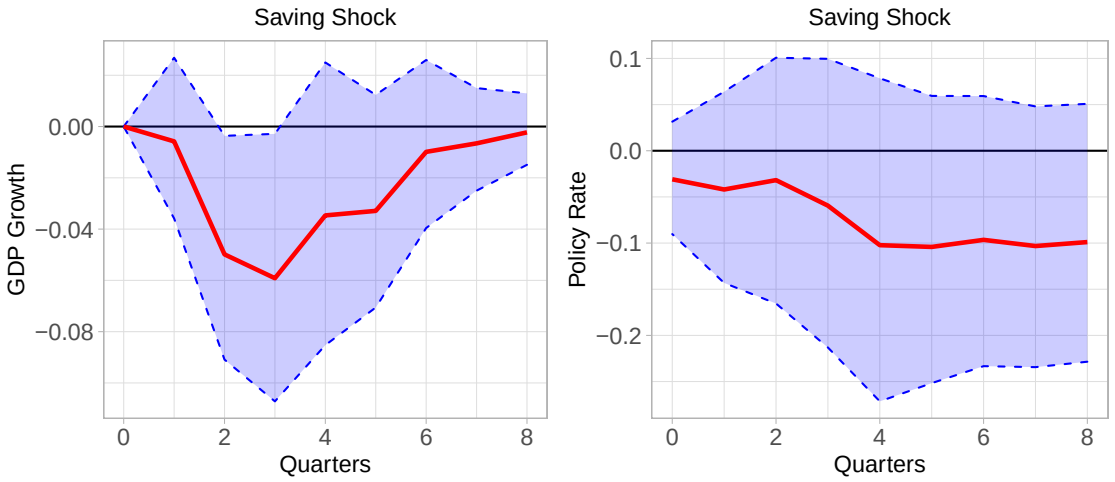


Figure 7: Impulse-Response Functions of a household saving shock on GDP and the policy rate
Note: Based on the BIS total credit statistics and FRED. The red line denotes the estimated response, while the blue area represents 90 percent confidence bands derived from 5,000 bootstrap runs.

The impulse response functions suggest a positive impact of a bank credit supply shock on economic growth. The effect is statistically significant for several quarters and then vanishes. These results suggest – in line with the cause-effect relationships of the 'monetary analysis' - that a bank credit shock causes an increase in economic growth. We also find a positive and statistically significant reaction of the policy rate immediately after the shock. The cause-effect relationships of the 'real analysis' would suggest that a shock in household saving should lead to similar effects. However, we only find negative and insignificant effects on economic growth and the policy rate. These findings are also robust when we use real GDP or real GDP per capita for economic growth, albeit the effects of bank credit on growth are less pronounced and less significant. The effect of a saving shock is still negative and insignificant on economic growth and the policy rate.[16] These findings support our previous cross-country panel analysis and are in line with the literature that examined the causal relationship between saving and growth. In the appendix (section 15) we provide country individual results for the impulse-response functions of a credit-supply shock. We use the quarterly bank credit data by the BIS and real GDP (deflated nominal GDP) and short-term interest rate data by the OECD. Albeit, the picture is rather heterogeneous, we also find for some countries a statistically significant negative impact of a credit supply shock on GDP growth, which could be an indicator for the adverse effects of credit growth that Schumpeter alluded to in his 'secondary wave' analogy.

[16]The results for household saving are also robust when we use the shadow rate by Wu and Xia (2016) for the period of 2009Q4 to 2015Q4. The effect of bank credit on economic growth is again less pronounced and less significant if we use the shadow rate.

6.5 Causality tests between credit and growth

So far, we have been able to show the importance of choosing dynamic indicators over static indicators when discussing the finance and growth nexus. Our panel analysis suggests overall a highly significant link between bank credit growth and economic growth. Our SVAR model, albeit only for the United States, even indicates a direction for this relationship with credit shocks positively affecting economic growth. This subsection further elaborates on the direction of effects of the financial system on economic growth, which is still an open topic as e.g. Asanović (2020, p. 102) points out: *'Despite the large volume of empirical research, many questions still remain unresolved and there is still no consensus on the direction of the relation between financial and real sector.'* Therefore, we examine the directions of the relationship between credit (financial sector) and economic growth (real sector). To do so, we resort to two standard empirical methods. First, we use Granger causality tests, to examine the relation between credit growth and GDP growth in our dataset. Granger causality tests are a standard method for empirical analysis in the finance and growth literature. In a second step, we use Forecast Error Variance Decompositions (FEVD) as a robustness check.

A standard approach to determining the usefulness of one time series for forecasting another is the so-called 'Granger causality test' even though the assertion of causality by this test would be too far-fetched. In short, the test is based on the idea that one series (call it x) Granger-causes another series y if the forecasts of y improve when x is included in the forecasting process (Granger, 1969). In general mathematical terms, a series x Granger-causes another series y if the extension of the univariate regression of y_t on its past values

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + ... + \alpha_m y_{t-m} + error_t \tag{3}$$

by series x

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + ... + \alpha_m y_{t-m} + \beta_p x_{t-p} + ... + \beta_q x_{t-q} + error_t \tag{4}$$

yields values for β_p to β_{t-p} that are significantly different from zero according to their t-statistics and increases the explanatory power of the regression as measured by an F-test.
For each country, we pass the test a matrix consisting of two columns, $X1$ and $X2$, with the null hypothesis being that the second column, $X2$, does not Granger-cause the first column $X1$ meaning that our null hypothesis is that all coefficients on $X2$ are not significantly different from zero.
We reject the null hypothesis if the reported p-values of the test are below a certain level for which we choose the conventional thresholds of 0.10, 0.05 and 0.01.
First, we test the null hypothesis that credit growth does not Granger-cause GDP growth. We then repeat the test for the opposite null hypothesis that GDP does not Granger-cause credit growth. The result of this two-sided test for almost the entire sample period from the first quarter of 1950 to

		Share of significant relations					
Test order	Countries	Credit growth Granger causes GDP growth			GDP growth Granger causes credit growth		
Significance level		0.1	0.05	0.01	0.1	0.05	0.01
Full sample	43	51.16%	39.53%	18.60%	62.79%	53.49%	34.88%
Developed countries	25	44.00%	36.00%	20.00%	52.00%	44.00%	24.00%
Developing countries	18	61.11%	44.44%	16.67%	77.78%	66.67%	50.00%

Note: The full sample covers a period from 1950Q1 to 2020Q1.

Table 10: Granger Causality p-values for overall period and by development level

the first quarter of 2020 is shown in Table 10.[17]

The test provides a mixed picture with Granger causality pointing in two directions. On the 10% significance level we find that in 51% of the countries in our sample we have a significant effect of credit growth on GDP growth. For the opposite direction (effect of GDP growth on credit growth), the share of countries with significant effect is even higher (62.79%). As there is the possibility of both-way causality, the numbers do not have to add up to 100 %. Even on lower significance levels, the effect of GDP on credit growth is higher than the effect of credit on GDP.

While for our panel analyses we have found heterogeneous effect sizes for developing and developed countries, we find a rather homogeneous picture with respect to the directions of the effects.

To give an overview for the relationships in the countries of the BIS database, we use the following classification:

- **Credit growth Granger causes GDP growth:** The p-values for credit growth Granger-causing GDP growth are significant at the 10% significance level. The p-values for GDP growth Granger-causing credit growth are not significant.
- **GDP growth Granger causes credit growth:** analogous to credit growth Granger causes GDP growth
- **Both directions:** The p-values for credit growth Granger-causing GDP growth are significant at the 10% significance level. The p-values for GDP growth Granger-causing credit growth are also significant.
- **No relationship:** The p-values for credit growth Granger-causing GDP growth are not significant. The p-values for GDP growth Granger-causing credit growth are also not significant.

For a majority of countries we find a significant relationship between credit growth and GDP growth. The number of countries in which GDP growth leads to credit growth is higher than the

[17] We exclude the sparse data from the third quarter of 1944 to the end of 1949 because there are plausible concerns about biases due to World War II and its immediate aftermath.

share of countries for which the data infer growth-generating lending. In about a third of the countries we find significant effects from credit growth on GDP growth and vice versa. In 20% of the countries, there is no empirical evidence for any relationship between finance and growth.

Credit Granger causes GDP	Both directions	GDP Granger causes credit	No relationship
Australia	Argentina	Brazil	Austria
Belgium	Chile	Canada	Colombia
Germany	China	Finland	Czech Republic
Hungary	Denmark	France	Greece
India	Indonesia	Hong Kong	Ireland
Japan	Israel	Luxembourg	Poland
Russia	Italy	Malaysia	Saudi Arabia
Switzerland	Korea	Norway	Spain
	Mexico	Portugal	
	Netherlands	Sweden	
	New Zealand	Thailand	
	Singapore	Turkey	
	South Africa	United Kingdom	
	United States		

Note: The full sample covers a period from 1950Q1 to 2020Q1.

Table 11: Overview on directions of p-values using all available data for the entire time period

As robustness check we apply Forecast Error Variance Decomposition (FEVD). This approach is based on estimating a VAR from the data, in our case a bivariate VAR, and then using the fitted model to forecast multiple periods by implementing exogenous shocks. In contrast to the structural VAR above, the bivariate VAR can easily be computed with our BIS dataset without the need for country specific data that go beyond this data set. The mean squared error (MSE) of this forecasting process is given by the formula

$$MSE[y_{j,t}(h)] = \sum_{i=0}^{h-1} \sum_{k=1}^{K} (e_j^{'} \Theta_i e_k)^2 \tag{5}$$

following the standard matrix notation of a VAR. This formula can be used to calculate the contribution of each variable (i.e. each time series') to the variance of the forecast error:

$$\omega_{jk,h} = \frac{\sum_{i=0}^{h-1} (e_j^{'} \Theta_i e_k)^2}{MSE[y_{j,t}(h)]} \tag{6}$$

$\omega_{jk,h}$ thus measures the proportion of forecast error variance of variable j that can be attributed to an exogenous shock to variable k. Further information on this approach can be found, for example, in Lütkepohl and Krägig (2004, p. 180f).

We determine the optimal lag-length using standard information criteria and estimate a VAR that

has a similar form to equation 4. We use our model to forecast 8 periods (=two years) and use exogenous shocks to generate the MSEs and finally to decompose the variance of the MSEs to obtain the impact of one variable on the other as described above.

We estimate the FEVD for all available data for each country.[18] The results are shown in Figure 8 and 9. The colors of the bars indicate the respective results for each country from Granger tests from Table 11.

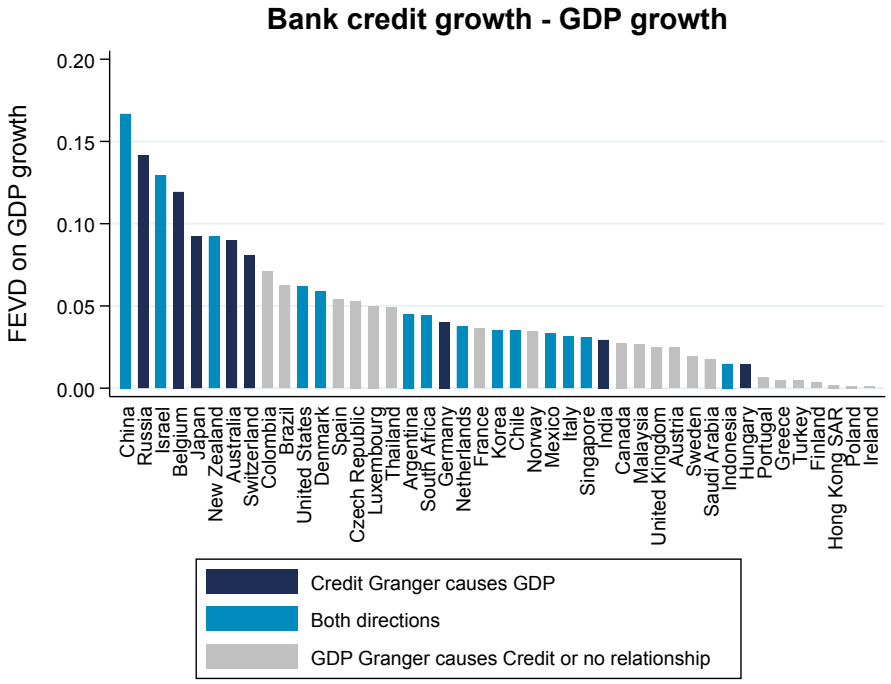


Figure 8: FEVD for GDP with credit shock.
Note: Based on the BIS total credit statistics (see chapter 6.1 for detailed description). Color of bars indicate how results fit to table 10.

[18]The individual results for each period and country are shown in Table 14 in the Appendix. The table shows the contributions from each individual shock averaged over the 8 periods. As an example, approximately 94% of the variation in GDP in the United States come from shocks to GDP itself. The credit growth shocks contribute to 6% of the variation in GDP. Analogously, 88% of the variation in credit growth comes from credit growth shocks and 12% from GDP.

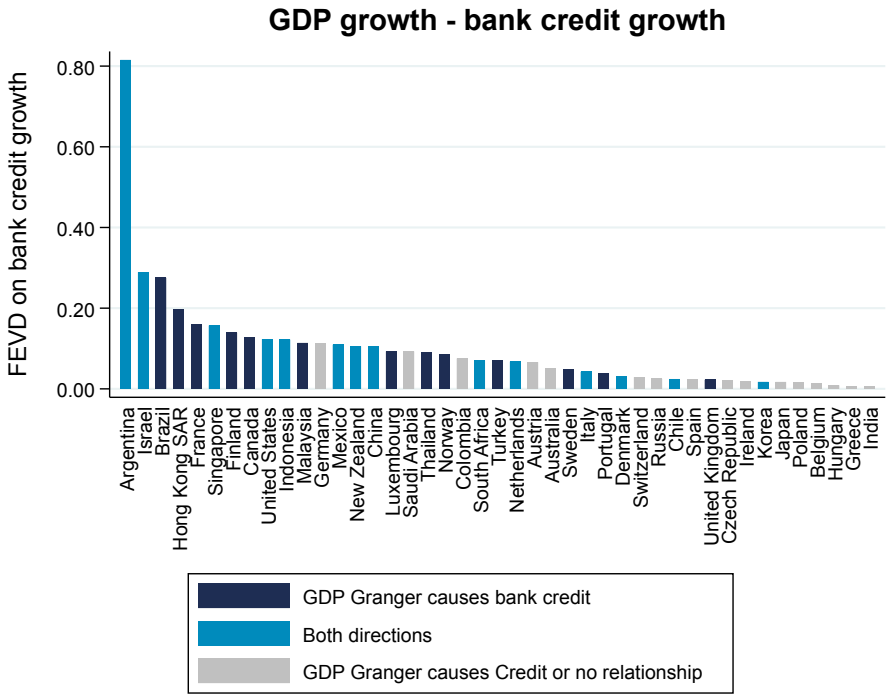


Figure 9: FEVD for Credit with GDP shock.
Note: Based on the BIS total credit statistics (see chapter 6.1 for detailed description). Color of bars indicate how results fit to table 10.

Our findings thus generally match with and confirm the results from our Granger causality tests (see table 11). For countries where we find that credit growth Granger causes GDP growth or the Granger tests suggest a both way significant relationship, we also find a high effect of credit growth on GDP growth. For example China, Russia, Israel, Belgium, Japan, Australia and Switzerland. The same applies for countries where GDP growth Granger causes credit growth or Granger tests suggest a both way significant relationship. Compared to the other countries of our sample, countries like Argentina, Israel, Brazil, Hong Kong SAR, France, Canada and the United States show a comparatively large effect size for GDP growth shocks affecting credit growth variations.

Our findings therefore provide support for Schumpeter's theory. The results of our previous panel and SVAR analyses that suggest a link between credit growth and economic growth seem to be confirmed. Granger causality tests and FEVD additionally give an indication of the direction of these links. While we do find significant results for both directions, the most common result suggest the direction running from credit growth to economic growth. This fits our first hypothesis that there should be a positive effect of credit growth on GDP growth. We also find result for an effect of economic growth on credit growth. These results seem quite straightforward and can be explained for example by second order effects of economic growth, which are rooted in income effects that facilitate the credit provision of banks - and thus increase credit growth (Bofinger &

Schächter, 1995).

Some results of our analysis are inconclusive. These results could be an indication for Schumpeter's distinction between **productive and unproductive credit** and thus our fourth hypothesis (*'secondary wave'*). While credit can be used for investment, i.e. for the production of new real assets, they can also be used for pure financial transactions, i.e. the purchase of existing real assets. The latter transactions only influence prices but not economic growth. These findings are somewhat related to the literature on credit cycles (e.g. Bezemer and Zhang (2014); Borio (2014); Jordà, Schularick, and Taylor (2016); Mian and Sufi (2018); Minsky (1992); Schularick and Taylor (2012)), which explains the positive and negative relationship between credit and growth and its drivers. In particular, the findings by (Jordà et al., 2016) that a significant share of credit growth to the private sector is due to mortgage credits is relevant in this context, as this is an important contributor to unproductive credits. The inconclusive results also pose a challenge to the 'critical assumptions' of real analysis. As Bofinger (2020, p.69) puts it: *'[I]n RA [real analysis] 'investment' is limited to transactions that increase the stock of real assets in the economy.'* It is therefore difficult to explain the proportion of inconclusive results with a model that assumes that credit can only be used for productive investment.

7 Schumpeter is right: What does this imply?

In this paper we describe the unusual finding in the history of economic thought that an eminent economist is declared as the patron of a research program that fundamentally contradicts his intentions. This misinterpretation is not only a problem for the history of economic theory. It is above all a problem for the vast literature, which since the 1990s has intensively studied the relationship between the financial system and its effects on economic growth. The research has unreservedly and without any discussion opted for the paradigm of the 'real analysis' which Schumpeter considered inappropriate for the analysis of financial processes. Our paper shows that this has led to a theoretical and empirical dead end.

After decades of intensive theoretical and empirical research, fundamental mechanics of the finance and growth nexus are still unclear. Above all, liquidity creation as a key function of the banking system has been almost totally neglected. There is no convincing evidence for growth-enhancing effects of the financial system in advanced economies as well as for the decisive nexus between saving and the financial system.

What does the '*True Schumpeter*' imply for the research on the role of the financial development in modern economies? First, one must abandon the idea that the financial system can be represented

by a model based on the unrealistic critical assumption of a general-purpose good. As Rodrik (2015, p. 94) rightly points out, the empirical relevance of a model is based on the realism of its critical assumptions. It is difficult to imagine a less unrealistic assumption than that of the general-purpose good, which is both a real asset and a financial asset. The rejection of real analysis has far-reaching consequences, as it dominates not only the literature on the finance and growth nexus, but almost all models of modern macroeconomics.

Second, Schumpeter tells us that we must abandon the idea that household saving is a source of funds that can be used to finance investment. We have shown that there is no empirical evidence for such a relationship either. This means that the role of the saver, who is the central figure in modern macroeconomic models, must also recede into the background. Given that there is no empirical evidence for the behavior of private households as assumed by the Euler equation (Ascari, Magnusson, & Mavroeidis, 2021), this does not have to be a disadvantage.

Third, Schumpeter gives banks a role that goes far beyond the 'easing of frictions'. Banks are unique in their function as producers of money. The production of money is identical with the creation of liquidity as the maturity of a credit which a bank provides is necessarily longer as the maturity of the deposit which the bank offers to the borrower. Therefore, the empirical analysis of liquidity creation must focus on the dynamics of credit creation, not on static balance sheet positions. In our empirical analysis, we show that this makes it possible to identify effects of the financial system, also for advanced economies.

Fourth, Schumpeter recognized that finance could have positive as well as negative effects. While the 'real analysis' with its GPG is unable to analyse financial crises, the 'monetary analysis' opens the view for the destabilising effects of financing consumption and speculative investments.

Finally, Levine (2005, p. 867) rightly argues that *'research that clarifies our understanding of the role of finance in economic growth will have policy implications and shape future policy-oriented research'*. The 'real analysis' with its focus on the easing of frictions supports policies that uncritically aim at financial liberalization. The monetary analysis which emphasizes the huge potential of the banking system to create purchasing power out of nothing leads to a more nuanced view.

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8 Appendix

8.1 Data set

Country coverage	
Developed countries	Developing countries
Australia	Argentina
Austria	Brazil
Belgium	Chile
Canada	China
Czech Republik	Colombia
Denmark	Hong Kong
Finland	India
France	Indonesia
Germany	Israel
Greece	Korea
Hungary	Malaysia
Ireland	Mexico
Italy	Russia*
Japan	Saudi Arabia
Luxembourg	Singapore
Netherlands	South Africa
New Zealand	Thailand
Norway	Turkey
Poland	
Portugal	
Spain	
Sweden	
Switzlerland	
United Kingdom	
United States	

* Classification follows United Nations (as of June 2021).
* For reasons of better data handling, Russia has been assigned to the developing countries.

Table 12: Country coverage

Variables and Sources			
Symbol	Variable	Definition	Data source
Dependent variables			
GROWTH	Growth of GDP per capita	Annual growth rate of GDP per capita (constant local currency) in percent	World Bank: WDI Database
Explanatory variables			
$\Delta CREDIT_{Total}$	Total credit growth	Annual growth rate of total credit to the private non-financial sector (in units of home currency) in percent	BIS long series on total credit
$\Delta CREDIT_{Bank}$	Bank credit growth	Annual growth rate of domestic bank credit to the private non-financial sector (in units of home currency) in percent	BIS long series on total credit
$\Delta CREDIT_{Alt}$	Alternative credit growth	Annual growth rate of alternative credit (as total credit minus bank credit) to the private non-financial sector (in units of home currency) in percent	BIS long series on total credit
$\Delta CREDIT_{Household}$	Household credit growth	Annual growth rate of total credit to private households (in units of home currency) in percent	BIS long series on total credit
$\Delta CREDIT_{Corporate}$	Corporate credit growth	Annual growth rate of total credit to the corporate sector (in units of home currency) in percent	BIS long series on total credit
ΔNHS	Net household saving growth	Annual growth in net saving (household sector) in percent	UN, AMECO, OECD, own calculations based on national statistics agencies
ΔNHSR	Net household saving rate growth	Annual growth in the share of net saving to net disposable income (household sector) in percent	UN, AMECO, OECD, own calculations based on national statistics agencies
Control variables			
log(INITIAL GDP)	Level of initial GDP	Natural logarithm of current expenditure-side GDP at current PPPs from previous period (t-1)	Penn World Tables 10.0
SCHOOL	Secondary school enrollment rate	Gross secondary school enrollment rate (percentage of population in secondary school age group)	World Bank: WDI Database
GOV	Government expenditure	General government final consumption expenditure (percentage of GDP)	World Bank: WDI Database
OPENNESS	Trade	Natural logarithm of trade, as the sum of exports and imports of goods and services as a share of GDP	World Bank: WDI Database
INFL	Inflation	Inflation in consumer prices (annual percentage change)	World Bank: WDI Database

Table 13: Variable definitions and sources

8.1.1 Credit data

Figure 10 shows the growth rates of bank credit to the private non-financial sector in the countries that we sampled from the BIS statistics, measured as median values of the years 2009 to 2019. The map illustrates that over the past 10 years, some European countries have experienced negative bank credit growth rates, namely that countries that were hit particularly hard by the financial and economic crisis starting in 2007/2008. At the same time, it is mainly less developed countries in South America or Asia that have shown particularly high credit growth rates. By contrast, bank credits in the USA, Japan and non-crisis countries in Europe only grew at a median rate of between 0 and 5% per year. This first observation may already underline the idea of investigating a potential link between bank credit growth and GDP growth.

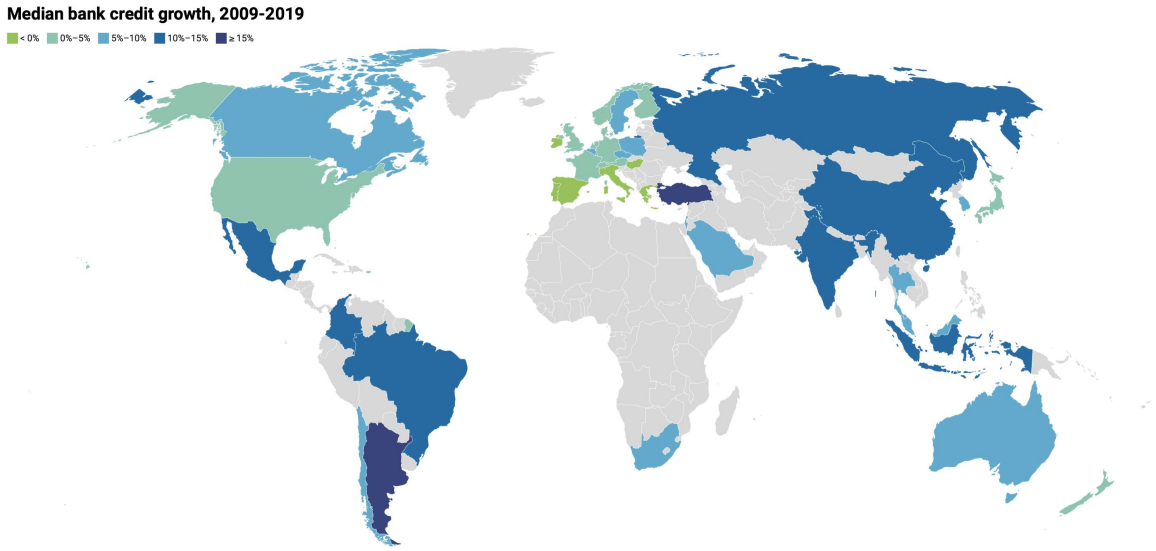

Figure 10: Median bank credit growth in the period 2009-2019.
Note: Based on the BIS total credit statistics.

The average growth of bank credit to the non-financial private sector across all countries and points in time in our dataset is 17.71 percent. However, looking at the kernel density functions in figure 11 indicates, that also prior to the 2010 decade, bank credit growth rates tended to be lower in developed countries than in less developed countries. Also, developing countries show greater variability and stronger outliers in the data. Particularly strong growth rates for private bank credit are seen during periods of crisis, such as the Latin American debt crisis (mainly in the 1990s), the Asian financial crisis (1997 onward), or national crises, such as the bank stock crisis in Israel (1983) and hyperinflation in Brazil (1980-1994). During these phases, we can also observe particularly high inflation rates (which we will thus control for in the later analyses). Following crisis phases, we often find negative credit growth rates, for example in Argentina (2000-2003), Greece (2011-2019), Spain (2010-2019) and Thailand (1999-2001). With -48.0 percent in 1999 the

decline in bank lending to the private sector was for instance particularly pronounced in Indonesia, following the Asian financial crisis. In general, both when looking at developed countries and less developed countries, a decline in credit growth rates has been observed over the past decades.

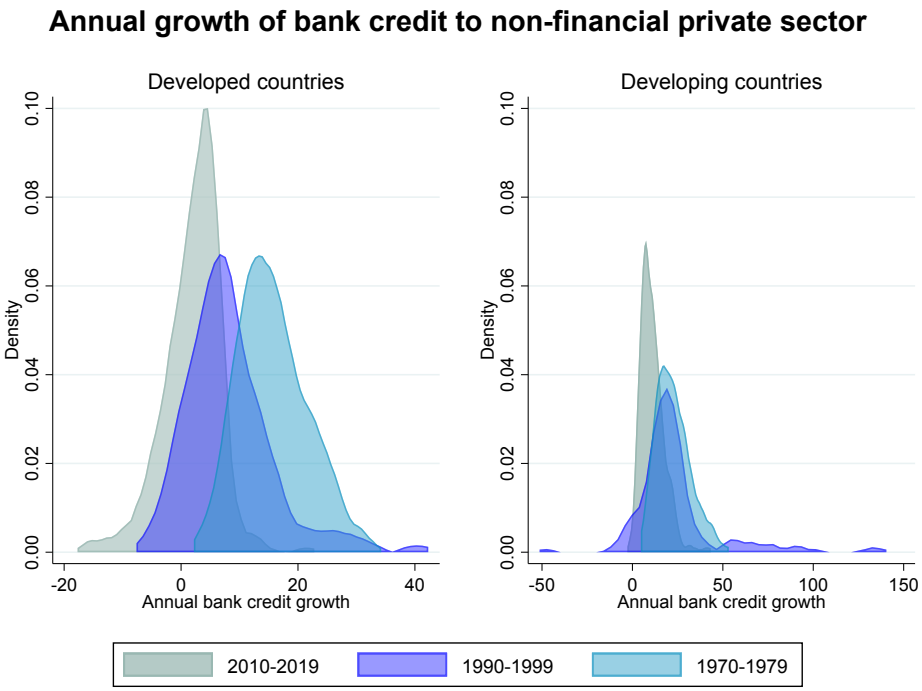

Figure 11: Kernel density by development status in the past decades, based on the BIS total credit statistics

Note: Particularly strong outliers (Argentina, Brazil and Israel) have been excluded for better presentability.

8.1.2 Saving data

Looking at the data, it can be seen that net household saving rates in developed countries are considerably lower than those in areas classified as developing countries across almost all points in time. Over the entire time horizon under consideration, this results in a mean household saving of 13.6 percent of disposable income in developing economies and 7.4 percent in developed economies. This systematic difference is usually explained by a lack of social safety nets and the need for strong private pension provision in many less developed economies (e.g. Feldstein (1977), Reisen and Bailliu (1998), Edwards (1996)).

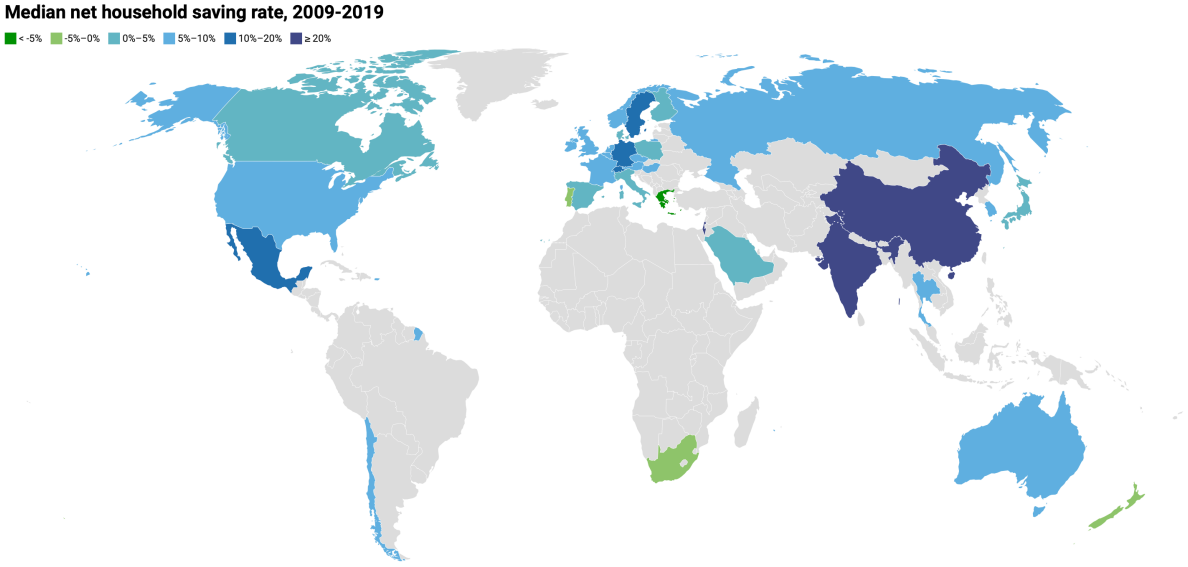

Figure 12: Median net household saving rates in the period 2009 - 2019, based on constructed database

Furthermore, a clear downward trend in net household saving rates can be observed over the last 80 years,[19] even though this indicator is usually quite constant over the short and medium term. In the 1980s, for instance, the average net household saving rate was still around 0.10 in developed countries and 0.16 in developing countries, while the averages from 2010 to 2019 are 0.06 and 0.13, respectively.

Countries with the strongest average net household saving rates over the past 80 years have included China (0.336), India (0.232), and Israel (0.218). Households in Greece (-0.042), Denmark (-0.001), and South Africa (0.002) save the least. If only the average of the most recent ten years is considered (2010 to 2019), China, India and Israel also top the list of savers, although larger downward outliers can be identified with Greece (-0.123), Portgual (-0.003) and South Africa (-0.010).

[19]This observation is also subject to the 'saving glut' discussion, as in Summers (2016), Bernanke (2005) and Bofinger and Ries (2017).

8.2 Correlations

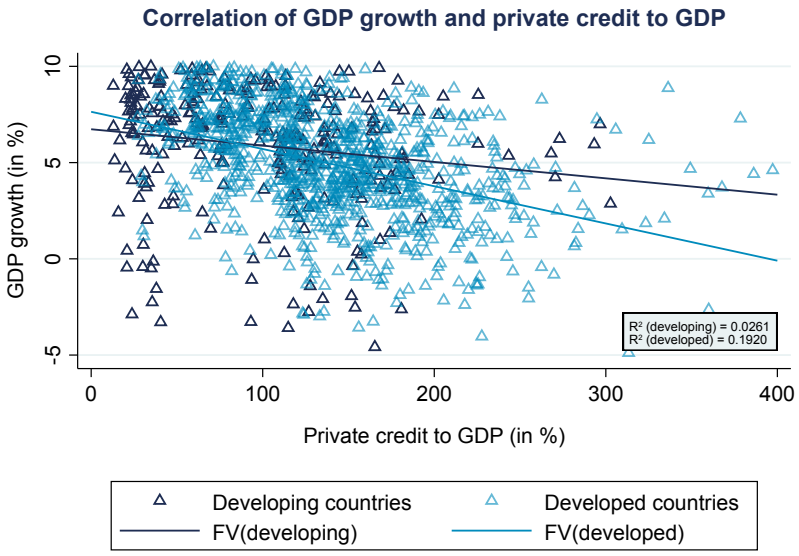

Figure 13: Correlation of total credit to the non-financial private sector as share of GDP and GDP growth

Note: Based on the BIS total credit statistics (see chapter 6.1 for detailed description).

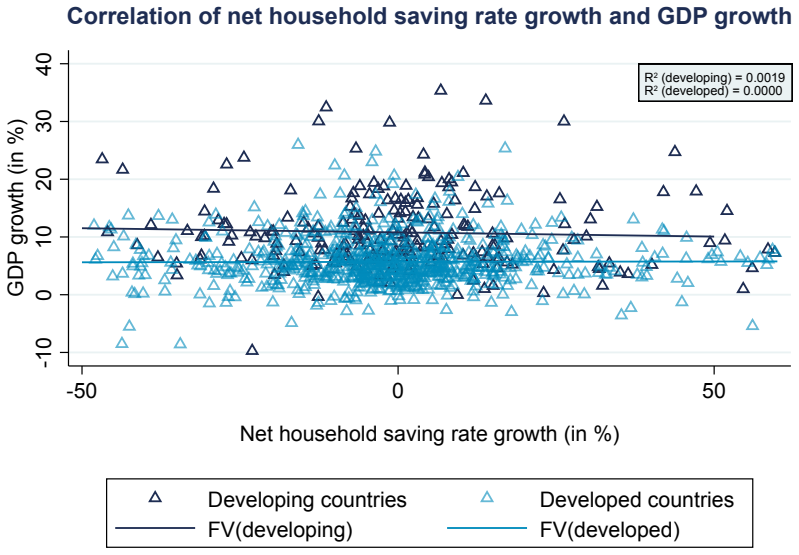

Figure 14: Correlation of net household saving rate growth and GDP growth

Note: Based on the BIS total credit statistics and household saving data from our saving data set (see chapter 6.1 for detailed description).

8.3 Country individual Impulse-Response Functions of Structural VARs

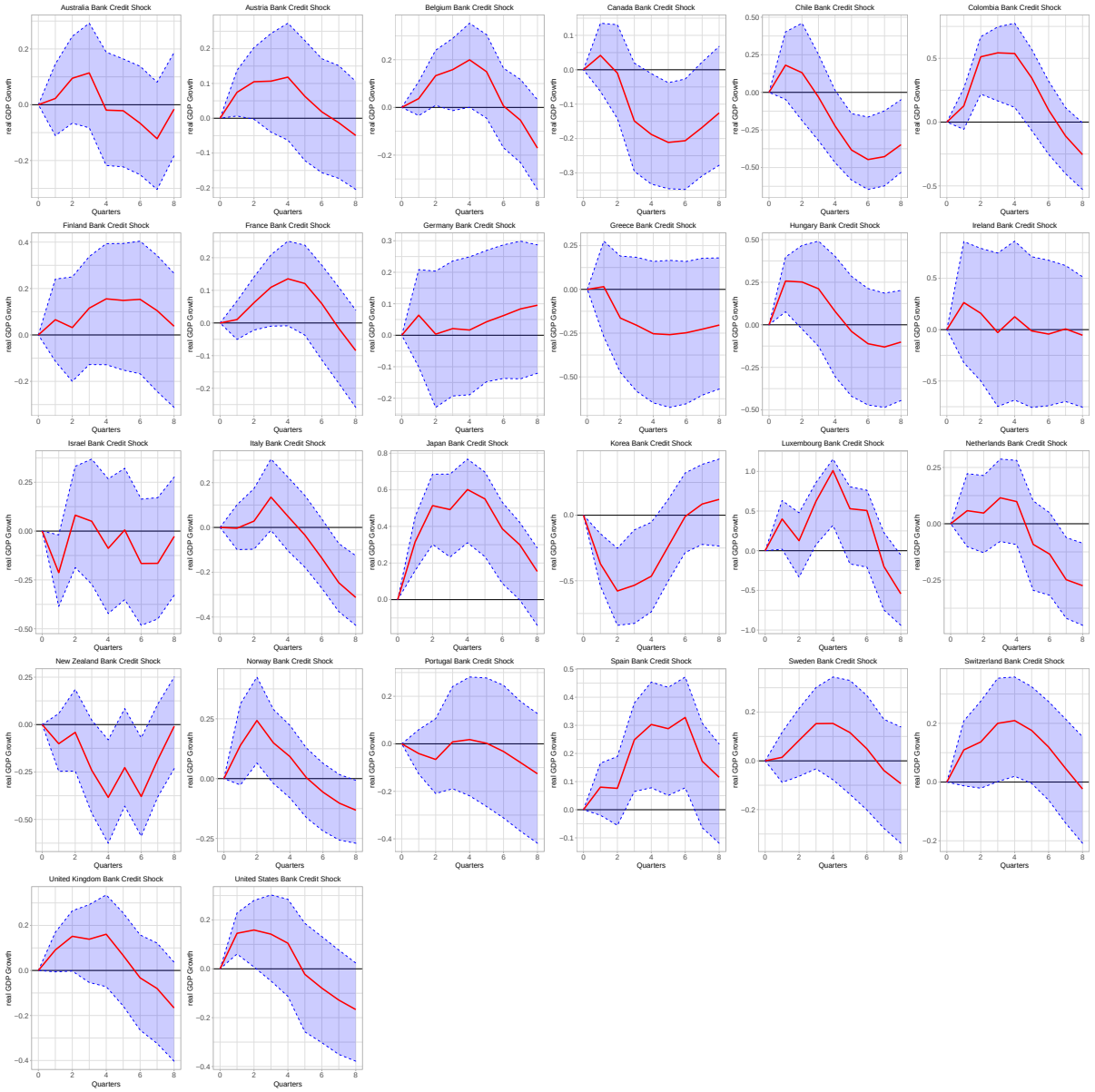

Figure 15: Impulse Response Functions of Credit Supply Shocks

8.4 Forecast Error Variance Decomposition - Detailed Results

Country	FEVD for	GDP	Credit
China	GDP	0,8332	0,1668
Russia	GDP	0,8584	0,1416
Israel	GDP	0,8705	0,1295
Belgium	GDP	0,8807	0,1193
Japan	GDP	0,9076	0,0924
New Zealand	GDP	0,9079	0,0921
Australia	GDP	0,9101	0,0899
Switzerland	GDP	0,9192	0,0808
Colombia	GDP	0,9292	0,0708
Brazil	GDP	0,9377	0,0623
United States	GDP	0,9384	0,0616
Denmark	GDP	0,9411	0,0589
Spain	GDP	0,9460	0,0540
Czech Republic	GDP	0,9469	0,0531
Luxembourg	GDP	0,9500	0,0500
Thailand	GDP	0,9508	0,0492
Argentina	GDP	0,9549	0,0451
South Africa	GDP	0,9558	0,0442
Germany	GDP	0,9598	0,0402
Netherlands	GDP	0,9626	0,0374
France	GDP	0,9635	0,0365
Korea	GDP	0,9648	0,0352
Chile	GDP	0,9650	0,0350
Norway	GDP	0,9653	0,0347
Mexico	GDP	0,9666	0,0334
Italy	GDP	0,9688	0,0312
Singapore	GDP	0,9692	0,0308
India	GDP	0,9706	0,0294
Canada	GDP	0,9725	0,0275
Malaysia	GDP	0,9735	0,0265
United Kingdom	GDP	0,9750	0,0250
Austria	GDP	0,9754	0,0246
Sweden	GDP	0,9809	0,0191
Saudi Arabia	GDP	0,9822	0,0178
Indonesia	GDP	0,9852	0,0148
Hungary	GDP	0,9856	0,0144
Portugal	GDP	0,9935	0,0065
Greece	GDP	0,9953	0,0047
Turkey	GDP	0,9954	0,0046
Finland	GDP	0,9965	0,0035
Hong Kong SAR	GDP	0,9981	0,0019
Poland	GDP	0,9987	0,0013
Ireland	GDP	0,9989	0,0011

Country	FEVD for	GDP	Credit
Argentina	Credit	0,8154	0,1846
Israel	Credit	0,2891	0,7109
Brazil	Credit	0,2753	0,7247
Hong Kong SAR	Credit	0,1966	0,8034
France	Credit	0,1596	0,8404
Singapore	Credit	0,1570	0,8430
Finland	Credit	0,1392	0,8608
Canada	Credit	0,1275	0,8725
United States	Credit	0,1232	0,8768
Indonesia	Credit	0,1221	0,8779
Malaysia	Credit	0,1139	0,8861
Germany	Credit	0,1119	0,8881
Mexico	Credit	0,1094	0,8906
New Zealand	Credit	0,1056	0,8944
China	Credit	0,1043	0,8957
Luxembourg	Credit	0,0928	0,9072
Saudi Arabia	Credit	0,0927	0,9073
Thailand	Credit	0,0900	0,9100
Norway	Credit	0,0850	0,9150
Colombia	Credit	0,0753	0,9247
South Africa	Credit	0,0701	0,9299
Turkey	Credit	0,0701	0,9299
Netherlands	Credit	0,0672	0,9328
Austria	Credit	0,0661	0,9339
Australia	Credit	0,0506	0,9494
Sweden	Credit	0,0479	0,9521
Italy	Credit	0,0423	0,9577
Portugal	Credit	0,0390	0,9610
Denmark	Credit	0,0318	0,9682
Switzerland	Credit	0,0288	0,9712
Russia	Credit	0,0249	0,9751
Chile	Credit	0,0245	0,9755
Spain	Credit	0,0238	0,9762
United Kingdom	Credit	0,0226	0,9774
Czech Republic	Credit	0,0199	0,9801
Ireland	Credit	0,0193	0,9807
Korea	Credit	0,0174	0,9826
Japan	Credit	0,0173	0,9827
Poland	Credit	0,0153	0,9847
Belgium	Credit	0,0132	0,9868
Hungary	Credit	0,0088	0,9912
Greece	Credit	0,0060	0,9940
India	Credit	0,0052	0,9948

Note: The full sample covers a period from 1950Q1 to 2020Q1. The table shows the contributions from each individual shock averaged over the 8 periods. As an example, approximately 94% of the variation in GDP in the United States come from shocks to GDP itself. The credit growth shocks contribute to 6% of the variation in GDP. Analogously, 88% of the variation in credit growth comes from credit growth shocks and 12% from GDP.

Table 14: Overview of FEVD results using all available data for the entire time period, sorted by size of shock. Left table is sorted by size of credit growth shock, right table is sorted by GDP growth shock.