A contribution to the Quantity Theory of Disaggregated Credit

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Abstract

In my view, Richard Werner is sitting on a pot of gold. In Werner (2014), he has shown the tremendous potential his 'Quantity Theory of Credit' has to reorient public policy and stimulate nominal GDP. Yet, his ideas do not seem to take root. In this paper my aim is to refine his theory and provide some improvements by constructing new empirical proxies of 'bank credit for GDP transactions'—a quite arduous and open-ended task. I conclude that the theory is very promising, but it is still in a stage of maturation.

JEL: E50, G21.
Keywords: bank credit, Quantity Theory of Credit, credit-growth nexus, banking and the economy, disaggregation of credit, credit creation, flow of funds, national accounts.

Introduction

My aim in this paper is to make some improvements to Richard Werner's *Quantity Theory of Credit* (QTC). This theory was formulated in a series of papers in the 1990s in the context of the Japanese economy (cf. Werner, 1992, 1997) and was subsequently applied to Spain (cf. Werner, 2014), the UK (cf. Ryan-Collins, Werner and Castle, 2016; Lyonnet and Werner, 2012), and the Czech Republic (Bezemer and Werner, 2009), and Japan later again (cf. Werner, 2005, 2012; Voutsinas and Werner, 2011b). In its briefest formulation, the theory asserts the existence of a causal, robust, stable, autonomous relationship or mechanism[3], relating two and only two variables: nominal GDP growth, and the growth rate of 'bank credit used for GDP transactions'.

$$C_R^b \quad = \quad \text{'bank credit for GDP transactions'} \quad\quad (\text{see } \textbf{Table 1})$$
$$nGDP \quad = \quad \text{'nominal GDP'}$$

Causality running from C_R^b to $nGDP$. Let us refer to this stable and autonomous relation by:

$$\frac{\Delta C_R^b}{C_R^b} \to \frac{\Delta nGDP}{nGDP}$$

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[2] I certify that I have the right to deposit the contribution with MPRA

[3] The following quote might clarify why I use the strange word *mechanism*: ' … the task of causal discovery is an induction game that scientists play against Nature. Nature possesses stable causal mechanisms that, on a detailed level of descriptions, are deterministic functional relationships between variables, some of which are unobservable. These mechanisms are organized in the form of an acyclic structure, which the scientist attempts to identify from the available observations.' (Pearl, 2009, p. 43)

The mysterious variable C_R^b needs some clarification. **Table 1** shows a two-by-two matrix disaggregating credit into four types, according to creditor type (rows) and the types of uses given to the credit instrument by the debtor (columns). Creditor types are classified as banks (more precisely, monetary financial institutions, MFIs) and non-banks (non-MFIs), each extending bank credit and non-bank credit, respectively. Credit instruments consist of loans and debt securities[4] (Eurostat, 2013, p. 136). Loans are created when creditors extend funds to debtors, their value being measured in nominal terms. Debt securities are negotiable financial instruments serving as evidence of debt, measured in market value (Eurostat, 2013, p. 139). Importantly, equities and shares are not considered as credit instruments. These conceptual classifications follow the latest standard in national accounting, the *European System of Accounts 2010* (Eurostat, 2013). A more thorough presentation of the institutional sectors and financial instruments implied in **Table 1** will be given in **Section 3.**

		Uses of credit	
		GDP transactions	Non-GDP transactions
Creditor	Bank	C_R^b	C_F^b
	Non-bank	C_R^{nb}	C_F^{nb}

Table 1. Disaggregation of credit by type of creditor and type of use

The *upper left* cell shows 'bank credit used for GDP transactions'. This category refers to loans extended by banks, or debt securities purchased by banks from debtors, who devote the newly acquired funds in the form of bank deposits—which represent an asset to the debtor and a liability to the bank—to finance expenditures such as inventories in the case of private non-financial corporations, consumption in the case of consumers, and public services provision in the case of the public sector. The *upper right* cell contains credit issued by banks which is used to finance expenditures that are not part of GDP, such as the acquisiton of new land by the real estate sector, the acquisition of financial assets by hedge funds, or the financing of mergers and acquisitions by private non-financial corporations. The lower tier cells represent credit extended by the non-MFI sector, which is comprised of households, non-financial corporations, financial corporations except MFIs, insurance corporations, pension funds, general government, and non-profit institutions serving households. Wheras MFIs extend credit in the form of loans (bank-based finance), non-MFIs often lend to each other by purchasing commercial paper, corporate bonds, etc., from each other (capital market issuance). Equally, this non-MFI credit can be used to finance GDP and non-GDP transactions. This taxonomy of credit instruments by issuer and use will be used throughout the rest of the analysis.

Let me go back to the putative mechanism. If such a link exists, any other relationship between candidate explanatory variables and nominal GDP must be spurious or indirect. Supporting evidence for such claims has been collected, and thusfar it seems promising (cf. Werner, 1995, 1997, 1998, 1999, 2000, 2012a, 2012b, 2014; Ryan-Collins, Werner and Castle, 2016; Lyonnet and Werner, 2012; Werner, 2014; Bezemer and Werner, 2009). Yet, the state of this theory is still preliminary, that is, not entirely conclusive. This literature will be reviewed below.

But it is not so much its 'inconclusiveness' that impedes it from gaining widespread dissemination and acceptance. For one, all theories are in some sense incomplete, and second, scientists are paid to

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[4] The Bank of International Settlements defines credit instruments as covering 'the core debt, defined as loans, debt securities and currency & deposits' (BIS, 2016). I will use a more restricted definition of credit, limiting it to loans and debt securities. Another difference between the definitions used here and the ones used by the BIS is that credit will be considered whether granted/issue by MFIs and non-MFIs alike.

come up with innovative ideas and to spot, appropriate and exploit ideas that might have the seeds of scientific utility in them. While some might simply think the theory is unripe fruit, and do not see anything in it for them, the core reasons of why the theory does not persuade economists lie elsewhere.

I can think of the following five factors that might explain the phenomenon:

1. *Empirical search for good proxies is hard.* The first factor is the lack of a 'methodological benchmark' providing clear guidance as to how good empirical proxies of C_R^b should be constructed. As I will explain, unlike traditional monetary aggregates, the variable 'bank credit for GDP transactions' is quite difficult to estimate correctly, and requires a meticulous disentangling of empirical bits and pieces. Several proxies have been crafted so far, but the authors do not give a thorough argumentation as to why the proxy was constructed in *that* particular way. Many questions have been left unaddressed, and many choices seem arbitrary and not properly justified. This does a poor favour to the credence of the theory. For example, Werner constructed his original proxy of 'bank credit for GDP transactions' as the sum of loans to the private sector excluding 'loans to the real estate sector, construction firms and non-bank financial institutions' (Werner, 1997). But, as I will explain in more detail later, there are some arbitrary choices in there. Why not include loans to the government or households as well? Do not they contribute to GDP? Why not include other types of bank lending, such as governments borrowing from banks by issuing debt securities? Werner does not offer a justification; nor do the other authors, apart from mild allusions. If the theory is to realise its potential, a thorough exploration of the details in the proxy construction process is needed.

2. *Irrefutability of QTC.* The second factor, which is not on the surface but may have been perceived by some, is the fact that it is never possible to know for sure whether the proxy one has constructed is the 'correct proxy', and a process of 'triangulation' is required, that is, the combination of theoretically-informed search with empirical refinement. Thus, the theory can only be granted shades of plausibility, which renders it *irrefutable* in the strictest sense of the word. Refutability, falsifiability, or testability are core criteria that demarcates scientific from non-scientific theories[5] (Popper, 1998, p. 40). Perhaps this makes QTC less attractive as a scientific endeavour.

3. *Banks create money ex nihilo.* Thirdly, the theory rests on a critically important premise about modern banking: banks create money (i.e., deposits) when they lend; banks do not intermediate funds from savers to borrowers, they create money, credit, and purchasing power *ex nihilo* by the act of lending to non-banks (Jakab and Kumhof, 2014, 2015; Benes, Kumhof and Laxton, 2014; Kumhof and Jakab, 2016; Berry et al., 2007; Bridges, Rossiter and Thomas, 2011; McLeay, Radia and Thomas, 2014; King, 2012; Tucker, 2007; Bundesbank, 2009, 2012; Borio and Disyatat, 2011; Turner, 2011, 2015a). This is a fact (see **Section 1**). But it is also a massive, widely misunderstood issue. Most textbooks teach the 'loanable funds', 'intermediary' conception of banks, and this is the view most economists hold. It is no wonder then that a theory that has this fact about money creation as its starting point eludes economists' attention.

4. *Stable an unstable velocities.* A fourth factor that comes to mind is—not the premise of the theory—but its corollary. The theory asserts the existence of stable, robust relationship between

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[5] Pruzan (2016, p. 33) summarises Poppers conclusions on the properties of a scientific theory: (1) It is easy to obtain confirmations/verifications for nearly every theory—if we look for them. (2) Confirmations should count only if they are the result of risky predictions. (3) Every good scientific theory is a prohibition—it forbids certain things to happen. The more it forbids, the better the theory; (4) Theory that is not refutable by any conceivable event is non-science. (5) Every genuine test of a theory is an attempt to falsify it, to refute it. (6) Some theories are more testable than others in that they forbid more outcomes, take so to speak a greater risk. (7) Evidence should not count as a confirmation unless it is the result of a genuine test—a serious but unsuccessful attempt to falsify it. (8) Some genuinely testable theories, when found to be false, are still upheld by their admirers—for example by introducing some auxiliary assumptions or reinterpreting the theory—this is at the price of lowering their scientific status.

nominal GDP (a flow, measured in £/year) and 'bank credit for GDP transactions' (a stock, measured in £), the link between which is given by a variable usually referred to as 'velocity' (measured in years^{-1}). A stable relationship between $nGDP$ and C_R^b implies a *constant* velocity, as I will explain later. Seasoned monetary economists run away scared when told about stable velocities, and the 1980s trauma with the 'equation that came apart at the seams' (Goodhart, 1989) still resonates in their memory. It is thus natural that a theory like QTC finds no friends among them, who ultimately are its intended audience.

5. *Theory-driven economics.* The fifth factor is the predominance in economics of the theory-driven methodology as opposed to data-driven. As I will show, constructing proxies of C_R^b requires an ardous search in the empirical data, across many types of financial instruments, assets, liabilities, balance sheets, flow-of-funds, national accounts, and so on. It is not controversial to say that economists generally do not feel comfortable with accouting.

As can be appreciated, it is not so much the weaknesses of the theory (the first two points) that hold it back, but also the idiosyncrasies of economics as a field (the last three points). These five factors have conspired against more broad dissemination and acceptance of QTC; perhaps there are more reasons, but these at least capture the core. It would do a good favour to the theory to try to reconcile a somewhat obscure theory and a skeptic, reluctant or even stubborn audience.

This is precisely the task I undertake in this paper. My aim is to give more *credence* to QTC by exploring its foundations, the literature, the theoretical predictions, and the empirical evidence supporting it. While I can do nothing about the fifth point, all the other points are touched upon in the paper.

This paper is structured as follows. In **Section 1** ('the elusive realities of banking and money creation'), I explore the details of money creation and identify and hopefully abate some of the misunderstandings on this topic. In **Section 2** ('the creditor-use decomposition of credit and links with nominal GDP'), I delve into the literature on the 'credit-growth' nexus and into the details of Werner's findings and reasoning. In **Section 3** ('the process of constructing good empirical proxies of C_R^b'), I explore in great detail the concepts and steps involved in searching for empirical data in the proxy construction phase, starting from scratch until the final proxy is crafted. I also explore what choices and compromises emerge along the way, the points of uncertainty and vulnerability, and what can be done about them. **Section 4** concludes.

A methodological note. I perform the study for the case of the UK economy, for three reasons. First, it has very good data sources, such as the Bank of England's *Bankstats,* the Office for National Statistics, and the Debt Management Office. Second, studies on bank credit analogue to this one have already been performed by several authors (cf. Ryan-Collins, Werner and Castle, 2016; Lyonnet and Werner, 2012). Third, in Clavero (forthcoming), I use UK data to extend the ideas in this paper and in Werner (2014) to describe a new policy tool. The UK is a 'liberal market economy', which has been observed to typically display substantial fiscal and monetary policy discretion (Soskice, 2008). Would such a tool be implemented in Europe, it would likely be implemented in the UK first.

1.   The elusive realities of banking and money creation

> 'In the real world, banks extend credit, creating deposits in the process, and look for the reserves later.'
>
>> Alan Holmes (1969), former Senior Vice President, Federal Reserve Bank of New York

The financial crisis has brought to the public's attention a fact that has generated much perplexity and disbelief, namely, that leading economic theories and models, as well as influential advanced textbooks in macroeconomics and monetary economics, did not feature money (e.g. Woodford, 2003), or banks (Walsh, 2003; Woodford, 2003). Current cutting-edge macroeconomic models since the 1980s do not include credit, debt, or a financial sector (King 2012; Sbordone et al. 2010), nor are there borrowing constraints or risks of default in them (Goodhart and Hofmann, 2008). The dominant New Keynesian model of monetary economics 'lacks an account of financial intermediation, so that money, credit and banking play no meaningful role' (King, 2012), and 'treat[s] intermediaries largely as a veil' (Gertler and Kiyotaki, 2010). Similarly, in consumption theory, debt plays no causal role in determining the amount of spending[6] (Bunn and Rostrom, 2014). DSGE models, considered state-of-the-art and widely used among central bankers, do not include a financial sector, a deficiency not easily remedied due to their particular methodology and assumptions (Werner, 2012). As Olivier Blanchard put it with some regret, 'we assumed we could ignore the details of the financial system'[7].

The reason for not treating banks in macroeconomic models as analytically distinct actors is explained by the capacities attributed to them by theory. Banks, according to the dominant view, are functionally no different from other non-bank financial institutions: they gather deposits and lend these out (Werner, 2015). This view has come to be known as the 'loanable funds' or 'financial intermediation' model of banking. Deviants from that view have either been ignored or mocked (e.g., Krugman, 2012).

Though dominant today, this conception of banking enjoyed much less recognition during most part of the 20th century, during which it co-existed and alternated in predominance with at least two competitors (Werner, 2015). The oldest, the 'credit creation theory' of banking, maintains that each bank can individually create money 'out of nothing' through accounting operations, and does so when extending a loan. The 'fractional reserve theory' states that only the banking system as a whole can collectively create money, while each individual bank is a mere financial intermediary, gathering deposits and lending these out. The 'financial intermediation theory' considers banks as financial intermediaries both individually and collectively, rendering them indistinguishable from other non-bank financial institutions in their behaviour, especially concerning the deposit and lending businesses, being unable to create money individually or collectively[8].

From the 1930s until the 1960s, the accepted view was the 'credit creation theory'. The 'deposit multiplier' view was widely accepted in academic and policymaking circles between the 1930s and the late 1960s, and overlapped with the periods during which the 'credit creation' and 'intermediary' views dominated (Jakab and Kumhof, 2015). But since the 1960s, the position of the 'credit creation' view has weakened and the 'financial intermediation' perspective has replaced it eversince (Jakab and Kumhof, 2016).

Still, science is not monolithic, and some central bankers and policymaking authorities *today* give full endorsement to the 'credit creation' theory. The following quotes are a sample of the contemporary views of prominent economists working in different institutions:

> '… the banking system as a whole does not collect additional deposits from non-bank depositors, it creates additional deposits for non-bank borrowers. There are no pre-existing loanable funds, new funds materialize on the banker's keyboard at the moment he makes a new loan.'

> Jakab and Kumhof (2014), International Monetary Fund

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[6] In the Modigliani and Brumberg (1979) model, consumption depends only on expected lifetime income and wealth, with households smoothing spending over their lifetimes. Typically, households should borrow to help finance their consumption when they are young and their incomes are relatively low. They then repay that debt later in life as their incomes rise and they build up savings ahead of retirement, when income falls back again (Bunn and Rostrom, 2014)

[7] Comments at IMF press conference, October 2012

[8] See Werner (2015) and Kumhof and Jakab (2016) for a review of this history

'… bank loans give borrowers new purchasing power that did not previously exist'

<div align="right">Benes, Kumhof and Laxton (2014), International Monetary Fund</div>

'… in the real world, the key function of banks is the provision of financing, or the creation of new monetary purchasing power through loans'

<div align="right">Jakab and Kumhof (2015), International Monetary Fund</div>

'New funds are produced only with new bank loans (or when banks purchase additional financial or real assets), through book entries made by keystrokes on the banker's keyboard at the time of disbursement. This means that the funds do not exist before the loan'

<div align="right">Kumhof and Jakab (2016), International Monetary Fund</div>

'… by far the largest role in creating broad money is played by the banking sector … when banks make loans they create additional deposits for those that have borrowed the money … Under the present system banks do not have to wait for depositors to appear and make funds available before they can on-lend, or intermediate, those funds. Rather, they create their own funds, deposits, in the act of lending.'

<div align="right">Berry et al. (2007), Bank of England</div>

'… the extension of loans mechanically creates deposits … Any transaction between the banking sector and the non-bank private sector will involve the creation or destruction of banking sector deposits and will thus affect the supply of broad money'

<div align="right">Bridges, Rossiter and Thomas (2011), Bank of England</div>

'When banks make loans they create additional deposits for those that have borrowed … Banks making loans and consumers repaying them are the most significant ways in which bank deposits are created and destroyed in the modern economy … Just as taking out a new loan creates money, the repayment of bank loans destroys money … in the modern economy, those bank deposits are mostly created by commercial banks themselves'

<div align="right">McLeay, Radia and Thomas (2014), Bank of England</div>

'When banks extend loans to their customers, they create money by crediting their customers' accounts.'

<div align="right">Mervyn King (2012), former Governor of the Bank of England</div>

'The Bank [of England] supplies base money on demand at its prevailing interest rate, and broad money is created by the banking system'

<div align="right">Mervyn King (1994, p. 264), former Governor of the Bank of England, then Chief Economist and Executive Director of the Bank</div>

'Banks extend credit by simply increasing the borrowing customer's current account … That is, banks extend credit [i.e. make loans] by creating money'

<div align="right">Paul Tucker (2007), Deputy Governor for Financial Stability, Bank of England (2009-2013)</div>

'The initial process of lending involves only the extension of an individual commercial bank's balance sheet, an increase in assets from the freshly created loan and a matching increase in liabilities from the accompanying deposit created for the recipient of the loan.'

<div align="right">Rule (2015), Bank of England</div>

'The commercial banks can also create money themselves… in the eurosystem, money is primarily created by the extension of credit…'

<div align="right">Bundesbank (2009)</div>

'How is deposit money created? The procedure is equivalent to the creation of central bank money: As a rule the commercial bank extends a loan to a customer and credits the corresponding amount to his deposit

<div align="right">6</div>

account. ... The creation of deposit money is therefore an accounting transaction.'

<div align="right">Bundesbank (2012)</div>

'banks … create additional purchasing power in the form of deposits through the act of extending credit … Through the creation of deposits associated with credit expansion, banks can grant nominal purchasing power without reducing it for other agents in the economy … The banking system can … expand total nominal purchasing power'

<div align="right">Borio and Disyatat (2011), Bank of International Settlements</div>

'… the banking system does not simply transfer real resources, more or less efficiently, from one sector to another; it generates (nominal) purchasing power … Deposits are not endowment that precede loan formation; it is loans that create deposits'

<div align="right">Borio (2012), Bank of International Settlements</div>

'The banking system can thus create credit and create spending power – a reality not well captured by many apparently common sense descriptions of the functions which banks perform. Banks it is often said take deposits from savers (for instance households) and lend it to borrowers (for instance businesses) … But in fact they don't just allocate preexisting savings, collectively they create both credit and the deposit money which appears to finance that credit.'

<div align="right">Adair Turner (2011), then Chairman of the Financial Services Authority</div>

'… banks do not just intermediate flows of already existing money from savers to borrowers, but create credit, money and purchasing power *ex nihilo*'

<div align="right">Adair Turner (2015a), former Chairman of the Financial Services Authority</div>

'When a bank extends a loan, it creates a deposit account, increasing the supply of money. … the creation of money and the creation of credit occur together'

<div align="right">Stiglitz and Greenwald (2003, p. 295), Columbia University and Columbia Business School</div>

'Banks lend to borrowers and create credit and money simultaneously … assets and liabilities of the bank have thus expanded simultaneously, and the bank has in essence created its own funding through the very process of lending … Because the new entries on both sides of the bank's balance sheet are in the name of [the same person], there is no intermediation of loanable funds between savers and borrowers at the time the loan was made'

<div align="right">Markus K. Brunnermeier (Princeton), Harold James (Princeton), and
Jean-Pierre Landau (SciencePo Paris) (2016, p. 160)</div>

These voices convey the same message without a trace of ambivalence: commercial banks create deposits *ex nihilo* when they extend loans. Banks do not collect deposits so the can lend them out. In fact, bank deposits are simply a record of how much the bank itself owes its customers. So they are a liability of the bank, not an asset that could be lent out (McLeay, Radia and Thomas, 2014). Deposits, in turn, consitute the vast majority of 'broad money', with notes and coins—issued by central banks—constituting just 3%.

However, science is built not on 'expert opinion' alone—and there are views contrary to these ones held by these leading economists as well. Evidence is required to back up any scientific proposition. There is a small though important body of evidence to the effect that banks are special in some way that standard theory cannot explain (e.g. Ashcraft, 2005; Fama, 1985; Leary, 2009; Peek & Rosengren, 2000; Voutsinas and Werner, 2011a, 2011b; Werner, 1992, 1997, 2005). Blanchard and Fischer (1989) pointed out already more than 20 years ago: 'the notion that there is something about banks that makes them 'special' is a recurrent theme'. Unfortunately, traditional theory has failed to identify what it is that makes banks different, and the question which of the three views is accurate has until recently not been

empirically examined (Werner, 2015).

The first empirical test published in a leading journal on this issue was Werner (2014), in which the author obtained the cooperation of *Raiffeisenbank Wildenberg e.G.,* a cooperative bank in Lower Bavaria, to examine the actual operations and accounting entries taking place when a 'live' bank loan is granted and paid out. It was found that only the credit creation theory was consistent with the observed empirical evidence. The author states: 'thus it can now be said with confidence for the first time— possibly in the 5000 years' history of banking—it has been empirically demonstrated that each individual bank creates credit and money out of nothing'. In Werner (2015), the author performed a similar test, reaching the same conclusions.

The 'money creation' powers of banks can also be traced to the *legal* sphere. Werner (2014b) has shown that, in the UK context, what distinguishes banks from non-banks, and therefore allows them to do this, is that they are exempt from legal rules known as Client Money Rules, which are outlined in Chapter 7 ('Client Money Rules') of the *Financial Conduct Authority Handbook 2016* (FCA, 2016). These rules require non-banks to hold retail client monies in trust, or off-balance sheet[9]. Banks, on the other hand, are allowed to keep retail customer deposits on their own balance sheet[10]. Depositors who deposit their money with a bank are therefore no longer the legal owners of this money, with the bank holding it in trust for them, but rather they are one of the general creditors of the bank. This implies that when non-banks disburse a loan to their clients, they need to give up either cash or their own bank deposits, while when banks disburse a loan, they do so by reclassifying an "accounts payable" liability (their obligation to disburse the loan in return for having received the right to receive future payments of principal and interest) as a "customer deposit" (Kumhof and Jakab, 2016). Outside the UK, the regulation of money creation differs in terminology, but on broad brush it is highly similar. **Table 2** is taken from Burgess and Janssen (2007), and provides the details of which institutional units are able to create what types of instruments considered as 'money'.

Country	Money creators	Instruments included
United Kingdom (M4)	Banks and building societies licensed by the Financial Services Authority to receive deposits.	Currency in circulation, all deposits (including repos) and holdings of certificates of deposits, holdings of other debt securitiesof up to and including five years' maturity issued by MFIs.
United States (M2)	All depository institutions; this includes banks, non-banks thrift institutions and money market mutual funds.	Currency in circulation, demand deposits, savings deposits, time deposits (under US$100,000) and retail money market mutual funds (under US$50,000). Repos and debt securities are excluded. There is no maturity cut-off.
Euro area (M3)	Banks and other credit institutions, money market funds, and central government (Post Office, national savings and Treasury accounts only).	Currency in circulation, all deposit and debt securities with original maturity of up to and including two years, repo aggreements and money market fund shares.

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[9] 'A firm, on receiving any client money, must promptly place this money into one or more accounts opened with any of the following: (1) a central bank; (2) a CRD credit institution[9]; (3) a bank authorised in a third country; (4) a qualifying money market fund' (FCA, 2016, §7.13.3)

[10] 'The client money chapter does not apply to a depositary when acting as such' (FCA, 2016, §1.4.6R)

Japan (M3+CDs)	All banks and credit co-operatives, including Shinkin banks, Shoko Chukin Bank, Norinchukin Bank and Japan Post	Currency in circulation, deposits and certificates of deposit of any maturity. Repos, debt securities and commercial paper are excluded

Table 2. Institutional units that create the money supply, with four different definitions of the broad money supply. Source: Burgess and Janssen (2007)

Regarding the explanatory power of the 'credit creation' view, Benes, Kumhof and Laxton (2014) develop and simulate a new IMF model (the MAPMOD) of the DSGE type, in which banks 'do not have to wait for deposits to arrive before using those deposits to fund loans'. One of the implications is that bank lending, and provision of purchasing power to the economy, can expand and shrink at a much faster rate than in traditional models. The authors show that 'these features allow the model to capture the basic facts of financial cycles'. This is in accord with the empirical evidence. In an important paper, Adrian et al. (2013) show that there is a strong co-movement between changes in US banks' total assets and total debt[11]. In other words, the banking system responds to shocks mainly through one-for-one changes in assets and debt, rather than through changes in bank net worth (Jakab and Kumhof, 2015).

A common counter-argument to the 'credit creation' view resorts to the *reserve requirement[12]*. The argument goes as follows: banks might indeed create money by the act of lending, but must acquire central bank reserves[13] before they can extend new loans and are thus bound by the reserve requirement and by the willingness on the part of the central bank to provide them with reserves. This argument, however, is also problematic. As acknowledged by the former Senior Vice President of the Federal Reserve Bank of New York, 'in the real world, banks extend credit, creating deposits in the process, and look for reserves later. The question then becomes one of whether and how the Federal Reserve will accommodate the demand for reserves. In the very short run, the Federal Reserve has little or no choice about accommodating that demand' (Holmes, 1969). Willliam C. Dudley, the current President of the New York Federal Reserve Bank, makes the same point: '... the Federal Reserve has committed itself to supply sufficient reserves to keep the fed funds rate at its target. If banks want to expand credit and that drives up the demand for reserves, the Fed automatically meets that demand in its conduct of monetary policy' (Dudley, 2009). In other words, banks' reserves do not constrain the amount of credit creation (Borio and Disyatat, 2011; Jakab and Kumhof, 2015). Furthermore, some countries do not have reserve requirements at all, the UK being among them[14] (McLeay, Radia and Thomas, 2014). Six out of the thirty OECD countries do not employ reserve requirements (O'Brien, 2007)[15].

In reality, neither are reserves a binding constraint on lending, nor does the central bank fix the amount of reserves that are available. In the UK, reserves are, in normal times, 'supplied on demand', in the words of the Bank of England, to commercial banks in exchange for other assets on their balance sheets, and in no way does the aggregate quantity of reserves directly constrain the amount of bank lending or deposit creation (McLeay, Radia and Thomas, 2014). This holds for many central banks, not only the Bank of England. In the case of banks in the eurozone, the ECB always provides the banking system with the liquidity required to meet the aggregate reserve requirement (ECB, 2012). Central banks

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[11] This holds for both for both aggregate and micro-level data, for both commercial banks and the shadow banking system

[12] *Reserve requirements* are the minimum percentages or amounts of liabilities that depository institutions are required to keep in cash or as deposits with their central banks (O'Brien, 2007)

[13] Central bank reserves is money held by banks at the central bank, primarily used by banks to make payments to each other in the inter-bank market

[14] In the UK, participation in the reserve scheme is voluntary except for CHAPS sterling and CREST sterling settlement banks (O'Brien, 2007)

[15] A 2010 IMF survey showed 9 out of 121 central banks which responded had no reserve requirement: Australia, Canada, Denmark, Mexico, New Zealand, Norway, Sweden, Timor–Leste, and the United Kingdom; additionally, the Hong Kong Monetary Authority does not impose reserve requirements (Gray, 2011)

set an official interest rate and then supply the volume of reserves necessary in order to steer short-term market interest rates close to the official interest rate (ECB, 2011). The main constraint is banks' expectations concerning their profitability and solvency (Jakab and Kumhof, 2015). In fact, the level of reserves hardly figures in banks' lending decisions (Borio and Disyatat, 2009). This is confirmed by the day-to-day experience of a Barclays banker (see the testimony given by Michael Kumhof in several youtube videos).

Not only do reserves not constrain lending, but the causal direction from reserves to lending actually works *in reverse* of what is actually described (Brunner and Metzer, 1990). Banks first take their credit decisions and then look for the necessary funding and reserves of central bank money (Constancio, 2011). Loans drive deposits, not the other way around (Disyatat, 2008, 2010; McLeay, Radia and Thomas, 2014; Constancio, 2011). In fact, reserves requirements in some countries are *backward looking*, i.e. 'they depend on the stock of deposits (and other liabilities of credit institutions) subject to reserve requirements as it stood in the previous period, and thus after banks have extended the credit demanded by their customers' (ECB, 2012). These are called 'lagged reserve requirements'(LRR)[16]. O'Brien (2007) has documented that in a sample of thirteen OECD countries, all use LRR, except for Mexico and the UK. Average lags for these countries are around one month. According to Gray (2011), of the central banks around the world that impose reserve requirements, 80% of them impose them in a lagged manner. As shown by Kydland and Prescott (1990), the availability of central bank reserves did not even constrain banks during the period, in the 1970s and 1980s, when the central bank did in fact officially target monetary aggregates. These authors show that broad monetary aggregates, which are driven by banks' lending decisions, led the economic cycle, while narrow monetary aggregates, most importantly reserves, lagged the cycle. In modern banking sectors, credit decisions precede the availability of reserves in the central bank (Constancio, 2011).

Another common misconception is that injecting reserves into the banking sector automatically translates into an increase in lending, or the so called 'money multiplier' theme. For the theory to hold, the amount of reserves must be a binding constraint on lending, and the central bank must directly determine the amount of reserves. As we have seen, rather than controlling the quantity of reserves, central banks today typically implement monetary policy by setting the price of reserves, i.e., interest rates (McLeay, Radia and Thomas, 2014). As long as the central bank sets interest rates, as is the generality, the money stock is a dependent, endogenous variable (Goodhart, 2007). That is, if you set the price, you must let quantity adjust. In the words of the former Deputy Governor of the Bank of England, 'cash reserves supplied to the banking system are whatever they have to be to ensure that the desired policy rate is in fact achieved' (White, 2002). On the other hand, the central bank can do little to control precisely the quantity of its liabilities in the short run. Demand for both banknotes and reserves is exogenous in the very short run and central bank attempts to ration either form of liability will only lead to significant market instability (Rule, 2015). Furthermore, reserves cannot be lent out; reserves can only be lent between banks, since consumers do not have access to reserves accounts at the central bank (Sheard, 2013; McLeay, Radia and Thomas, 2014). Thus, this description of does not reflect modern central banking practice (Gray, 2011). As Charles Goodhart (1995) pointedly argued, it would be more appropriate talking about a 'credit divisor' than about a 'credit multiplier'. This has led some authors to conclude that the concept of the money multiplier is 'flawed and uninformative' (Disyatat, 2010), 'misleading' (Disyatat, 2008), 'misleading and incomplete' (Lombra, 1992), 'innacurate' (McLeay, Radia and Thomas, 2014), 'slight in information content' (Goodhart, 1989b, p. 136), 'misleading, atheoretical and without predictive value' (Goodhart, 2010), 'detatched from reality'

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[16] Reserve requirements can generally be classified into three types: (1) lagged reserve requirements; (2) semi-lagged reserve requirements; and (3) contamporaneous reserve requirements. The lag is measured from the start of a computation period to the start of the corresponding maintenance period. (O'Brien, 2007)

(Bindseil, 2004), 'an oversimplification' (Rule, 2015), an 'unsatisfactory description' (Stevens, 2008), 'totally divorced from reality' (Feroli, 2010), a 'myth' (Kydland and Prescott, 1990). Carpenter and Demiralp (2010) provide the most authoritative and devastating statement:

> 'While the institutional facts alone provide compelling support for our view, we also demonstrate empirically that the relationships implied by the money multiplier do not exist in the data ... Changes in reserves are unrelated to changes in lending, and open market operations do not have a direct impact on lending. We conclude that the textbook treatment of money in the transmission mechanism can be rejected.'

However, there are limits to how much money commerical banks can create. In the modern economy there are three main sets of constraints (McLeay, Radia and Thomas, 2014): the profitability of the loan, the behaviour of the money holders—for example, households and companies who receive the newly created money might respond by undertaking transactions that immediately destroy it, for example by repaying outstanding loans—, and monetary policy—which through interest rates affect how much households and companies want to borrow.

To recapitulate. We have seen that the act of lending by MFIs is what creates deposits, and that deposits constitute 97% of the broad money stock. Banks can do this because they are exempt of the Client Money Rules. This is confirmed by on-the-ground evidence on a real bank in Lower Bavaria. The 'financial intermediation' theory of banking, according to which banks lend out deposits that savers put in them, is incomplete at best. Banks do face limits as to how much liquidity they can create, the primary factors being the creditworthiness of borrowers and the profitability of the loan. I have shown how this view of banking is not new, and in fact was common wisdom during the 1930s, 1940s and 1950s, but it got pushed to the side starting in the 1960s. We have also seen that the 'deposit multiplier' is a bad conceptual device to describe reality, since loans 'pull in' reserves, and instead of reserves 'pushing out' loans. We have also seen that central banks in normal times provide liquidity to the banking sector 'on demand', because they must ensure a smooth operation of the payment system, otherwise they would create havoc in the economy.

This conclusions stand in stark contrast with what is taught in courses in macroeconomics and what is believed by most economists. As Cheng and Werner (2015) show, among the 3,882 research papers produced and made available online by five major central banking research outlets (Federal Reserve Board Washington, Federal Reserve Bank of New York, Bank of Japan, European Central Bank, Bank of England) in the two decades to 2008, only 19 articles even included the words 'credit creation'. Of these, only 3 seemed to use the term in the correct sense of bank creation of credit and money.

It also contradicts what is believed by the public at large. In a survey carried out by Positive Money in 2015 in Switzerland, only 13% of the respondents were conscious that commercial banks provide the majority of the money in circulation, while 73% thought the state or the *Schweizerische Nationalbank* (Swiss National Bank) create it (Positive Money, 2015). Perhaps more interestingly, only 4% approved of the system of private money creation once they were told the correct answer.

2. The creditor-use decomposition of credit and links with GDP

The aim of this section is to stablish some robust points of contact between credit aggregates and nominal GDP. I review the credit-growth literature and analyse the different disaggregations of credit and their relationship with GDP growth. Later, I will review Werner's *Quantity Theory of Credit* (QTC), the empirical evidence supporting it, and provide an improvement with a more refined empirical proxy for 'bank credit for GDP transactions'.

2.1   The credit-growth nexus literature

Before the crisis, the predominant assumption of much macroeconomic theory and policy was that increases in private sector leverage could be either ignored or positively welcomed (Turner, 2013). A large amount of literature has examined the effect of financial development on economic growth (cf. King and Levine, 1993a, 1993b; Levine, 1997, 2003; Rajan and Zingales, 1998; Levine et al., 2000; Beck and Levine, 2004; Beck, Levine and Loayza, 2000; Beck, Demirgüç-Kunt and Maksimovic, 2005). In a comprehensive literature survey, Levine (2005) reports empirical findings that increasing private leverage is good for growth. By and large, the evidence has demonstrated that there is a positive long-run association between the indicators of financial development and economic growth, supporting the proposition 'more finance, more growth' (Law and Singh, 2014).

The financial crisis has made those views to be reevaluated and challenged (cf. Arcand, Berkes, and Panizza, 2015; Panizza, 2012, 2014; Beck et al., 2012, Cecchetti and Kharroubi, 2012, 2013; Zhu, 2011; Cœuré, 2014; Shen and Lee, 2006; Law and Singh, 2014; Bezemer and Hudson, 2016; Rioja and Valev, 2004). The new literature has consistently found a non-linear relationship between 'financial deepening' and economic growth. Cecchetti and Kharroubi (2012) find that for private sector credit extended by banks, the turning point is close to 90% of GDP. Arcand et al. (2012) also highlight that the finance-growth relationship turns negative for high-income countries, where finance starts having a negative effect when credit to the private sector reaches 80-100% of GDP. One of the conclusions of their analysis is that 'there are several countries for which smaller financial sectors would actually be desirable', contradicting the pre-crisis consensus of the same literature. Rioja and Valev (2004) find that financial development exerts a strong positive effect on economic growth only when it has achieved a certain level or threshold of financial development; below this threshold, the effect is at best uncertain. Shen and Lee (2006) also demonstrate a similar non-linear, inverse U-shaped relationship between financial development and economic growth, where a higher level of financial development tends to slow down economic growth. Reinhart and Rogoff (2013) illustrate the extreme difficulty which countries face if total domestic credit rises to very high levels. Assa (2012), using OECD data for 1970-2008, finds a similar negative relationship: 'each percentage increase in the share of fianance in total value added is associated with up to 0.12% slower growth … [and] each percentage increase in share of finance in total employment added is associated with up to 0.2% slower growth'. Adair Turner (2013) puts it appropriately: 'in retrospect those assumptions were part of a widespread intellectual delusion which left us ill-equipped to spot emerging financial stability risks'.

The new literature has also begun to analyse more extensively *disaggregated* credit statistics, in order to differentiate between the effect different *uses* of credit have on growth. This has come to be known as the 'functional differentiation of credit' (Bezemer, 2014). For example, Bezemer and Zhang (2014) created a data set covering 1970-2012 for 37 economies, with credit decomposed into four different categories: non-financial business credit, consumption credit, mortgages and financial business credit. The authors find that the interaction of mortgage credit growth and increasing house prices is a good predictor of a credit boom. 'Credit booms in which the share of mortgage credit in total bank credit increases more, are credit booms which are more likely to 'go bad', leading to subsequent credit growth contractions' (Bezemer and Zhang, 2014). Similarly, Jordá, Schularick and Taylor (2014) have shown, using a recent data set that covers 1880-2010 and 14 advanced economies, that over the past 140 years, mortgage booms and house price bubbles have been closely associated with a higher likelihood of a financial crisis. The same authors find in a later paper that what makes some bubbles more dangerous than others is credit, with credit-financed housing price bubble being particularly dangerous (Jordá, Schularick and Taylor, 2015). Similarly, Sutherland and Hoeller (2012) find that when household debt rises above trend, the likelihood of recession increases, and the depth of the recession is greater. Bunn

and Rostrom (2014) found evidence that households with higher levels of debt reduced their spending on goods and services, as a proportion of income, by more than the average household during and after the 2008-2009 financial crisis. These ideas are not new, though, and writers such as Marx, Keynes, Minsky, Schumpeter and Tobin advocated a distinction between credit flows to the productive sectors and credit to property and capital markets (Bezemer, 2014).

Perhaps more interesting for our discussion, a substrand of that literature has payed particular attention to *bank* credit in a disaggregated form, with very revealing results. The lending activities of the banking sector in the real world again deviate violently from how they are depicted in textbooks or for that matter in state-of-the-art DSGE models[17]. In these models, banks lend primarily to businesses, who use the funds for investment purposes—meaning capital formation. The financial system in general, and credit markets in particular, is described as a system for the allocation of scarce capital to alternative capital investment projects.

But as a description of the role of credit in modern advanced economies, these accounts are inadequate (Turner, 2014). Jordá, Schularick and Taylor (2014) have shown that mortgage credit has risen dramatically as a share of banks' balance sheets from about one third at the beginning of the 20th century to about two thirds today, driven by a sharp rise of mortgage lending to households. This shift is complemented by a declining share of unsecured credit to businesses and households, a process that the authors have called 'the great mortgaging'. They also find that the intermediation of household savings for productive investment in the business sector constitutes only a minor share of the business of banking today, even though it was a central part of that business in the 19th and early 20th centuries (ibid.). 'As a result', they conclude, 'the intermediation of savings into the mortgage market has become the primary business of banking, eclipsing the stylised textbook view of banks financing the capital formation of businesses' (ibid.).

A quick glance at the financial position of MFIs vis-à-vis the rest of the economy confirms this (see **Fig. 1,** left panel). If we broaden the definition of MFI lending to include the purchase of shares, equity, and debt securities from non-MFIs, the figure shows that 'lending' to PNFCs is a small portion of 'total lending'. The panel on the right shows MFI loans to non-MFI sectors. We can see that secured lending (mortgage loans) accounts for a big chunk of the total. If we take out lending to households, financial intermediaries and the public sector, the remaining (which represents lending to PNFCs) accounts for less than 40% during the 1990s, and less than 30% since 2010. Furthermore, as mentioned earlier, PNFCs might borrow to finance expenditures that would not count as investment, such as real estate, balance sheet restructuring, and the funding of mergers and acquisitions (Bank of England, 2016). Actual MFI lending for investment purposes might very well be below 20% of total MFI lending in the real world[18].

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[17] With the exception of Jakab and Kumhof (2015)

[18] These figures are for the UK, however, which is probably an extreme case. In Continental Europe banks play a more important role in the provision of credit to businesses, compared to Anglo-Saxon economies (Allen et al., 2011, p. 22).
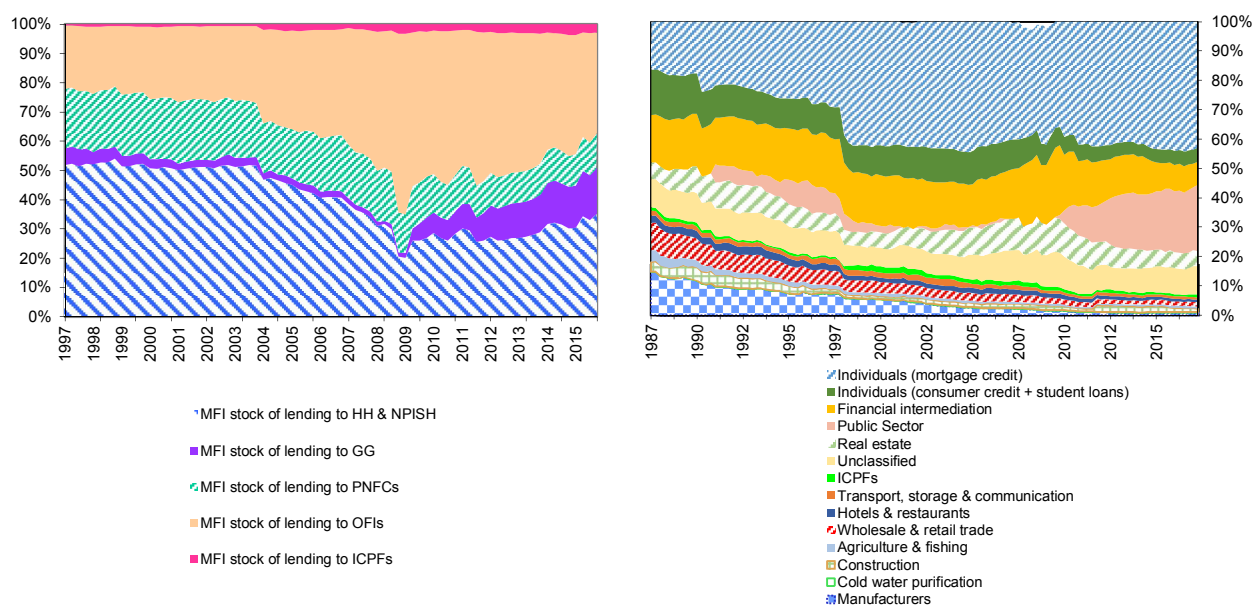
Fig. 1. MFI lending to non-MFIs. The left panel shows financial assets held by MFIs (loans, debt securities, equity, shares, etc.), that have a liability counterpart in the borrowing sector. The right panel is restricted to lending in the form of loans, and breaks down private non-financial corporations (PNFCs) into sub-categories (e.g., construction, agriculture, etc.). MFI-to-MFI lending is consolidated out. Source: UK Office for National Statistics (left panel); Bank of England *Bankstats* (right panel)

Disaggregated data on bank lending makes it possible to disentangle lending that might *contribute to GDP* to different degrees. While a non-disaggregated view finds no strong causal relationship between credit flows and real activity[19] (Zhu, 2011), the 'funcionally differentiated' perspective leads to much more conclusive and illuminating results. For example, Federal Reserve economists note that many contemporary '[a]nalysts have found that over long periods of time there has been a fairly close relationship between the growth of debt of the nonfinancial sectors and aggregate economic activity' (BGFRS, 2013, p. 76). As shown by Bezemer and Hudson (2016) using their newly created dataset, in the US, growth of bank credit to the real sector and nominal GDP growth 'moved almost one-on-one, until financial liberalisation gathered steam in the early 1980s'. Using cointegration analysis, Calza, Manrique and Sousa (2006) identified a long-run relationship linking loans to non-financial corporations and households and real GDP. While the authors argue that this should be interpreted as a long-run credit demand function, they concede that the inverse relationship, with credit supply driving GDP, cannot be excluded. In the Euro area, Ciccarelli, Maddaloni and Peydró (2010) find that a reduction of credit supply to firms significantly contributed to the decline in GDP growth. Shaikh (2016, pp. 704-5) shows that there is a strong correlation between the growth rate of nominal GDP and the growth rate of new purchasing power[20] created by the banking sector relative to GDP. Regarding the direction of causality, Barnett and Thomas (2013) provide evidence of an independent role for bank credit shocks in influencing nominal output over and above aggregate demand shocks, stating: 'credit supply shocks can account for most of the weakness in bank lending since the onset of the crisis and between a third and a half of the fall in GDP relative to its historic trend.'

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[19] '… tests of causality between credit and real activity are inconclusive concerning the direction of causality, or indeed whether causality exists' (Zhu, 2011)

[20] New purchasing power is calculated as the sum of new domestic and foreign [bank] credit directed toward expenditure on GDP transactions plus the current account balance of the external sector (Shaikh, 2016, p. 698)

14

However, when it comes to a disaggregated analysis of bank credit, the work of Richard Werner stands out as unique. While other authors skip over the role of banks as creators of the bulk of broad money, Werner's analysis incorporates this fact explicitly as a critical element. Werner's insight is that not only the *uses* of credit matter, but also the *creditor*, with an inescapable distinction to be made between creditors that lend out preexisting deposits and creditors that create new expenditure power *ex nihilo* when they lend. In other words, a proper analysis of credit calls for a distinction between bank lending and non-bank lending.

In the following I describe Werner's theory and explore the literature that has contributed to it. The aim is to make the empirical and theoretical case for the existence of a stable, causal relationship between a component of credit (i.e., 'bank credit for GDP transactions') and nominal GDP.

2.2   The Quantity Theory of Credit and empirical evidence

Links between the 'real' and 'monetary' sides of the economy have long been acknowledged, the most common formulation being the 'quantity equation of exchange'. This equation (Eq. (1)) gives a relationship between the money stock (M), the price level (P), the quantity of goods exchanged against money (Y), and the average turnover velocity of money (V).

$$M \times V = P \times Y \qquad (1)$$

The left-hand side shows the money stock M (measured in units of currency, e.g., £), multiplied by a factor V. The right-hand side shows the price level P (measured in £) multiplied by the quantity of goods exchange over the accounting period, for example a year (a flow, measured in £/year). The factor V has 1/year units, so both sides of the identity are consistent.

Rudimentary prototypical versions date back at least to the late 17th and 18th centuries, followed by increasingly sophisticated versions in the 19th and 20th century. For example, Locke, Hume, Smith, Thornton, Ricardo, Mill and Marshall employed the equation at one point or another in merely arithmetic or verbal form (Humphrey, 1984). Later Pigou (1917) gave it the form most widely known since then, (that of Eq. (1)), where $P \times Y$ represents nominal GDP (P being the GDP deflator), and M represents the money supply (measured as various monetary aggregates, e.g., M0, M1, M2, M3 or M4). Until about the mid-1980s, versions similar to Eq. (1) were the widely accepted work-horse that represented the link between the 'real' and the 'monetary' sides of the economy (Werner, 1997).

However, from the early 1980s onwards, faith in this link had been increasingly shaken by the widespread and growing empirical observation that velocity had become erratic, was declining significantly and the money demand function was unstable (e.g. Belongia and Chalfant, 1990; Boughton, 1991; Hendry, 1985). The 'quantity equation' relationship, expressed as a stable income velocity, 'came apart at the seams during the course of the 1980s' (Goodhart, 1989b). This phenomenon is known as the 'velocity decline'. As a result, economists could not identify a reliable relationship between a monetary aggregate and nominal GDP. It was during this time that the paradigm of moneyless economic models became influential, which seemed to offer an scape route from an apparently intractable problem (Werner, 2012).

Werner (1992, 1997) was the first to perform a 'surgery' to the quantity equation that would yield a correct formulation and a constant velocity. His first innovation was to incorporate the observation made by Mill (1848) and Bentham (1952-54) that money could not only be used to purchase goods but also to purchase financial assets. If an increasing stock of money is used to purchase financial assets, this will not be reflected in the GDP numbers and velocity will appear to be declining. This is what happened in the US and Japan during the 1980s. The trick is to disaggregate the general equation of exchange for all transactions into two flows: those of money used for GDP and those of money used for non-GDP

transactions[21] (Werner, 2015)

The second of Werner's innovations was to incorporate a definition of 'money' in line with the institutional realities of banking and money creation. In Werner (2012), he provides the reasoning: 'nominal GDP growth this year means that more transactions (that are part of GDP) have taken place this year than last year … we know that this is only possible if more money has also exchanged hands to pay for these transactions … the next question therefore is: how can the amount of money used for transactions increase in our modern financial system?' We know the answer: banks create 97% of the money supply of out nothing when they extend credit (see **Section 1**). Therefore, a proper definition of money should be 'bank credit'. This excludes other types of debt contracts often referred to as 'credit', such as commercial paper or government bonds. Such instruments, as will be explained in the next section, will only count as bank credit if they are assets for the banks and liabilities for the non-banks[22].

But despite deposits being created when bank credit is extended, *loans and deposits are not the same thing.* This is true both in a 'practical' sense and in a 'quantitative' sense. As for the first, as Werner (1997) eloquently points out:

> 'Traditional money measures, such as M1, M2 or M3 mainly refer to money that is deposited with banks. At any moment in time, this is merely *potential,* not *effective* purchasing power, since deposits need to be withdrawn first. Deposits do not represent spending but the opposite, namely savings. But only spending can be expected to affect GDP directly'

Using total bank credit as the measure of the 'money supply' *M* in the equation has the advantage that credit always represents effective purchasing power, as *no borrower will take out a loan if there is no plan to use the money for transactions*. It also becomes possible to define effective purchasing power clearly—namely not bank liabilities, but bank assets or private sector liabilities to the bank sector (Werner, 1997). This overcomes the recurrent problem of how to define money properly[23]. Werner points out a third advantage, that disaggregated credit data are available by economic sector and hence provides a better tool to decompose the equation into different flows. However, the Bank of England has since begun to publish data on deposit holdings by economic sector (see the Bank of England's *Bankstats*). Nonetheless, the first and second advantages still hold today.

As for the second aspect in which loans and deposits are not equal—namely that their quantities differ—, Werner (1996) showed that a broad credit measure, M2 + CD—traditionally used in Japan as a deposit measure—and a broad credit measure diverged greatly in the 1990s[24]. **Fig. 2** shows a similar deviation for the case of the UK. While money and credit flows are tightly correlated, that relationship is not exact and at certain times credit growth has exceeded money growth. During these period, some of the lending to households and companies is likely to have been funded by issuance of non-deposit liabilities (for example long-term bonds, equity or securitisations) or deposits from non-residents (Bridges, Rossiter and Thomas, 2011).

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[21] Though this idea is not new, and already in the 1970s Milton Friedman considered such possibility; 'Each side of this equation can be broken into subcategories: the right-hand side into different categories of transactions and the left-hand side into payments in different form' (Friedman, 1977, 'Quantity Theory', *Encyclopedia Britannica, 15th edition,* p. 435)

[22] '… only the net creation of new transferable purchasing power is part of the definition. Thus what is often termed 'credit', for instance, the issuance of corporate debt or government bonds, does not in itself constitute credit creation, as in these cases already existing purchasing power is transferred between parties' (Werner, 2012)

[23] Today, textbooks, as well as leading central bank publications, state that they do not know just what money is. In the words of then Federal Reserve staff: "…there is still no definitive answer in terms of all its final uses to the question: What is money?" (Belongia and Chalfant, 1990, p. 32).

[24] 'While significant growth of M2+CD seemed to suggest an economic recovery in 1995, the credit aggregate suggested a contraction of nominal GDP growth — for the first time since 1931. The latter is what happened. Conversely, while M2+CD growth remained stable from mid-1995, the credit aggregate suggested a sudden economic recovery from the fourth quarter of 1995, which again materialised' (Werner, 2012)
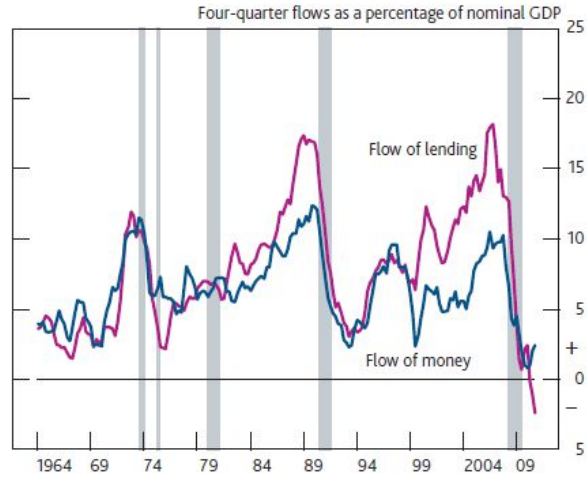
Four-quarter flows as a percentage of nominal GDP

Fig. 2. Money and MFI credit flows. Both (broad) money (M4) and lending (M4L) flows exclude transactions with intermediate other financial corporations (OFCs) where available. M4L is adjusted to exclude the effects of securitisation. M4 covers private sector (households and companies, excluding public corporatios) holdings of sterling notes and coin, sterling deposits with banks and building societies, and sterling shares issued by building societies. Deposits are understood to include both certificates of deposit and other debt securities of up to and including five years' original maturity issued by banks and building societies (Burgess and Janssen, 2007). The following identity holds: M4 = M4 lending + net foreign currency lending to private sector + net lending to public sector (including coin) + net lending to non-residents + net other assets. Source: Bridges, Rossiter and Thomas (2011)

Using the these two observations, two 'surgeries' can be performed on the quantity equation. First, the proper usage of 'money' as bank credit can be introduced (substituting M). Second, the decomposition of money flowing to two different types of transactions. Werner's *Quantity Theory of Credit* is derived as follows:

$$CV = PQ \qquad (2)$$

$$CV = C_R V_R + C_F V_F \qquad (3)$$

$$PQ = P_R Q_R + P_F Q_F \qquad (4)$$

Eq. (1) shows the substitution of M (representing broad monetary aggregates) by C, which represents bank credit. Eq. (3) shows the decomposition of the flow of bank credit spent in the 'real' economy—on transactions that are part of GDP, such as investment or consumption—, and the flow that is spent in the 'financial' economy—primarily financial assets but also non-produced non-financial assets[25] (e.g., real estate). The identity must also hold for the individual flows, so:

$$C_R V_R = P_R Q_R = P_R Y \qquad \text{with } V_R = \frac{P_R Y}{C_R} = \text{const.}$$

$$C_F V_F = P_F Q_F \qquad \text{with } V_F = \frac{P_F Q_F}{C_F} = \text{const.}$$

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[25] For the distinction, see Eurostat (2013, p. 176)

Applying the chain rule for differences[26]—which, when applied to stocks, represent flows—, and using YoY relative growth rates:

$$\frac{\Delta C_R}{C_R} = \frac{\Delta(P_R Y)}{P_R Y}$$

(5)   YoY 'bank credit for GDP' = YoY 'nominal GDP'

$$\frac{\Delta C_F}{C_F} = \frac{\Delta(P_F Q_F)}{P_F Q_F}$$

(6)   YoY 'bank credit for financ. trans.' = YoY 'financ. trans. volume'

This is Werner's quantity theory, as presented in Werner (1992, 1995, 1997, 2005, 2015). Eq. (5) states that for a constant velocity V_R, any percentage change in the stock of credit used for GDP transactions will translate one-for-one in a percentage change in nominal GDP. In other words, the stock of credit money that enters the real circulation determines the nominal value of goods and services. Eq. (6) states that for a constant velocity V_F, any percentage change in the stock of credit used for non-GDP (or 'financial') transactions will translate one-for-one in a percentage change in the value[27] (measured in nominal terms) of those transactions.

In the real world, the 'two economies' defined here are not hermetically shielded from one another, and their boundary is somewhat porous. Certainly, all analytical categories are human constructs, but they allow us to understand the world. Bank credit to the non-bank 'asset' sector, though it might 'spill over' to the the real sector eventually, does not enter the real sector initially to finance tangible capital formation or wages (Bezemer and Hudson, 2016). Its principal immediate effect is to inflate asset prices, specially non-produced assets such as real estate that are 'in inelastic supply' (Turner, 2014). Liang and Cao (2007) report that there exists unidirectional causality running from bank lending to property prices in China. Davis and Zhu (2011) on Hong Kong, and Goodhart and Hofmann (2003) on a panel of countries, find significant relationships between bank credit and property prices. Recent econometric analysis confirms that mortgage credit causes house prices to increase (Favara and Imbs 2014), *and not just vice versa*, as in the demand-driven textbook credit market theories. In this case, credit-money may also be used to purchase financial or real estate assets 'without directly entering the investment-wage-consumption cycle of the real economy for a significant length of time' (Werner, 1997). During the Great Moderation there were substantial asset price bubbles while the Consumer Price Index (CPI) or other standard measures of 'real' economy inflation were not much affected. As argued by Turner (2014a), there is no reason why asset price inflation will automatically translate—not even in the medium-to-long run—into goods and services inflation, contrary to what is believed. In some cases it will, it some cases it will not. Borio and Lowe (2004) note that in periods of low inflation and central banks commited to price stability, price pressures of unsustainable credit expansion 'might take longer to emerge'. Instead, symptoms of the unsustainable boom would more likely first show up in excessive credit and asset price growth and hence in overstretched balance sheets, before showing up in consumer price inflation. Thus, in periods of price stability, the inflationary potential of excessive credit growth may be 'camouflaged' under the form of asset price overvaluation (Calza, Manrique and Sousa, 2006). Recognising this, The Bank of International Settlements (2016b, p. 20) recommends a more prominent role for monetary policy in preventing financial instability, allowing for the possibility of tightening policy even if near-term inflation appears under control. A case in which asset prices did not affect

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[26] $\Delta(ab) = a\Delta b + b\Delta a$. With a constant, $\Delta(ab) = a\Delta b$

[27] The price of a product is defined as the value of one unit of that product. This price will vary directly with the size of the unit of quantity selected. For a single homogeneous product, the value of a transaction (v) is equal to the price per unit of quantity (p) multiplied by the number of units of quantity (q), that is: $v = p$ x q. Quantities of different products cannot however be aggregated without a certain weighting mechanism. For aggregate products, the term volume is used instead of quantity. Price and volume measures have to be constructed for each aggregate of transactions in products within the accounts so that: *value index = price index* x *volume index*. (Eurostat, 2011)

consumer prices is Japan during the 1980s and early 1990s, when the proportion of bank loans that ended in real estate related transactions increased dramatically, resulting in nominal commercial land prices rocketing, while the economy registerd remarkably low consumer price inflation, as shown in Werner (1997). A case in which bank lending to the financial sector *did* enter the real economy was the UK during the 1980s. In this case, the speculators were mainly individuals, not firms. Their increased purchasing power reduced savings, boosted consumption and by entering the real circulation pushed up consumer prices (Werner, 1997).[28]

2.3 Empirical evidence and econometric tests supporting QTC

Since Werner formulated it in the 1990s, the 'quantity theory of credit' has been put to test by several authors with data for various countries (cf. Werner, 1997, 2005, 2014; Voutsinas and Werner, 2011; Ryan-Collins, Werner and Castle, 2016; Lyonnet and Werner, 2012; Bezemer and Werner, 2009). The theory has the advantage of making theoretical predictions that can be checked in the empirical data. On the other hand, it has the downside that *it can never be refuted entirely conclusively.* As two sides of the same coin, incompleteness for refutation implies incompleteness for corroboration. As I explain later, the variable 'bank credit for GDP transactions' is not, unlike monetary aggregates, directly observable, and empirical proxies have to be constructed that approximate it. This is further complicated by the fact that it is never possible to know whether the proxy one has constructed is the 'correct proxy', and a process of 'triangulation' is required, that is, the combination of theoretically-informed search with empirical refinement. Thus, the theory can only be granted *shades of plausibility,* and one must be equally judicious in the process of empirical testing as in the process of proxy construction. Issues related to proxy construction are explored in **Sect. 3.**

In the 'fuzzier' or more general formulation, the theory predicts the existence of a stable, autonomous mechanism linking two pairs of variables, with unidirectional causality going from the 'bank credit' variables to the 'nominal value of transactions' variables. In the case of the first pair of variables, causality runs from the growth rate of bank credit for GDP transactions to nominal GDP growth, which can be represented in the following form:

$$\frac{\Delta C_R^b}{C_R^b} \rightarrow \frac{\Delta nGDP}{nGDP}$$

One of the implications of the existence of such autonomous relation is that, as an explanatory variable, bank credit for GDP transactions should outperform competing explanatory variables, where the variable to be 'explained' is nominal GDP growth. In fact, additional explanatory variables should be identified as redundant, and bank credit for GDP transactions should suffice (the 'autonomous' property). Another implication is that the direction of causality must run from bank credit for GDP transactions to nominal GDP. In its more precise formulation, the theory makes the prediction shown in Eq. (5), which reads: 'there is a one-to-one relationship between the growth rate of nominal GDP and the growth rate of bank credit used for GDP transactions'. This prediction can be tested by checking the contemporaneous correlation between growth rates of the two variables. Importantly, it is not only correlation that matters, but the area between the two curves. That is, in growth rates, one variable should *not* be a scaled version of the other variable; both time series should appear to be, ideally, perfectly superposed one on top of the other.

What has the literature found so far regarding these predictions? As far as I know, there are seven

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[28] As will be shown later, this gives us reasons to *exclude* real estate lending from the proxy and to *include* mortgage lending.

papers that try to test some aspect or other of the theory. These papers share a common methodology. First, they construct a proxy of 'bank credit used for GDP transactions', each with their own peculiarities but following the same overall logic[29]. Then various econometric tests follow, of the 'general-to-specific' (GETS) type (Hendry and Mizon, 1978), which consists of a single independent variable (nominal GDP growth), and and a number of candidate explanatory variables and their lags. These variables compete with each other in terms of explanatory power and significance. This equation is reduced based on progressive discarding of candidate variables based on statistical (in)significance, a sequential downward reduction, going from a general to a parsimonious equation. The competing variables often are a combination of a short term interest rate, a long-term interest rate, the growth rate of a broad monetary aggregate, ten-year bond yields, exchange rates, and the growth rate of the proxy of bank credit for GDP transactions. This method has the advantage of being inductive model-independent approach, with minimum or none a priori assumptions and restrictions (Ryan-Collins, Werner and Castle, 2016). The general-to-specific methodology has a good track record when it comes to estimating robust time series models (see e.g. Bauwens & Sucarrat, 2010; Voutsinas & Werner, 2010; Werner, 2005). The papers also perform various other tests, including Granger causality tests, strong exogeneity tests, etc.

Werner (1992, 1997, 2005) was the first to perform such tests for the case of Japan, followed by Voutsinas and Werner (2011b). They show that credit for GDP transactions explains nominal GDP well over several decades ('growth of loans to the real economy single-handedly accounts for almost 90 % of nominal GDP growth in the observed time period'), while alternative explanatory variables—including interest rates and money supply—are eliminated in a reduction from a general to the parsimonious specific model (Hendry and Mizon, 1978). Explicit tests for omitted variables, adding M2+CD, ten year bond yields and exchange rates also found no omissions. Granger-causality is uni-directional from credit to growth at the 1% significance level, concluding that 'bank credit growth appears to be in a stable long-term relationship with nominal GDP growth'.

Similarly, Lyonnet and Werner (2012) found that UK credit for GDP transactions explains nominal GDP over several decades, beating monetary aggregates, interest rates, central bank asset purchases and a variable representing 'qualitative easing' in a reduction from the general to the parsimonious form. The also find their proxy is 'is found to be in a stable long-term relationship with nominal GDP growth'.

Ryan-Collins, Werner and Castle (2016) and Lyonnet and Werner (2012) both construct proxies for the UK. Both sets of authors use Bank of England data. In both papers, the authors find a 'long-run cointegrating relationship' between the growth rate of nominal credit to the real economy and nominal GDP growth, discarding competing explanatory variables such as the bank rate, bank reserves, asset purchases by the Bank of England, the ratio of long-term assets of central bank balance sheet ('qualitative easing') and the money supply (M4), in a general-to-specific econometric model. Moreover, they find real economy credit growth to be strongly exogeneous to nominal GDP growth, in line with the results obtained by Barnett and Thomas (2013) on the independent role for bank credit shocks in influencing nominal output over and above aggregate demand shocks.

Bezemer and Werner (2009) study the link between credit and output in the Czech Republic, by using separate measures of credit to the real sector and credit to the financial sector. The authors find their '… disaggregated measure for credit flows exhibits better short-term correlation and causation to output growth than traditional, aggregate measures of credit and money. Our measure also appears to be a better annual predictor of nominal growth'.

Werner (2014) constructs a proxy for C_R^b for the Spanish economy using data from *Banco de España* (Bank of Spain) covering 1995-2013. The author finds that 'bank credit for GDP transactions' outperforms competing explanatory variables in a downward reduction from a general model to a

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[29] These different proxies will be described later

parsimonious model, where the independent variable is nominal GDP growth. The competing variables are interest rates (10-year benchmark government bond yield) and money supply (M1). Co-integration and Granger-causality analysis in these studies suggests 'unidirectional causation from bank credit creation to nominal GDP growth'.

Table 3 shows the estimated (inverse) velocities by the different authors. Given that the papers find a stable cointegrating relationship between nominal GDP growth and growth rate of the proxy, this velocities come out stationary.

$\dfrac{C_R^b}{nGDP}$ Inverse velocity	Country	Source	Notes
0.656	Japan	Werner (1997)	Parsimonious model; 1981-1995
0.432	Japan	Voutsinas and Werner (2011)	Parsimonious model; 1984-2008
0.521	Japan	Werner (2012)	Parsimonious model; 1984-2001
0.659	UK	Lyonnet and Werner (2012)	Parsimonious model A; 1995-2010
0.534	UK	Lyonnet and Werner (2012)	Parsimonious model B; 1995-2010
0.588	UK	Ryan-Collins, Werner and Castle (2016)	Parsimonious model I(1); 1965-2012
0.709	Spain	Werner (2014)	Parsimonious model; 1997-2013

mean = 0.585

Table 3. Inverse income velocities of the proxies derived by different authors

The values of the inverse velocity, shown in **Table 3**, can be used to make a *complementary test* of the theory for a larger sample of countries and longer periods, saving the arduous work of having to construct one proxy per country. Instead, we can use non-disaggregated credit data available at the Bank of International Settlements' website. The trick is to '*dis-disaggregate*' the proxy into 'total credit', and divide it by nominal GDP. This way we can stablish the following relationship:

$$nGDP = C_R^b V_R = \frac{C_R^b}{0.6}$$

$$C = total\ credit = \ C_R^b + \ C_F^b + \ C_R^{nb} + \ C_F^{nb}$$

$$\frac{C_R^b}{nGDP} = \frac{1}{V_R} = 0.6 \leqslant \frac{C}{nGDP} = \ total\text{-}credit\text{-}to\text{-}GDP$$

Fig. 3 shows that this relationship is not violated in the data, which provides additional empirical support for the quantity theory of credit.
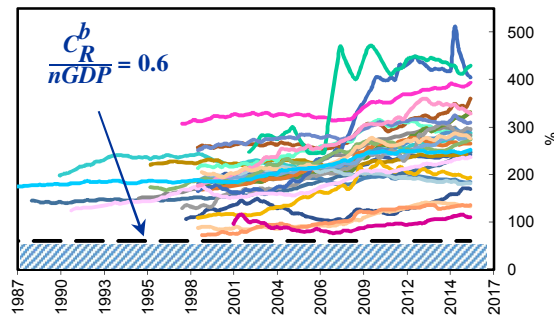
Total credit to GDP

Fig. 3. Total credit to GDP ratios, in percentage terms. Total credit is bank and non-bank credit, from-all-to-all the domestic sectors, both public and private. Source: Bank of International Settlements. The countries are: Austria, Belgium, Switzerland, Czech Republic, Denmark, Finland, France, Greece, Ireland, Italy, Korea, Netherlands, Poland, Sweden, USA, Australia, Canada, Chile, Germany, Spain, Finland, UK, Hungary, Israel, Japan, Luxemburg, Norway, Portugal and Turkey.

3. The process of constructing good empirical proxies of C_R^b

In this section I explore the most delicate issue when it comes to improving QTC, namely, empirical proxy construction. Since the variable 'bank credit for GDP transactions' is not, unlike monetary aggregates, directly observable, the process of crafting a good proxy is one that needs to be handled with great care. In the following, I study the proxies constructed by Werner (1997) for Japan, Ryan-Collins, Werner and Castle (2016) and Lyonnet and Werner (2012) for the UK, Bezemer and Werner (2009) for the Czech Republic, and Werner (2014) for Spain. In **Section 3.2**, I will introduce an improvement by including the public sector, the external sector and the non-profit sector.

As I will explain, the 'correct proxy' cannot be known in advance, and only a process of 'triangulation', combining a theoretically-informed search with empirical refinement, can make reasonable approximations to the best proxy. As a rule-of-thumb, a good proxy should yield year-over-year growth rates that are very close—and ideally identical—to nominal GDP growth rates[30].

Before explaining the proxies for C_R^b that have been constructed by several authors, I feel the need to present in some detail some terminological and conceptual devices so that the posterior analysis does not miss anything and is well structured. Given that C_R^b establishes a flow relation between a specific creditor (banks) and a debtor who engages in specific types of transactions (GDP), the analysis calls for a 'panoramic' view of creditors, debtors, and transactions. I follow the latest national accounting standards, the *System of National Accounts 2008* (SNA2008) and the *European System of Accounts 2010* (ESA2010) (cf. UN, 2009; Eurostat, 2013).

Regarding creditors and debtors, the ESA2010 divides the domestic economy into 'institutional sectors' (Eurostat, 2013, p. 31). Monetary financial institutions (MFIs) include the national central bank (NCB, S.121), deposit-taking corporations except the central bank[31] (S.122, which includes commercial banks, savings banks, post office giro institutions, rural and agricultural credit banks, credit unions, and

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[30] This rule runs the risk of being tautological and misleading. This is because the quest for good proxies might incite dubious 'fine-tunning' of proxies, with a posteriori rationalisation of the method used for crafting them. This is why good proxies must be grounded on both good theory to provide justification, and good empirics and good statistical sources.

[31] 'Deposit-taking corporations, except the central bank, have financial intermediation as their principal activity. They incur liabilities in the form of deposits or financial instruments that are close substitutes for deposits.' (IMF, 2015, p. 28, §4.18).

others), and money market funds[32] (MMFs, S.123). In our analysis, the terms MFIs and 'banks' will be used interchangeably, as the ones creating 97% of broad money. Financial corporations except MFIs include non-MFI investment funds (S.124), other financial intermediaries (OFIs, which include insurance corporations[33] and pension funds[34] (ICPFs, S. 128-129), financial auxiliaries (S.126) and captive financial institutions and money lenders (S.127). The non-financial sector would include private non-financial corporations (PNFCs, S.11), general government[35] (GG, S.13, the sum of central, state and local government and social security funds), non-profit institutions serving households[36] (NPISH, S.15) and households[37] (HH, S.14). In turn, PNFCs, HH and NPISH comprise the private non-financial sector (PNFS) (BIS, 2016a), while public corporations[38] and the general government comprise the public sector (IMF, 2015, p. 31, §4.42). Finally, the rest of the world (S.2) sector refers to flows and positions between resident units and non-resident units.

Regarding credit instruments, these consist of loans and debt securities[39] (Eurostat, 2013, p. 136). Loans (F.4) are created when creditors lend funds to debtors (Eurostat, 2013, p. 139, §5.112), their value being measured in nominal terms. Nominal valuation reflects the sum of funds originally advanced, plus any subsequent advances, less any repayments, plus any accrued interest. Nominal value is not the same as face value (Eurostat, 2013, p. 174, §7.39). Debt securities (F.3) are negotiable financial instruments serving as evidence of debt, measured in market value (Eurostat, 2013, p. 136, §5.89). Negotiability refers to the fact that legal ownership of the instrument is readily capable of being transferred from one owner to another by delivery or endorsement[40] (IMF, 2015, p. 1, §1.6). The most common types of debt security include bills[41], bonds[42], notes, negotiable certificates of deposit, commercial paper, debentures, asset-backed securities, and similar instruments normally traded in the financial markets that serve as evidence of a debt (IMF, 2015, p. 15, §3.2). The market value is that at which financial assets are

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[32] 'Money market funds (MMF) are collective investment schemes that raise funds by issuing shares or units to the public.' (IMF, 2015, p. 28, §4.20).

[33] 'Insurance corporations consist of incorporated, mutual, and other entities whose principal function is to provide life, accident, sickness, fire, or other forms of insurance to individual institutional units or groups of units, or reinsurance services to other insurance corporations.' (IMF, 2015, p. 29, §4.29).

[34] 'Pension funds are set up to provide retirement benefits for specific groups of employees and selfemployed persons.' (IMF, 2015, p. 29, §4.30).

[35] 'Government units are unique kinds of legal entities established by political processes that exercise legislative, judicial, or executive authority over other institutional units within a given area.' (IMF, 2015, p. 29, §4.31).

[36] 'NPISHs provide goods and services to households free of charge or at prices that are not economically significant. NPISHs consist mainly of associations such as: trade unions; professional or learned societies; consumers' associations; political parties (except in single-party states where the political party is included in general government); churches and religious societies (including those financed by government); social, cultural, and recreational sports clubs; and organizations that provide goods and services for philanthropic purposes rather than for the units that control them.' (IMF, 2015, p. 30, §4.39).

[37] 'A household is a group of persons who share the same living accommodations, pool some or all of their income and wealth, and consume certain types of goods and services collectively, mainly housing and food.' (IMF, 2015, p. 30, §4.38).

[38] 'Public corporations comprise public nonfinancial corporations, public financial corporations other than the central bank, and the central bank.' (IMF, 2015, p. 31, §4.42).

[39] The Bank of International Settlements defines credit instruments as covering 'the core debt, defined as loans, debt securities and currency & deposits' (BIS, 2016). I will use a more restricted definition of credit, limiting it to loans and debt securities. MFI credit thus comprises bank loans and the holdings by MFIs of securities issued by non-banks (Bê Duc and Le Breton 2009). Another difference between the definitions used here and the ones used by the BIS is that credit will be considered whether granted/issued by MFIs and non-MFIs alike.

[40] 'The criteria for a financial instrument to be considered negotiable are: (1) the ability to be transferred to another person's legal ownership (or offset in the case of financial derivatives); (2) standardization (often evidenced by fungibility) and an eligible International Securities Identification Number (ISIN); and (3) no right of recourse against previous holders of the relevant asset.' (IMF, 2015, p. 9, §2.3)

[41] 'Bills are debt securities that give the holders the unconditional right to receive stated fixed sums on a specified date. Bills are generally issued with short-term maturities at discounts to face value that depend on the rate of interest and the time to maturity, and are usually traded in organized markets. Examples of such short-term securities are treasury bills, negotiable certificates of deposit, promissory notes, bankers' acceptances, and commercial paper.' (IMF, 2015, p. 15, §3.4)

[42] 'Bonds and debentures are long-term debt securities that give the holders the unconditional right to fixed payments or contractually determined variable payments on a specified date or dates, that is, the earning of interest is not dependent on earnings of the debtors. Bonds and debentures also give holders the unconditional right to fixed sums as payments to the creditor on a specified date or dates.' (IMF, 2015, p. 15, §3.5)

acquired or disposed of, between willing parties, on the basis of commercial considerations only, excluding commissions, fees and taxes (Eurostat, 2013, p. 174, §7.38). Importantly, equities[43] and investment fund[44] shares or units (listed[45] and unlisted[46]) are not considered as credit instruments.

Credit instruments can be allocated to different projects and expenditures. Expenditures are classified as being part of GDP transactions or as not being part of them. Transactions that are part of GDP[47] include *final consumption*, *gross capital formation* and *net exports* (OECD & Eurostat, 2012, p. 6).

The sectors engaging in *consumption* are HH, NPISH and GG. HH and NPISH consumption covers a broad range of goods and services that includes food, clothing, housing, heating, furniture, medical goods and services, recreation, transport equipment and services, cultural services, education, etc. GG consumption is divided into individual consumption, which includes housing, health, recreation and culture, education, and social protection, and collective consumption, which includes general public services, defence, public order and safety, economic affairs, environment protection, and housing and community amenities, but also expenditures on the overall policy-making, planning, budgetary, co-ordinating and monitoring responsibilities of ministries overseeing the services and on the research and development carried out for the services (ibid., pp. 7-8).

Gross capital formation (GCF) is done by resident producers, i.e., unincorporated enterprises (including households engaged in own-account production), general government and non-profit institutions (ibid., p. 11). The SNA93 and the ESA95 define gross capital formation as comprising *gross fixed capital formation*, *change in inventories* and *acquisitions less disposals of valuables*, of which gross fixed capital formation is the most important. *Gross fixed capital formation* is the acquisitions less disposals of fixed assets[48] plus major improvements to non-produced assets[49]. An important element of gross fixed capital formation is own-account production of fixed capital assets, including the construction of new dwellings and the extension and modification of existing dwellings carried out by households on own account. Non-produced assets like land which are subject to improvement are also counted. Other components of gross fixed capital formation are construction of buildings and structures, machinery and equipment, intellectual property products, R&D, software and databases, and hardware (Eurostat, 2016, p. 48). *Change in inventories* is the acquisition less disposals of stocks of raw materials, semifinished goods and finished goods that are held by producer units prior to their being further processed or sold or otherwise used. *Acquisitions less disposals of valuables* comprise the changes in the stocks of goods that have been acquired primarily as stores of value because they are expected to appreciate—or at least not to decline—in value and do not deteriorate over time under normal

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[43] 'Financial assets that acknowledge claims on the residual value of a corporation or quasi-corporation, after the claims of all creditors have been met' (Eurostat, 2013, p. 187)

[44] 'Investment funds are collective investment schemes that raise funds from the public by issuing investment fund shares or units (F52), in order to acquire financial or nonfinancial assets' (IMF, 2015, p. 2, §1.10)

[45] 'Equity securities listed on an exchange. Such an exchange may be a recognised stock exchange or any other form of a secondary market. Listed shares are also referred to as quoted shares. The existence of quoted prices of shares listed on an exchange means that current market prices are usually readily available.' (Eurostat, 2013, p. 187)

[46] 'Equity securities with prices that are not listed on a recognised stock exchange or other form of secondary market.' (Eurostat, 2013, p. 187)

[47] I use the *expenditure* side of GDP, since borrowing is done to finance expenditures, which become someone else's income, but borrowing does not finance one own's income. When payed wages, workers see deposits in the bank increase, which represent an asset to them. Borrowing would add to their stock of liabilities. So it is clear that 'borrowing to finance income' is a concept that makes no sense. On the other hand, we are interested in nominal GDP (volume measure of GDP), and the income approach to GDP cannot be used to measure GDP volume (Eurostat, 2016, p. 10).

[48] *Fixed assets* are used repeatedly, or continuously, in processes of production for more than one year. Fixed assets are either tangible, such as buildings, machinery, etc., or intangible, such as mineral exploration, computer software (OECD & Eurostat, 2012, p. 4). Fixed assets produced assets used in production for more than one year (Eurostat, 2013, p. 73, §3.124).

[49] Sales and purchases of existing fixed assets between residents cancel out over the economy as a whole, while sales and purchases of existing fixed assets between residents and non-residents do not cancel each other out and are recorded as investment by the importer and disinvestment by the exporter (OECD & Eurostat, 2012, p. 4).

conditions. Valuables include gold (other than monetary gold) and other precious metals, expensive jewellery and precious stones, works of art and antiques (ibid., p. 12).

Net exports is the difference between exports of goods and services less imports of goods and services (ibid., p. 17). Net exports plus income receivable less income payable (both primary and secondary income) are equal to the current account balance, and recorded in the current account of the Balance of Payments (BoP) statistics (IMF, 2009, p. 9).

The more recent standards of SNA2008 and ESA2010 have introduced some changes compared to previous standards that affect the computation of GDP. For example, purchases of *R&D* were treated as intermediate consumption (non-GDP) in the SNA93, whereas the SNA2008 prescribes to record it as investment (part of GDP). Another component is expenditures on *military weapon systems*. The SNA93 treated this as intermediate consumption (non-GDP), whereas SNA2008 treats them as fixed capital formation (GDP) (OECD, 2015).[50]

Transactions that are not counted by national accountants as part of GDP include the purchase and sales of assets (financial, produced and non-produced alike) between residents. This means that the purchase and sale of the following items is not part of GDP transactions: stocks, bonds, land ownership rights, shares, equity. These represent the transfer of ownership of existing assets. In the case of transactions across borders, changes in financial assets for the resident sectors do not contribute to GDP (registered in the financial account of the balance of payments), whereas changes in produced and fixed assets do contribute to GDP; these are recorded as investment by the importer and disinvestment by the exporter (OECD & Eurostat, 2012, p. 12). Finally, one should not equate 'investment', 'gross capital formation', and 'foreign direct investment'. The first two terms are often used interchangeably, and that is a semantic choice, but the first two terms have nothing to do with the third, at least in a strictly definitional sense, so that $I = GCF \neq FDI$. Foreign direct investment has to do with 'a category of cross-border investment made by a resident entity in one economy (the direct investor) with the objective of establishing a lasting interest in an enterprise (the direct investment enterprise) that is resident in an economy other than that of the direct investor' (OECD, 2008, p. 22). The main motivation of the direct investor is to exert some degree of influence over the management of its direct investment enterprise(s). This is what differentiates direct investment from cross-border portfolio investments. Whether the funds advanced by the foreign direct investor are used for fixed capital formation is a separate issue. The effects of FDI on GCF may vary for different countries, trading partners and industries. In Canada, for example, inward FDI is found to have a strong positive impact on domestic capital formation for the overall economy and for non-service industries, but no measured impact on services (ICRPP, 2002, p. 4).

In terms of the uses given to borrowed funds, they take different forms. According to the Bank of England, households and individuals might borrow to pay for college tuition fees (student loans), mortgages (mortgage loans or secured lending), and consumption (consumer credit) (cf. Bank of England *Bankstats*). In the case of corporations, according to the quarterly *Credit Conditions Survey* done by the Bank of England, they borrow mainly to finance mergers and acquisitons, balance sheet restructuring, commercial real estate acquisition, inventory finance, and capital investment (Band of England, 2016). OFIs will not be studied here since they contribute little to GDP relative to their share of borrowing from banks (see **Fig. 2**), so they will be excluded from the proxies[51].

I turn now to the issue of *empirical proxy construction.* Werner's (1997) proxy provides the 'benchmark' against which other approaches can be compared. In that paper, he uses Bank of Japan quarterly sectoral bank loan data to measure C_R^b, which is defined as $C_R^b = C - C_F^b$, C being total bank

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[50] The increase on GDP levels is moderate: 2.2% points due to R&D and 0.3% due to military expenditures for OECD countries on average. GDP growth rates a generally affected to a much lesser extent, in the order of +/-0.1% (OECD, 2015)

[51] See Burgess (2011) for a good explanation of the measurement of financial services' contribution to GDP

credit[52]. By identifying C_F^b and substracting it from C he obtains a proxy for C_R^b. He identifies C_F^b as being:

> '… those asset collateralising bank loans that have been used for speculative asset transactions … loans to the real estate sector, construction firms and non-bank financial institutions (which mainly served as conduit for real estate loans) represent such speculative credit creation that was used for real estate transactions' (Werner, 1997)[53]

With this operationalisation of bank credit for GDP transactions, he obtains a constant velocity and a good regression fit between the growth of the proxy and nominal GDP growth.

This particular proxy merits several observations:

- First, although Werner acknowledges that money for GDP transactions might be created by the banking sector by means *other than loans* (cf. Werner, 2015[54]), he decides nonetheless to drop this from the analysis.

- Second, two important sectors are excluded from the proxy, namely the *public sector* and the *external sector*. This is a bit odd given that we know government expenditure and net exports enter directly into the national income stream, which is transparent in the GDP identity, $Y = C + I + G + NX$. In the case of government expenditures, while it is true that as a percentage of GDP might be around 30-40%, expenditure financed by borrowing (i.e., the government deficit) is much smaller, say around 5%; and thus it can be glossed over. Yet, at the same time, this omission is particularly puzzling since in later papers Werner proposes bank borrowing to finance government deficits as a means to stimulate C_R^b and nominal GDP, i.e., his 'Enhanced Debt Management' (cf. Werner, 2014). In the case of the external sector, net exports are usually a non-insignificant share of GDP, either as a positive or a negative trada balance. The UK, for example, has been running 2-3% trade deficit since the early 2000s (see **Fig. 13**). More will be said below about the external sector. Additionally, he also omits non-profit institutions serving households (NPISH)[55].

- Thirdly, he discriminates GDP from non-GDP uses given to bank loans by excluding certain recipient sectors and not others. In this case, those excluded sectors are real estate companies, construction firms and non-bank financial institutions. He thus includes as sectors receiving bank loans that contribute to GDP private non-financial corporations (PNFCs) excluding from them real estate and construction. This implies the hidden assumption that the sectors excluded devote *none* of their liabilities vis-à-vis banks to finance GDP expenditures, for example, construction firms paying for office material. It also implies the assumption that those sectors included in the proxy will allocate *all* the funds borrowed from banks to expenditures that contribute to GDP. This are, as can be seen, gross approximations.

These three observations point to possible weaknesses in Werner's operationalisation of C_R^b. The following figures[56] give some clues as to whether this method is appropriate or not[57].

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[52] Remember, credit is a stock, while lending is a flow
[53] Werner (1997) is not explicit about the treatment of mortgage lending, so I assume he is excluding it from the proxy. This is supported by comments elsewhere in the paper, where he argues that while in the UK mortgage lending in the UK did spill over to consumption, this was not the case in Japan during the 1980s.
[54] '… banks create money out of nothing when they extend bank credit (or purchase other assets, or pay their staff)' (Werner, 2012)
[55] I deal with this issue later
[56] Although we are talking about the Japanese case, we will use UK data since the principles for constructing a good proxy should hold for all countries, although the posterior fine-tunning might vary.
[57] As explained in a previous footnote, when constructing a proxy, we cannot judge its validity by merely looking at the fitness in the regression against nominal GDP growth. The proxy must be consistent *both* with theory and empirics.

Regarding the *first and second criticisms*, **Fig. 4** shows shows bank holdings of assets that constitute liabilities for the rest of the sectors, discriminating between the different financial instruments. The instruments are debt securities and loans, which consitute bank credit, and other liabilities, which include equity and investment fund shares. The graphs show the percentage of total liabililities of each of the sectors that is held by domestic banks. It can be seen that *for three out of four sectors, the most common liability is in the form of loans*. That is, the business of banks is primarily that of extending loans. Households and non-profit institutions depend heavily on bank credit, while private non-financial corporations, other monetary-financial institutions and insurance companies and pension funds have a more rich set of financial positions vis-à-vis banks and non-banks. Firms, financial and non-financial alike, typically rely substantially on capital markets (shares, equities, commercial paper, etc.) to finance their operations, where banks and non-banks alike issue and buy these instruments from each other. Thus, the first criticism can be ignored for these three sectors. In their case, debt securities issued by them and purchased by banks are a negligible fraction of total bank lending.
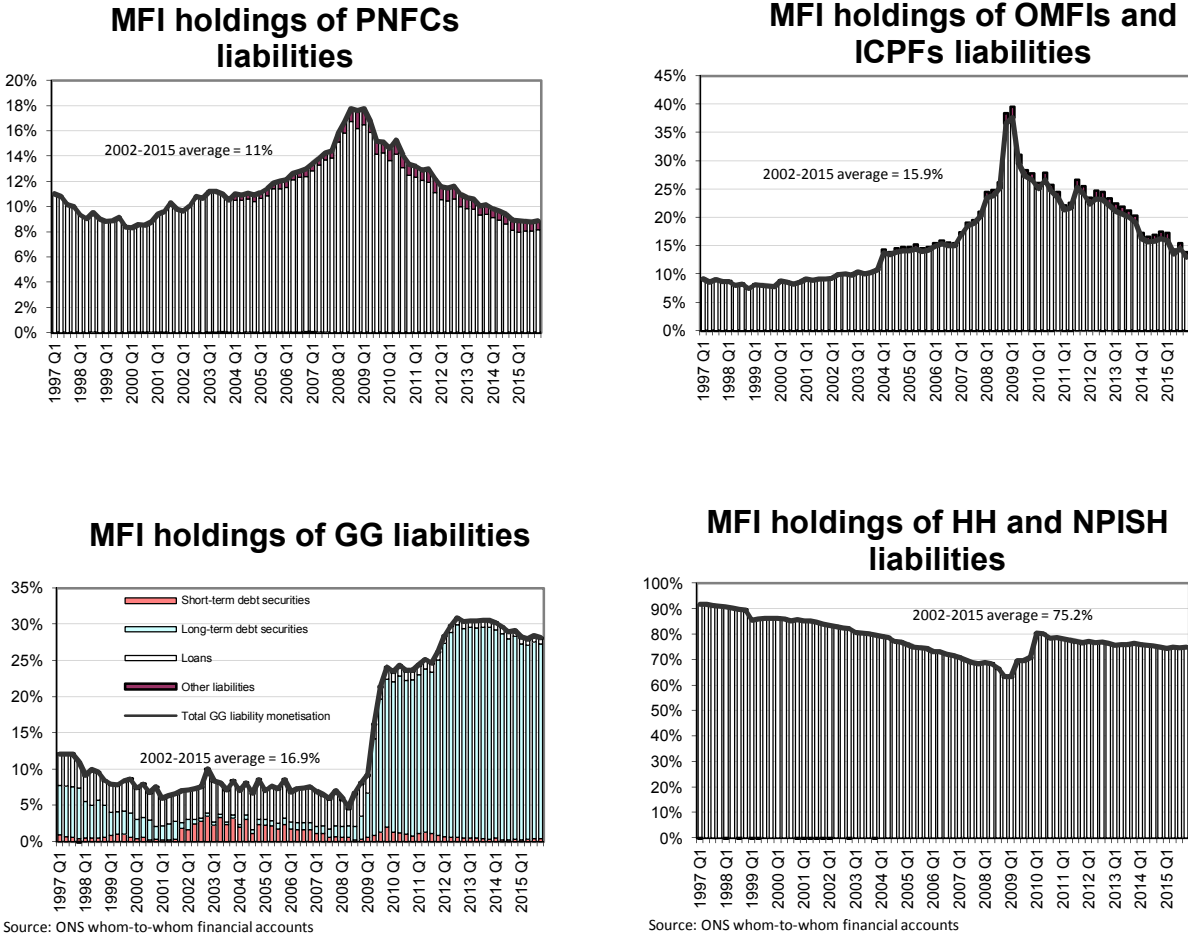

Fig. 4. Liabilities of the non-banking sector vis-à-vis monetary financial institutions (MFIs). Source: Enhanced Financial Accounts (Flow of Funds), UK Office for National Statistics, original publication date 8 August 2016. Note: GG = general government; HH = households; NPISH = non-profit institutions serving households; PNFC = private non-financial corporations; OMFI = other monetary financial institutions; ICPF = investment corporations and pension funds

However, the opposite is true for the general government, as shown in the upper-left panel of **Fig. 4**. Prior to the crisis, loans and debt securities shared a similar piece of total bank lending. This is not true for the period after the crisis, however. Here, bank loans are a marginal part of government debt, and debt securities are the main liability vis-à-vis banks.

Fig. 5 expands on this. The graphs show liability-side of the British government balance sheet (left panel) and the sectoral distribution of holdings of government securities (right panel). Three conclusions flow from these two figures. First, around 70% of the government's liabilities are incurred by the issuance of debt securities, mostly long-term, that is, with a maturity of one year or more[58], while loans constitute a very small fraction. Second, while there has been a marked increase in the MFI sector's holdings of British gilts post-2007, most of the holdings are accounted for by the Bank of England's balance sheet, with a smaller fraction being held by non-NCB banks. Third, a significant fraction of the British government's debt is held by non-residents, mainly overseas investors and foreign central banks. Foreign sector lending to the government has several subtle implications that will be explored later.
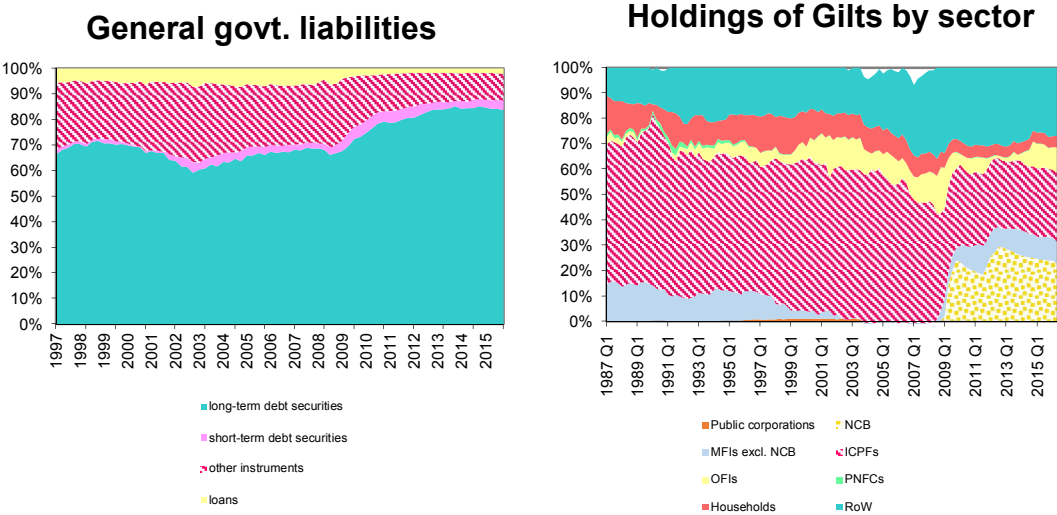

Fig. 5. On the left, the instrument composition of the government liabilities. On the right, the sectoral distribution of gilt holdings. Source: UK Office for National Statistics

We might conclude that Werner's proxy is excluding an important component of bank credit for GDP transactions when using only loan data and omitting government securities held by banks. The story is mixed in this case, because on the one hand, in normal times government deficits account for around 2-4%[59], and the fraction of that deficit financed by bank lending is much smaller, say 2% (see right panel in **Fig. 5**). These figures are small compared to the size of bank lending to the rest of the sectors.

The *third criticism* is a bit more subtle. Indeed, this is the hardest of the phases of proxy construction. While it is easier to discriminate empirically how much bank lending flows to the different sectors (the 'bank credit …' part), it is much more challenging to discriminate what these sectors *do* with the funds borrowed (the '… for GDP transactions' part). Clearly all sectors contribute to some extent to GDP, and all sectors have at least some fraction of their financial liabilities incurred vis-à-vis banks. Thus, it follows, all sectors must be included in the computation of the proxy. The procedure would be to

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[58] 'A debt security with a long-term maturity is defined as one that is payable in more than one year or that has no stated maturity' (IMF, 2015, p. 10, §2.13)

[59] This is an oversimplification. The UK registered mild budget surpluses in 1999-2001, budget deficits around -3% in 2002-2007, and deficits higher than 4% since 2008, with a peak of -10.2% in 2009 (Eurostat statistics)

disentangle the fraction of bank credit that each sector devotes to finance GDP and non-GDP transactions.

This task is far from trivial. The level of detail and depth in the empirical data this demands is prohibitive. I am personally not sure if such data exist[60]. I have found survey data collected by the Bank of England on *corporate funding*. This is shown in the right panel of **Fig. 6**. It has many weaknesses. For one, it covers a very short period of time. Second, the data are based on subjective judgments made by employers and business owners, not on objective data. Nonetheless, if we are to trust these data, one thing that emerges from them is that the uses given to the borrowed funds by businesses vary considerably, making the GDP and non-GDP components very variable. In this figure, the GDP expenditures by business financed by bank borrowing are capital investment and inventories, while non-GDP components are balance sheet reestructuring, mergers and acquisitions, and commercial real estate rental or purchase.

The left panel in **Fig. 6** shows the different instruments they use when borrowing. This also varies considerably from sector to sector. For example, the real estate sector relies heavily on bank finance, the manufacturing sector relies equally on loans and equity markets, while the utilities sector finances itself almost entirely through bond markets.
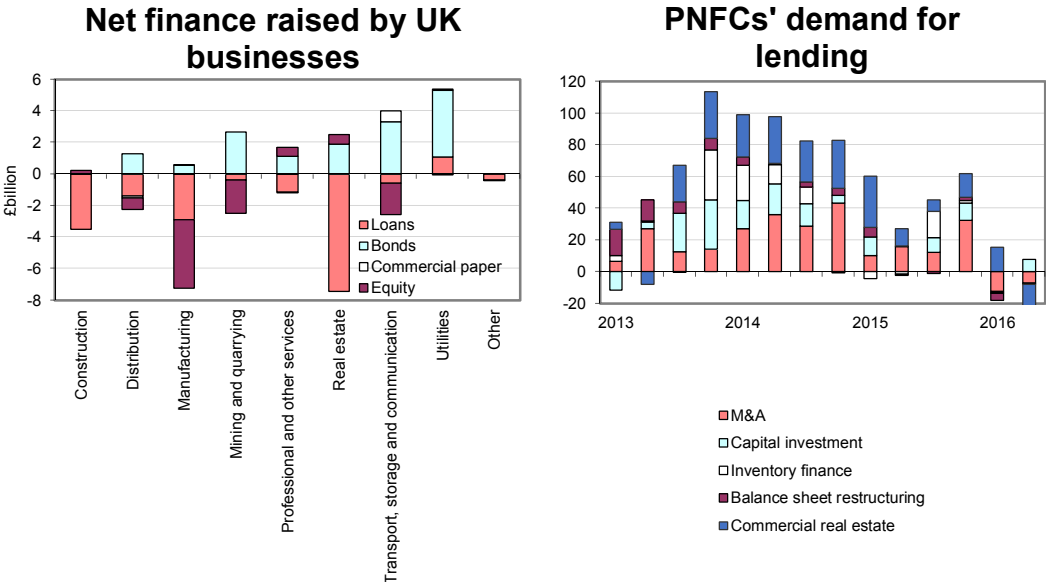

Fig. 6. Use. Left panel: Financing instruments used by different industries. Values represent the mean for 2011-2013. Source: Source: Bank of England, *Trends in Lending 2015Q1*. Right panel source: Bank of England, *Credit Conditions Survey 2016Q2*.

Households, on the other hand, are also quite challenging in terms of disentangling the different uses given to the the borrowed funds and their effects on nominal GDP. The Bank of England distinguishes between secured lending[61] (mortgage loans), and unsecured lending[62] (consumer credit and student loans) (cf. Bank of England *Bankstats*). There are other types of lending, though, such as personal loans,

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[60] The task of looking for and using such data is beyond the scope of this paper

[61] Secured debt is a loan secured on an asset which serves as collateral. This means that if the person borrowing the money can't repay it, the creditor will then be able to take possession of the asset. The most obvious example of secured lending is mortgages. In the UK, mortgages account for the vast majority of overall household debt (Harari, 2016)

[62] Unsecured debt is lending provided to individuals that is not secured on an asset. Credit card lending is the most prominent example. Personal loans, student loans and loans from payday lenders also come under this category (Harari, 2016)

car loans, and overdrafts on bank accounts (Harari, 2016). While the effect of non-mortgage credit on GDP is direct, the link between mortgage loans and economic activity is much more subtle.

Perhaps the best example is when mortgage credit is diverted to consumption instead of being used to finance property purchases, what is known as *housing equity withdrawal* (HEW), a 'collateral effect' (Button and Pezzini, 2010; Reinold, 2011). Mortgage equity withdrawal is borrowing that is secured on the housing stock but not invested in it, so it represents additional funds available for reinvestment or to finance consumption spending (Davey, 2001). HEW increases when the household sector increases its mortgage debt by more than its net spending on housing assets. This means that housing-related transactions have generated a net positive cash flow for households which is available for other uses (RBA, 2003). The reverse situation is called *housing equity injection*. The Bank of England's measure of HEW is the following:

> HEW = net lending secured on dwellings (plus grants for housing)
> – households' gross investment in housing

During the 1970s, there was significant domestic deregulation in the UK. The *Competition, Credit and Control Act* of 1971 marked a shift away from quantitative controls on credit towards price via interest rate adjustments and, in 1979, the lifting of exchange controls opened the banking sector to greater foreign competition and giving domestic institutions access to the developing Eurodollar markets (Ryan-Collins, 2016). Banks were permitted to enter the mortgage market from 1980 and mortgage lending significantly liberalised, enabling consumption smoothing via home equity withdrawal (Aron et al., 2012). **Fig. 7** shows data on HEW.

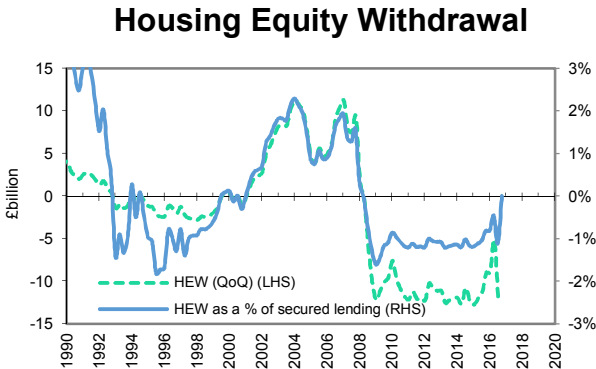## Housing Equity Withdrawal

Fig. 7. Housing equity withdrawal by UK households. Source: Bank of England *Bankstats*

HEW is closely related empirically to consumption (Davey, 2001). In the UK case, empirical studies suggest household lending is an important contributor to GDP growth via consumption since credit liberalisation in the early 1980s (Muellbauer, 2009; Aron et al., 2012). There is evidence that the liberalisation of credit markets in the UK and the US enabled households to smooth their consumption via home equity withdrawal (Grydaki and Bezemer, 2013, Aron et al., 2012). There is also evidence that house prices play a significant role in the monetary policy transmission mechanism in the UK via consumption-collateral effects (Muellbauer and Murphy, 2008; Aron et al., 2012). By definition, consumption is funded by income, unsecured borrowing, HEW or disposal of assets. One way to disentangle the part of mortgage credit that is directly used for consumption and residential investment rather than for house purchases is to only include lending for mortgage equity withdrawal and exclude mortgage lending (Ryan-Collins, 2016).

There is a second channel from secured lending to GDP, namely *wealth effects*[63] on household consumption (Goodhart and Hofmann, 2008, Aron et al., 2012). Empirically, there is a strong link between consumer spending and house prices (Benito et al., 2006). Some of this consumption is financed by HEW, *but some is not*. Part of the increase in consumption is financed out of households' existing money balances. In the UK, a strong relationship has been found between house prices, housing collateral and consumption, via *both* wealth effects and equity withdrawal (Aron et al., 2012).

The relationship between house prices, mortgage lending and consumption is even more convoluted due to the circular causality between mortgage lending and house prices. In fact, there are good reasons to believe that there exists a multidirectional link between money, credit, house prices and the wider economy (Goodhart and Hofmann, 2008). We know that residential real estate, being in inelastic supply, tends to price inflation when big flows of bank credit enter the sector, as shown by Werner (1997) for the Japanese case, and as elaborated by Turner (2014). This in turn, makes households feel wealthier and spend more on consumption[64].

A key issue is whether the 'non-HEW' component of household consumption should enter into the computation of the proxy[65], even if this expenditure is not financed out of bank credit strictly speaking. Here we are confronted by two related issues: the problem of *fungibility,* and the *fallacy of composition* or the invalid extrapolation of micro arguments to the macro level. This is explained as follows. If at the micro level, a single household borrows from a bank to pay for the mortgage, the price of the dwelling will not increase, and absent HEW-type expenditures, we would be right not to count mortgage credit as contributing to GDP. However, at the aggregate (macro) level, when more mortgage credit is extended to the household sector, this makes residential real estate prices go up. Due to a 'wealth effect', households decide to consume more out of their existing deposits, which contributes to GDP (see the generic consumption function in Eq. (7) below). In this second case, we would be wrong not to include mortgage credit as a component of the proxy. Even if, strictly speaking, no 'mortgage credit money' is being redirected to consumption purposes (that is, no HEW effect), the *net effect* is equivalent. This is because money is fungible, and it does not matter much from which bank account (existing deposits or deposits created by the extension of loans in the name of the same customer) are used to finance consumption expenditures. There is a further complication, in that, as described cogently by Turner (2013, 2014), there is a positive feedback between secured lending and house prices. Higher house prices produced by increased mortgage lending makes borrowers' net worth increase, increasing the value of the collateral against which further lending can occur, leading to self-reinforcing cycles of the type described by Minsky[66].

$$C = \alpha_1 YD + \alpha_2 H \qquad \text{Generic consumption function (Godley and Lavoie, 2007, p. 66)}$$

YD = disposable income of households

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[63] Though, strictly speaking, increased consumption through the HEW channel is also a wealth effect, I use the term to denote a more *indirect* effect, not registered by HEW

[64] In reality, the link between between household wealth and consumption is not simple. This is due to the fact that people not only own houses, they obtain a service from them — they live in them. By contrast, households only own shares; they do not 'consume' them. This characteristic means that house price movements affect people in two key ways. First, they affect the value of the houses that people own. Second, they affect the cost of living in them. When house prices rise, typically rents do too — so renters face higher housing costs. And even though homeowners' mortgage payments do not necessarily change, they have to pay more for their housing as well. A homeowner who intends to move house will have to pay more to live in the new home. Those staying put will also pay more, albeit implicitly, by continuing to stay in their now more expensive house (Benito et al., 2006)

[65] Ryan-Collins, Werner and Castle (2016) mention this as a critical issue when trying to estimate the household component of the proxy: 'A next step for this research would be to attempt a further disaggregation of credit aggregate data, to wean out mortgage credit that simply contributes to asset price inflation as opposed to translating into consumption'. The authors choose to include mortgage lending in their proxy, arguing that wealth effects due to house price inflation induce households to consume more out of equity withdrawal. However, they choose not to substitute 'mortgage lending' by 'housing equity withdrawal' due to data availability.

[66] Though mortgage lending is not the only factor. As shown in Werner (1997), in the case of Japan, the main determinant of Japanese land prices in the 1980s was real estate-related bank lending.

H = household wealth (mostly dwellings)

$0 < \alpha_2 < \alpha_1 < 1$

As can be appreciated, the household sector poses a challenge when trying to estimate its contribution to the proxy. I have mentioned one possible way to disentangle the part of mortgage credit that is directly used for consumption and residential investment rather than for house purchases, that is, to only include lending for mortgage equity withdrawal and exclude mortgage lending altogether. Yet, **Fig. 7** shows that HEW is very small relative to mortgage credit (around 2%). If we exclude mortgage credit, we might be missing important 'indirect-non-HEW-wealth-effect-induced' consumption increases.

Based on these findings, I conclude that it is not entirely clear whether a good proxy should include only housing equity withdrawal data, or whether it should also include secured lending data. I am personally ambivalent about this. In the absence of a definitive answer, I try both combinations (see **Sect. 3.3**), but give preferential status to the proxy that includes mortgage lending. In this sense, I follow 'established practices' and emulate Werner et al.

We have seen how difficult it is to estimate the '… for GDP transactions' part of the proxy both for the business sector and the household sector. This is due to the variety of expenditure types businesses and households can engage in, the limitations in the empirical data, and the possible indirect effects of bank credit on the components of GDP and difficulties of measuring them.

A possible way out of this is to make a rough approximation by looking at data on the *gross value-added* (GVA) by sector. This gives the contribution each sector makes to GDP from a production point of view[67]. **Table 4** shows two things: the share of bank credit of the different sectors, and their share in total GVA. Looking at this table, we see that while households and non-profit institutions account for the the majority of holdings of liabilities vis-à-vis banks, their contribution to GVA is second to the contribution of non-financial corporations. We also see that while financial corporations account for a similar share of bank credit as the non-household sector, their contribution to GVA is minuscule. One possible way to account for this would be to give a *relative weight* to each of the components of the proxy[68].

ESA2010	Sectors	Bank credit	Primary instrument	GVA
S.11	NFCs	0.114	Loans	0.577
S.12	FCs	0.159	Loans	0.05
S.13	GG	0.169	Debt securities	0.146
S.14 + S.15	HH + NPISH	0.752	Loans	0.228
Σ		1		1

Table 4. GVA is the 2000-2010 average. Note: NFCs = non-financial corporations; FCs = Financial corporations; GG = General government; HH = households; NPISHs = Non-profit institutions serving households. Source: UK Office for National Statistics and Eurostat.

The following table gives a more granular decomposition of the institutional sectors above by type of business. It is interesting to see the sectors excluded by Werner (1997). Real estate contributes 7.15%

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[67] Strictly speaking, taxes and subdsidies should be accounted for in order to stablish a relationshipt between GVA and GDP, since GDP(E) = GVA + taxes – subsidies (UN, 2003, p. 5)

[68] I choose not to pursue this path in this paper, since my aim is not so much to get to the 'perfect proxy' but more broadly to explore the problems one is confronted with when doing so, and more importantly the policy applications of the theory.

of the total GVA, the construction sector 6.84%, the government sector[69] 19%, and the financial and insurance sector contributes 6.12%. These are not small numbers, and by excluding those four sectors Werner ignores[70] 40% of the national gross value added. Some of that GVA is likely to be financed by bank credit.

PRODUCTS	Gross Value Added (%) (2000-2010 average)
Agriculture [1-3]	0.99
Production [5-39]	38.38
Construction [41-43]	6.84
Distribution, transport, hotels and restaurants [45-56]	9.49
Information and communication [58-63]	4.80
Financial and insurance [64-66]	6.12
Real estate [68.1-2-68.3]	7.15
Professional and support activities [69.1-82]	3.85
Government, health and education [84-88]	19.03
Other services [90-97]	3.36
Sum	100

Table 5. Use and use table for the UK, 2010. Source: UK Office for National Statistcs, Supply and Use Tables

Still, in some cases excluding sectors probably implies a lower penalty than not excluding them. For example, the real estate sector relies heavily on bank lending, and even if some of this will finance expenditures that are part of GDP (e.g., new physical investment), some will be simply used to purchase existing buildings, and there is evidence that such lending can be highly speculative (Crowe et al., 2013). Thus, not excluding the real estate sector would bias the proxy.

What would an 'ideal proxy'[71] of C_R^b look like? Based on what I have presented thusfar, the following characteristics appear desirable:

1. An ideal proxy would make use of highly disaggregated data on the *sources* of funding, both external and internal, that institutional units resort to to finance their expenditures; this data would ideally include cross-sectoral financial positions for a broad range of instruments, for a long period of time, in particular distinguishing between MFI and non-MFI sectors;
2. An ideal proxy would make use of highly disaggregated data on the *uses* given by businesses to those funds (internal and external), for a broad range of expenditure types, for a long period of time, particularly discriminating those expenditures that contribute to GDP and those that do not;
3. An ideal proxy would be incorporating possible *indirect effects* of bank lending on the spending behavior of each sector (e.g., households increasing consumption out of existing money balances due higher house prices induced by higher mortgage lending)
4. Overall, an ideal proxy would include the sum of all expenditures that contribute to GDP, made by all sectors and subsectors, that have been financed by liabilities that represent assets for the banks;

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[69] The non-profit sector is most likely included in the 'government, health and education' or 'other services' categories in Table 5
[70] Although this would be for the UK case
[71] In the *ex ante,* 'theoretical' sense, not in the *ex post,* 'empirical' sence

How does Werner's (1997) proxy measure against these criteria? Regarding the first characteristic, Werner copes with this by focusing only on one type of bank credit instrument, namely loans, and ignoring debt securities that represent assets for the banks. We have seen that this is an acceptable approximation for most of the sectors of the economy, but not for the general government, which finances its deficits mostly through issuance of debt securities, some of which are purchased by banks (cf. **Fig. 5**). Even if government borrowing from banks that finances GDP expenditures is considerable smaller than other components of C_R^b (such as bank lending to the PNFCs) during normal times, during recessions, the counter-cyclical nature of government spending makes this component more important. As I will show in the next section, this is part of the reason why Werner's proxy for the UK (in Ryan-Collins, Werner and Castle, 2016) falls during the recession but does not bounce back afterwards, despite nominal GDP bouncing back after a few quarters. In this regard, the proxy constructed by Lyonnet and Werner (2012) does bounce back. This is due to the fact that in this case they include 'bank lending to non-profit institutions serving households', which is also of a counter-cyclical nature, and balances with the other components of the proxy, so that the proxy does bounce back with nominal GDP after the recession. This will be explored in the next section.

Regarding the second characteristic, Werner copes with data limitations using a 'binary choice' type of method, i.e., by completely excluding sectors that are suspected of not contributing much to GDP, and including those sectors that contribute more. Werner's excluded sectors are real estate, construction, non-bank financial institutions, non-profit institutions, and the public sector. According to **Table 5**, the combined gross value-added of these sectors accounts for around 40% of total GVA. Given that it is likely that part of that is financed through bank lending, we conclude that Werner's proxy is omitting an important component of bank credit for GDP transactions.

Regarding the third characteristic, Werner (1997) is not explicit about the treatment of mortgage lending, so I assume he is excluding it from the proxy. This is supported by comments elsewhere in the paper, where he argues that while in the UK mortgage lending in the UK did spill over to consumption, this was not the case in Japan during the 1980s.

3.1 Other proxies constructed by other authors

Similar proxies have been constructed for countries such as UK, Czech Republic and Spain by Werner and several other authors. In the following I explore these proxies, paying particular attention to their deviations from Werner's (1997) original version.

Japan

Apart from the proxy constructed by Werner (1997), Voutsinas and Werner (2011b) construct their own for Japan, which they define as 'bank credit to all sectors except real estate, financial institutions and construction'. The authors do not provide information regarding the details of the data, but it is very likely that the follow closely the method used in Werner (1997)[72].

Czech Republic

Bezemer and Werner (2009) study the link between credit and output by using separate measures of credit to the real sector and credit to the financial sector. In order to construct the proxy, the authors use bank loan data from the Czech National Bank (CNB) denominated in Czech Crowns (CZK) to resident

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[72] Another proxy for Japan is constructed in Werner (2005), but since I have no access to this source I cannot provide the details.

and non-resident households and firms and to the government, from 1992Q1 to 2007Q3. The CNB reports real sector loans to households and to firms in 26 sector categories comprising manufacturing, agriculture, natural resources and services. Household loans are disaggregated into lending for real estate investment—most of which were mortgages—and consumption lending.

The authors define bank credit to the financial sector (C_F^b) as … 'bank lending to non-bank financial institutions (such as pension funds and insurance companies) and real estate', and bank credit to the real sector (C_R^b) as '… credit flows to manufacturing, agriculture, natural resources … other services … [and] government'(ibid.). Importantly, the proxy for real economy transactions excludes *mortgage lending*. The authors note that this is an imperfect approximation to the real C_R^b:

> 'Obviously, this is an imperfect disaggregation as, for instance, real-sector firms use some of their funds in asset transactions (for instance, in servicing loans taken out for purchase of real estate and also the government also invests in land and buildings). Further, households may take out loans mortgaged with their real estate for consumption purposes.' (ibid.)

'But in broad brush', they continue, 'the bulk of credit to asset investment is captured by household mortgage lending and nonbank financial services' (ibid.). As can be observed, this proxy is very similar to the one constructed by Werner (1997), except for one difference: the proxy in Bezemer and Werner (2009) includes *lending to the public sector*. The reason they do so is that '… both public and private institutions … may contribute to GDP growth' (ibid.). Nothing is said about the *non-profit sector* nor the *external sector*.

Spain

Werner (2014) constructs a proxy for C_F^b and C_R^b for the Spanish economy using data from *Banco de España* (Bank of Spain) covering 1995-2013. The components of the C_R^b proxy follow those in Werner's (1997) version closely: 'credit for the 'real' economy was defined as total bank credit, but excluding bank credit extended to other financial intermediaries, to the real estate sector and to the construction industry' (Werner, 2014). I have checked the Bank of Spain's data and Werner seems to imply that 'credit for acquisition and rehabilitation of dwellings' (i.e., real estate lending) is excluded from the proxy, while 'credit for acquisition of one own's dwelling' (i.e., mortgage lending) is included. Furthermore, his proxy does not include bank *lending to the public sector* nor the *external sector*, but it does include *lending to non-profit institutions.*

United Kingdom

Ryan-Collins, Werner and Castle (2016) and Lyonnet and Werner (2012) both construct proxies for the UK. Both sets of authors use Bank of England data. In the first of the two papers, the proxy of C_R^b includes 'lending to private non-financial corporations … total lending to households … excluding other financial corporations … [because] such loans will not contribute to GDP-transactions' (Ryan-Collins, Werner and Castle, 2016, Table 1). This proxy is shown in **Fig. 8** in year-over-year growth rates, together with nominal GDP growth in the UK.

In Lyonnet and Werner (2012), the authors construct a similar yet different proxy, which includes 'lending to private non-financial corporations … lending to the household sector (secured lending to individuals and unsecured lending to individuals) … and lending to unincorporated businesses and non-profit making institutions'. So their definition of the proxy does include the real estate sector and the construction industry.

Thus, both proxies are very similar, in that they include lending to households—both secured (mortgage) and unsecured (consumer credit, student loans) —and the private non-financial sector, excluding other financial intermediaries. Neither Ryan-Collins, Werner and Castle (2016) nor Lyonnet and Werner (2012) include *lending to the public sector*. Importantly, whereas the first authors do not include *lending to non-profit institutions serving households*, the second authors do include it. Whereas neither set of authors includes the *external sector*.
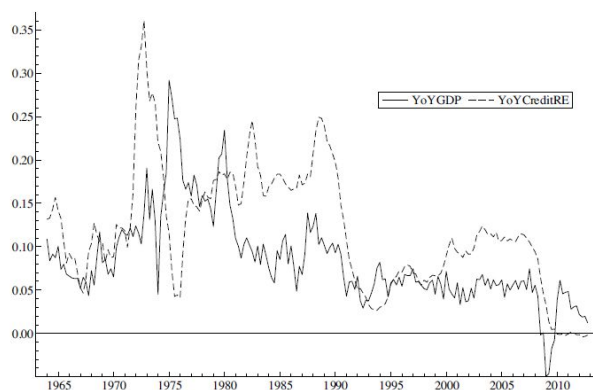

Fig. 8. Nominal GDP growth and the growth rate of the proxy of bank credit for GDP transactions. Source: Ryan-Collins, Werner and Castle (2016)

Table 6 gives a summary of the key sectors when it comes to deciding what to include and not to include in the computation of the proxy, and the choices made by the authors reviewed.

Sector included in C_R^b? (yes/no)	Ryan-Collins, Werner and Castle (2016)	Lyonnet and Werner (2012)	Bezemer and Werner (2009)	Werner (2014)	Voutsinas and Werner (2011b)	Werner (1997)
Country	UK	UK	Czech Repub.	Spain	Japan	Japan
Real estate	Yes	Yes	No	No	No	No
Construction	Yes	Yes	Yes	No	No	No
Non-profit sector (NPISH)	No	Yes	?	Yes	?	?
Public sector	No	No	Yes	No	No	No
Mortgage lending	Yes	Yes	No	Yes	No (?)	No (?)
Non-secured lending to individuals	Yes	Yes	Yes	Yes	No (?)	No (?)
Other financial intermediaries (OFIs)	No	No	No	No	No	No
External sector	No	No	No	No	No	No

Table 6. Sectors included and excluded in the calculation of the proxy, by different authors.

3.2   An improved empirical proxy of C_R^b that includes lending to the general government and net exports

3.2.1   The public sector

We have seen that one of the shortcomings of Werner's (1997, 2012, 2016[73]) empirical proxy of C_R^b is its omission of the public sector. This is because public sector borrowing in the form of bank loans is a minuscule component, and Werner is right to ignore it. Yet, governments finance their deficits not by loans but more significantly by the issuance of debt securities, some of which end up in banks' balance sheets (**Fig. 5**). Furthermore, government spending contributes substantially to GDP (around 30%). Part of this expenditure is financed by bank borrowing, known as the 'government deficit', which is usually around 5% of GDP. This is a small number during normal times, but during recessions the counter-cyclical behavior of public spending makes it a big component of C_R^b.

In this regard, the public sector is easier to analyse because the public finances are more transparent and obvious. Exluding interest payments on outstanding debt and the rolling over of mature debt, the primary deficit of the government sector is given by $D = G - T$, where G are government outlays and T are tax receipts. It must be noted, though, that not all government borrowing will be devoted to expenditures that contribute to GDP. Some will be devoted to finance non-GDP transactions such as the payment of the principal on public debt that reaches maturity[74] (gilt redemptions) and the payment of interest on outstanding debt.

The following identities are taken from reports by various British public agencies responsible for various aspects of the government budget[75]. The borrowing component that ends up financing GDP transactions corresponds to the 'public sector net borrowing', which is composed of the 'current budget deficit' and 'public investment'. **Fig. 9** shows some of these variables.

Public Sector Net Cash Requirement (PSNCR) = net borrowing + net lending to the private sector and rest of world + net acquisition of company securities + adjustment for interest on gilts + accounts receivable/payable + other financial transactions

Public sector net borrowing = current budget deficit + investment
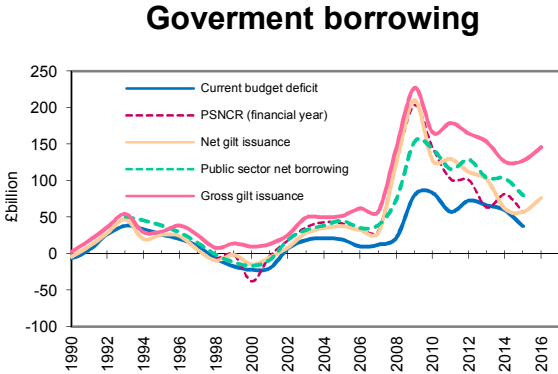
Net issuance of gilts = gross issuance – redemptions[76]

Goverment borrowing

Fig. 9. Components of government borrowing. Source: UK Office for National Statistics, UK Debt Management Office

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[73] But not Bezemer and Werner's (2009) proxy

[74] 'The redemption (or maturity) date is the point in time at which the final contractually scheduled repayment of the principal is due' (IMF, 2015, p. 10, §2.12)

[75] Office for National Statistics (ONS, 2016), Office for Budget Responsibility (OBR, 2015), HM Treasury (2013, 2015), Debt Management Office (DMO, 2016)

[76] Redemptions refer to public debt that comes due, which requires the payment of the principal back to the creditor. Usually, new debt is issued to pay for debt falling due. This is called 'rolling-over' of debt.

Thus, when adding the public sector component to the proxy, the correct thing is to use the 'public sector net borrowing' as the proper measure of government borrowed funds that are used for GDP transactions. The two series are quite similar, though, so I will simply assume all bank lending to the general government is allocated to finance its net borrowing requirement.

Nominal value and market value of debt securities

An important issue when measuring government borrowing is whether to measure it in nominal terms or in market value terms. In the case of loans, this does not represent a problem, since they are by convention measured in nominal terms. In the case of holdings of debt securities[77], however, national accounting recommends[78] measuring their value as the value expressed in the market, which often differs from the 'face' value at which they are initially issued[79]. Market value includes posterior revaluations[80]. The following identity holds (Eurostat, 2013, p. 175, §7.39):

Market value = nominal value + revaluations arising from market price changes

Given that we are interested in measuring the value of the funds lent to the public sector *at the moment when they are used*, the proper way to measure government borrowing is to measure the nominal value. I use BIS data to calculate the nominal-to-market value ratio, so that I can apply this ratio to the government liabilities (comprised mostly of debt securities), to get their nominal value. This way, I am calculating the value of the funds lent to government *the moment they were lent*, which corresponds to the moment when those funds are used to finance government expenditures (or shortly after). This is necessary since I am calculating lending (flow) as the change in outstanding debt (stock), which is subject to revaluations. **Fig. 10** shows this difference between market value and nominal value can be quite big.
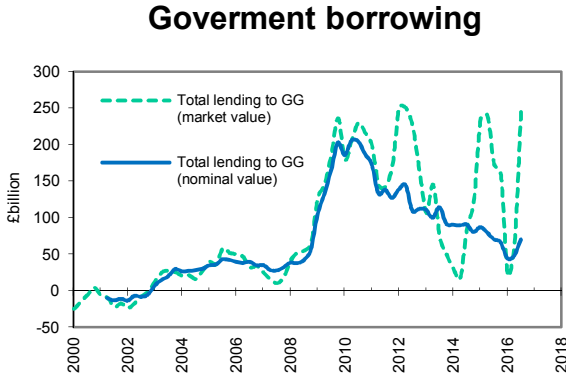
Goverment borrowing

Fig. 10. Market and nominal values of government borrowing. Source: Bank of International Settlements, UK Debt Management Office, UK Office for National Statistics

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[77] 'Whereas debt securities issues should be recorded at both market and nominal value, debt securities holdings should be recorded at market value.' (IMF, 2015, p. 37, §5.42)

[78] 'The values recorded should reflect prices observable on the market on the date to which the balance sheet relates. When there are no observable market prices, which may be the case if there is a market but no assets have recently been sold on it, estimates should be made of what the price would be if the assets were acquired on the market on the date to which the balance sheet relates' (Eurostat, 2013, p. 174, §7.34)

[79] 'Issuance relates to the situation where an issuer sells newly created debt or equity securities to holders. A security is considered to have been issued when the issuer transfers it to a holder, usually in exchange for currency or transferable deposits.' (IMF, 2015, p. 34, §5.22)

[80] 'Revaluations and holding gains or losses reflect changes in the price of securities.' (IMF, 2015, p. 35, §5.29)

MFI lending excluding the central bank

Another important issue when measuring government borrowing—or indeed any other sector—is the treatment given to the central bank. Until now, I have said nothing about this matter. Most of the statistical sources include the central bank as part of the MFI sector. Indeed, central banks, commercial banks and other MFIs have in common their power to create money, but the type of money they create varies. Whereas commercial banks create deposits when lending to non-banks or buying assets from them, central banks create both new reserves[81] and a corresponding new customer deposit when doing the same (Benford et al., 2009). This is precisely what happens when central banks engage in asset purchases or 'quantitative easing'[82]. A crucial issue is whether central bank 'lending' to non-banks should be part of the proxy.

At first, it seems that it *should* be included. After all, central banks create money in ways very similar to other banking institutions. However, on closer inspection, the picture is more complex. Let me analyse the problem piece by piece.

In the case of the general government, when the Bank of England buys gilts from the non-bank private sector in the secondary market, it buys them predominantly from insurance companies and pension funds (see the sectoral distribution of gilt holdings in **Fig. 5**). When doing so, the central bank is creating both new reserves and new deposits. The reserves represent an asset to the non-central bank banking sector, while deposits represent a liability for them and an asset for pension funds. While it is true that by such act new deposits are being created, it is very unlikely that a non-insignificant fraction of those deposits will be used to finance GDP expenditures, given the low gross value added of pension funds and insurance companies. Indeed, quantitative easing is said to work through a 'portfolio rebalancing' channel, which is known to be indirect and imperfect. *Only if* the central bank was purchasing government securities *directly* in the primary market, then the new deposits created, which represent an asset to the government, would indeed be used to finance GDP expenditures such as health care and education. We would then be right to include this component in the proxy. But this practice of 'monetary finance' is prohibited by law. So we can rule this option out.

What about an indirect path from central bank to general governemnt. Suppose a private pension fund buys gilts in the primary market directly from the debt management office[83], and *immediately after* the central bank buys them from the pension fund in the secondary market a part of QE operations. Would not that be equivalent to the case in which the central bank is buying them directly from the government—in terms of money creation and the uses given to that money? In the first transaction, a transfer of already existing deposits from the pension fund to the general government occurs; in the second transaction, a transfer of newly created deposits from the central bank to the pension fund occurs. The end result is a net transfer of newly created deposits from the central bank to the general government.

The problem is, there is *now way to determine the time lapse* between the first and the second transaction. If both occur simultaneously, the net effect is the one just described. But if say five years[84] elapse between the first and the second transaction, counting central bank holdings of gilts as part of the

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[81] Central bank reserves is money held by banks at the central bank, primarily used by banks to make payments to each other in the inter-bank market

[82] When the central bank purchases an asset from a bank, for example, it simply credits that bank's reserve account with the additional funds. This generates an expansion in the supply of central bank money. Commercial banks hold deposits for their customers, which can be used by households and companies to buy goods and services or assets. These deposits form the bulk of what is known as 'broad money'. If the central bank purchases an asset from a non-bank company, it pays for the asset via the seller's bank. It credits the reserve account of the seller's bank with the funds, and the bank credits the account of the seller with a deposit. This means that while asset purchases from banks increase the monetary base (or 'narrow money'), purchases from non-banks increase the monetary base and broad money at the same time (cf. Benford et al., 2009)

[83] Or, alternatively, through primary dealers

[84] And gilts have usually maturities longer than 5 years.

proxy would be temporally wrong by five years! In other words, in such case, counting central bank holdings of gilts would give the misimpression that newly created money is being used to finance GDP transactions 5 years earlier than what it actually happened.

A possible solution would be not to measure debt securities holdings by the central bank but government holdings of *deposits*. But this again is subject to the criticism made by Werner (1997) that deposits represent 'potential' purchasing power and not 'effective' purchasing power (see **Sect. 2.2**)

Since I cannot think of a way around this problem, I decide to *exclude* the central bank's holdings of government securities when calculating 'bank lending to general government'. **Fig. 11** shows that there is a considerable quantitative difference between these two measures.
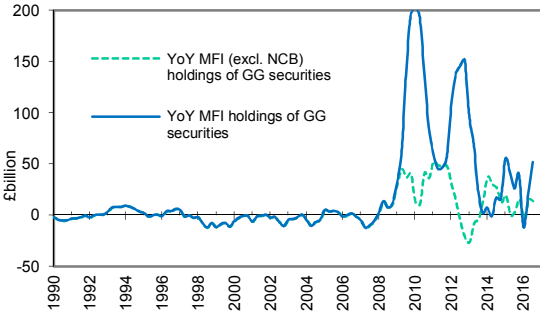

Fig. 11. Bank lending to the general government including and excluding the central bank. Source: UK Debt Management Office

What about the non-bank *private* sectors? Does not the central bank regularly purchase assets from them when engaging in open market operations? And does not the central bank create deposits when doing so, which in turn might used by these sectors to finance GDP expenditures? If this is the case, then this component should be incorporated into the proxy.

In **Fig. 4** I have shown the MFI sector's—which includes the central bank—holdings of non-MFI liabilities. That figure shows that most the liabilities of the non-bank sectors (e.g., general government, private non-financial corporations, etc.) vis-à-vis MFIs takes the form of loans, except for the general government, in which case it takes the form primarily of government securities. Are not some of these loans extended by the central bank itself? The answer is: *marginally*. So we can ignore them. **Table 7** gives some figures supporting this claim. It is evident that in the case of the private sector, the Bank of England holds an undetectable fraction of its liabilities relative to the non-NCB MFI sector.

£ billions	MFI holdings		BoE holdings	
	2015	2016	2015	2016
Private sector loans	1947.7	2015.8	0.004	0.003
Public sector loans	16.6	18.9	0.56	0.56
Private sector debt securities	207.3	195.6	-	0.66
Public sector debt securities	545.3	581.3	410.5	435.9

Table 7. The values represent mean values. In the case of 2016, it covers Q1-Q3. Source: Bank of England *Bankstats*

Fig. 12 gives a more historical view. We see that post-2008, the Bank of England's balance sheet expanded considerably, reaching heights never before seen in its history. Despite this, **Table 7** shows that the Bank does not hold but a marginal component of financial assets vis-à-vis the domestic private sector.
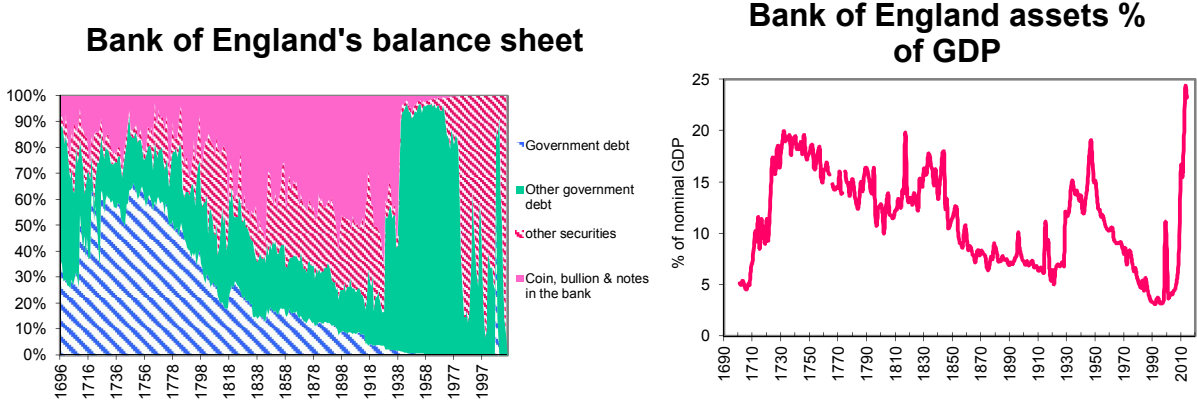

Fig. 12. Bank of England balance sheet. Source: Bank of England *Bankstats;* Hill, Thomas and Dimsdale (2015)

To summarise. When calculating the public sector component of the proxy, I will only consider MFI lending excluding the central bank. When calculating the private sector component, I will leave the central bank lending component since it contributes marginaly to MFI lending to the private sector.

3.2.2   The external sector[85]

As mentioned above, another crucial sector that is left out of Werner's (1997) proxy of C_R^b is the external sector. In a closed economy, we would be right to identify the components of the proxy as the credit flows originated in domestic banks alone. In an open economy, however, transactions involving domestic goods, services, and assets might occur through additional channels. Domestic sectors might finance their domestic expenditures by *borrowing* from abroad and by using *income received* from abroad. Cross-border flows of income may arise due the interest accrued on residents' investments abroad, the renting of natural resources or the provision of labour services to foreigners, among others[86]. In both cases, new purchasing power flows into the domestic economy, which in practical terms is equivalent to new purchasing power being created *ex nihilo* from a purely domestic point of view. Similarly, new means of payment enter the economy *when foreigners buy domestic goods, services or assets*. Thus, to be consistent with the definition of the proxy, these elements should be considered as potentially part of it. Since these movements of goods, services and assets are bidirectional, they can contribute as well as substract from the proxy, depending on the direction of the transaction, just as gross lending and repayments of loans add to and substract from the proxy.

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[85] I owe the insight behind this subsection to Shaikh (2016, p. 627, 697-8)

[86] *Primary income* represents the return that accrues to institutional units for their contribution to the production process or for the provision of financial assets and renting natural resources to other institutional units (IMF, 2009, p. 183, §11.3). Primary income should be distinguished from secondary income. Primary income captures returns for the provision of labor and financial assets and renting of natural resources (IMF, 2009, p. 183-4, §11.5). The *secondary income* account shows current transfers between residents and nonresidents (IMF, 2009, p. 207, §12.1). A transfer is an entry that corresponds to the provision of a good, service, financial asset, or other nonproduced asset by an institutional unit to another institutional unit when there is no corresponding return of an item of economic value (IMF, 2009, p. 207, §12.7).

Whether or not they should make into the proxy depends on what type of expenditures those flows of money are financing, or whether they are financing any type of expenditure at all. In the case of domestic sectors borrowing from abroad, we presume they do so to finance the purchase of domestic goods, services or assets, since the borrowed funds are denominated in domestic currency (sterling-denominated in the case of the UK). This is consistent with the treatment given by Werner (1997) to lending. On the other hand, income receivable[87] may or may not be used to finance expenditures; these funds may simply be saved. And even if they do finance domestic expenditures, we cannot know whether these are GDP-type or not. The treatment I give to income receivable is the same as the treatment given to deposits by Werner (1997); both represent potential purchasing power and not effective purchasing power. So I exclude income receivable from the proxy. As for net exports, they contribute to GDP by definition, so they ought to be included in it.[88]

In both cases (net exports and foreign lending to residents), these operations have flow-of-funds[89] counterparts, naturally. In the case of non-resident banks lending to residents, this will show up as four entries[90]: in the lender's balance sheeet, a financial asset (a loan) and a financial liability (a deposit); in the borrower's balance sheet, a financial liability (a loan) and a financial asset (a deposit). In the case of goods moving across borders, every good imported has a financial outflow counterpart (a deposit moving from the importer's bank account to the exporter's bank account), and every good exported has a financial inflow counterpart (the reverse case). While financial flows will only be registered in the *financial account*[91], across-border purchases and sales of goods will be registered both in the financial account and in the *current account*[92]. The two—together with the capital account—balance each other out, so that the flows of goods must be matched by the flow of funds (Elmendorf and Mankiew, 1998).

In order for domestic expenditures made by foreigners to occur, the non-resident sector must first acquire *domestic currency* in the foreign exchange market or dispose of currency already held. In the case of exporters, this operation is usually performed by banks through the interbank foreign exchange market, who buy and sell foreign currencies on behalf of their export/import-oriented customers who wish to consummate commercial transactions with foreigners (Seyoum, 2010, p. 225-6). Exporters often

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[87] *Income receivable* and *income payable* are registered in the current account of the Balance of Payments (BoP). The *current account* balance shows the difference between the sum of exports and income receivable and the sum of imports and income payable (exports and imports refer to both goods and services, while income refers to both primary and secondary income) (IMF, 2009, p. 9, §2.15).

[88] At this point I disaggree with Shaikh's (2016, pp. 704-5) decision to include the current account balance (CAB) in the proxy, instead of using net exports (NX). While it is true that net income from abroad injects purchasing power into the domestic economy, this is an 'income side' perspective, and nothing guarantees that these new income will be spent, nor whether it will be spent on GDP or non-GDP expenditures. One correct measure of new means of payment *actually* (or 'effectively', in the words of Werner, 1997) spent on domestically produced goods and services is NX, the other being foreing lending to residents *if* the lent funds are used for GDP expenditures.

[89] The flow of funds accounts measure financial flows across sectors of the economy, tracking funds as they move from those sectors that serve as sources of capital, through intermediaries (such as banks, mutual funds, and pension funds), to sectors that use the capital to acquire physical and financial assets (Teplin, 2001)

[90] The simultaneous application of both the vertical and horizontal double-entry book-keeping results in a *quadruple-entry bookkeeping*, which is the accounting system underlying the recording of transactions in the national accounts and international accounts (IMF, 2009, p. 34)

[91] Transactions between the resident sectors and the non-resident sectors are summarised in the *balance of payments* (BoP) statistics. It consists of the goods and services account, the primary income account, the secondary income account, the capital account, and the financial account (IMF, 2009, p. 9, §2.12). The *current account* shows flows of goods, services, primary income, and secondary income between residents and nonresidents (ibid., p. 9, §2.14). The *current account balance* shows the difference between the sum of exports and income receivable and the sum of imports and incom payable (exports and imports refer to both goods and services, while income refers to both primary and secondary income). The value of the current account balance equals the saving-investment gap for the economy (ibid., p. 9, §2.15). The sum of the balances on the current and capital accounts represents the net lending (surplus) or net borrowing (deficit) by the economy with the rest of the world. This is conceptually equal to the net balance of the financial account (ibid., p. 9, §2.18)

[92] The *current account balance* shows the difference between the sum of exports and income receivable and the sum of imports and income payable (exports and imports refer to both goods and services, while income refers to both primary and secondary income) (IMF, 2009, p. 9, §2.14).

use payment arrangements such as consignment sales[93], open accounts[94] (or trade credit), and documentary drafts[95], whereby the seller is paid by the foreign wholesaler or retailer, only after the goods have been received or sold (Seyoum, 2010, p. 239). It is estimated that approximately 35-50% of exports from the US and the UK are sold on open account and/or consignment (Cheeseright, 1994). In the case of domestic borrowing from foreign banks, this operation is performed by the banks themselves as well.

As can be seen, exports and imports, and foreign lending and foreign borrowing represent additions to and substractions from the flow of bank credit that finances domestic expenditures. In the case of positive net lending from abroad and a positive balance of trade, new domestically-denominated money is flowing to the economy and financing expenditures. Whereas in the case of a negative net lending from abroad and a negative trade balance, new domestically-denominated money (bank deposits) is flowing out of the economy. To the extent that these bank credit flows are contributing to or substracting from domestic expenditures, these two components should be included in the proxy.

Werner (2012) explicitly acknowledges the 'net exports' component, and mentions 'foreign lending' on passing[96], but decides not to include them. Regarding 'net exports', he states:

'… only the net creation of new transferable purchasing power is part of the definition [of bank credit]. Thus what is often termed 'credit', for instance, the issuance of corporate debt or government bonds, does not in itself constitute credit creation, as in these cases already existing purchasing power is transferred between parties. *Trade credit*, if not underwritten by financial institutions, is not transferrable …' (Werner, 2012)

But according to Seyoum (2010, p. 225-6), trade credit operations are most typically handled *by* banks and *between* banks, which makes Werner's argument a weak one. Accordingly, I decide to include the 'net exports' component into my proxy. As explained above, the net exports component of the current account captures foreign expenditures that contribute to domestic GDP.

UK Current Account

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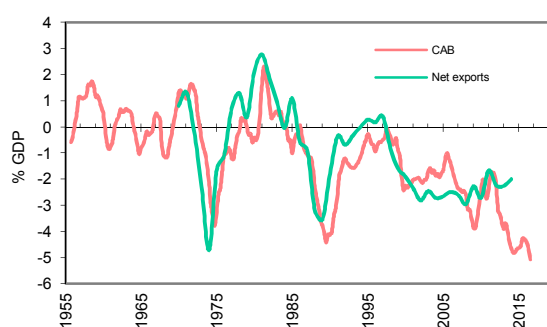
[93] A *consignment sale* is method in which the exporter sends the product to an importer on a deferred payment basis; that is, the importer does not pay for the merchandise until it is sold to a third party. Title to the merchandise passes to the importer only when payment is made to the exporter (Seyoum, 2010, p. 239).

[94] An *open account* is a contractual relationship between an exporter and importer in which a trade credit is extended by the former to the latter whereby payment is to be made to the exporter within an agreed period of time. The seller ships the merchandise to the buyer and separately mails the relevant shipping documents. Terms of payment range from 30 days to 120 days after date of shipping invoice or receipt of merchandise, depending on the country (Seyoum, 2010, p. 241).

[95] The documentary collection or *documentary draft* is one of the most customary methods of making payments in international trade. To facilitate the transaction, two banks are usually involved, one in the exporter's country and one in the buyer's country. The banks may be independent banks or branches of the same bank (Seyoum, 2010, p. 242).

[96] 'However, even this eminently sensible explanation raised more questions than it answered: the credit rationing argument itself does not explain why available alternatives to domestic bank credit (*foreign bank credit*, direct finance, equity issuance) failed to compensate for credit supply constraints' (Werner, 2012)

Fig. 13. Current account of the UK. CAB = current account balance = Net exports + net receivable income (primary and secondary income). Source: UK Office for National Statistics; OECD.stat

In the case of cross-border lending, here we must make the following qualification. In Europe, while it is true that cross-border financial flows have grown substantially since the 1990s, this is mostly inter-bank lending (Allen et al., 2011, p. 23). As shown in **Table 8**, the scale of cross-border inter-bank lending and borrowing within the euro area far exceeds the levels vis-à-vis non-banks, with ratios of the former to the latter ranging from 3:1 to 20:1.

In the case of the UK, most of the lending to domestic non-banks is done by resident banks, which include *UK-owned banks*, but also *foreign branches* and *foreign subsidiaries*. Foreign bank branches and subsidiaries have a significant presence in the United Kingdom's financial sector in particular, more so than in any other major advanced economy. A lot of their business activities are with non-residents but they are also important sources of credit for UK financial and non-financial companies. Currently, branches and subsidiaries of foreign banks account for around one third of UK-resident banking assets, holding 21.5% of the assets vis-à-vis UK households, 43.1% of the assets vis-à-vis PNFCs, 34.1% of the assets vis-à-vis OFCs, and 55.1% of the inter-bank assets (Hoggarth, Hooley and Korniyenko, 2013). However, I need not worry about foreign subsidiaries and branches, since their lending activities are registered in the *Bankstats* statistics as part of the MFI sector lending to UK residents[97].

So in the construction of the proxy, I will ignore foreign lending to domestic non-banks, and only consider lending that occurs through foreign branches and subsidiaries located in the UK.

Cross-border positions	Assets		Liabilities	
	2002	**2009**	**2002**	**2009**
Country	**Bank-to-bank:Bank-to-non-bank**			
Austria	12:1	20:1	7:1	9:1
Belgium	9:1	10:1	12:1	7:1
France	11:1	13:1	9:1	8:1
Germany	8:1	9:1	10:1	6:1
Ireland	5:1	4:1	5:1	4:1
Italy	5:1	9:1	10:1	17:1
Finland	12:1	9:1	3:1	7:1

Table 8. Cross-border lending in European countries. This table intends to represent the relative magnitudes of cross-border inter-bank lending and cross-border bank-to-non-bank lending. This is represented as *x:y,* with *x* = assets (liabilities) of the domestic banking system vis-à-vis foreign banks (i.e., cross-border inter-bank lending); *y* = assets (liabilities) of foreign banks vis-à-vis domestic non-banks (i.e., cross-border lending between domestic non-banks and foreign banks). High *x:y* ratios imply that cross-border positions are primarily due to bank-to-bank lending. The numbers are rounded. Source: Allen et al. (2011, p. 25-26, Tables 1.1 and 1.2)

What about the public sector? While the non-bank domestic private sector borrows mostly from UK resident banks, *public sector borrowing from non-residents* is a considerable fraction of total public sector borrowing, as I have shown in **Fig. 5**. Most of the gilts sold to non-residents are sterling denominated, as shown in **Fig. 14** (right panel). This means that most of the times, when a non-resident is lending to the British governement, sterling-denominated deposits are being injected into the

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[97] See http://www.bankofengland.co.uk/statistics/Pages/iadb/notesiadb/mfi_bs.aspx

economy. Given that the governement uses this money to finance GDP expenditures, this component of foreign lending should be part of the proxy.
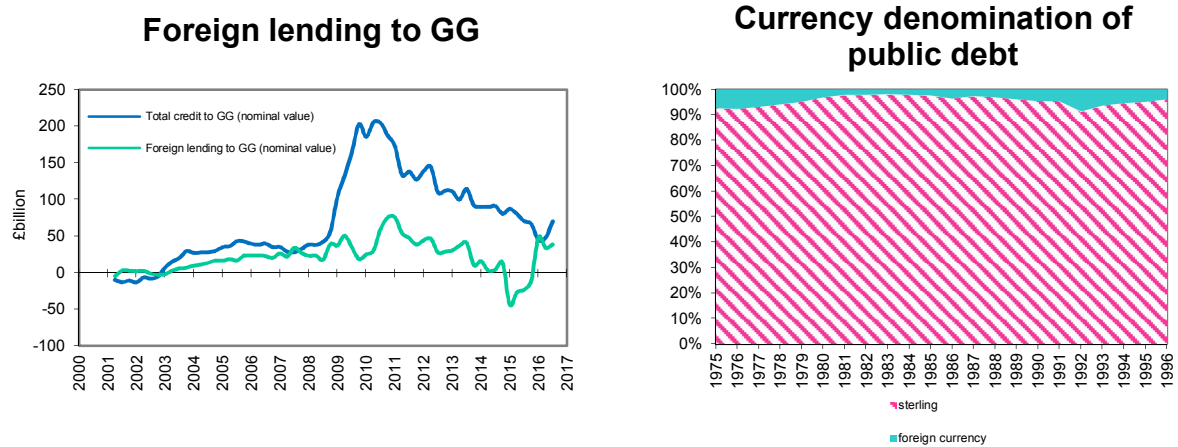

Fig. 14. Changes in gilt holdings by the foreign sector (left), converted into nominal value; and currency denominations of public debt: Bank of England *Bankstats*.

What about other financial flows? Should not they be considered in the calculation of the proxy? They should not, because financial flows that are not registered in the current account do not arise from GDP-related expenditures, but they represent the purchase or sale of financial assets. The same is true for the capital flows registered in the *capital account*.[98]

3.3   Proxy comparison

In the following I present the combinations of different proxy components and their resemblance with annual nominal GDP growth (blue line). I do not perform econometric tests or anything of that sort, since the aim of this paper is different. One thing to keep in mind when looking at these figures, though, is that the proxies constructed by Ryan-Collins, Werner and Castle (2016) (*Panel A*) and Lyonnet and Werner (2011) (*Panel B*) have succesfully passed rigurous econometric tests, mentioned above. Each panel in **Fig. 15** shows one combination constructed using data from different sources. Several patterns stand out:
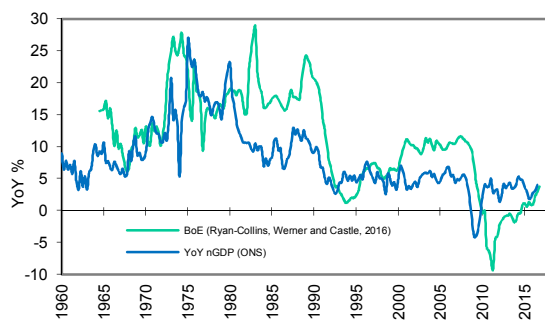
- *Panels A and B.* The inclusion of the NPISH sector makes a big difference on the proxy. While nominal GDP growth recovers some quarters after the drop of 2008Q3, the counter-cyclical behavior of MFI lending to NPISH captures this bouncing back better than the proxy that excludes this sector.
- *Panels C and D.* The inclusion of the GG sector to the three domestic sectors in panels *A* and *B* does not seem to make much difference, except for the brief period of 2009-2011 in which the counter-cyclical government expenditure kicks in and compensates for the private sector's drop. In normal times, though, the GG component is quite small compared to MFI lending to the PNFS.

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[98] The *capital account* shows credit and debit entries for nonproduced nonfinancial assets and capital transfers between residents and nonresidents. It records acquisitions and disposals of nonproduced nonfinancial assets, such as land sold to embassies and sales of leases and licenses, as well as capital transfers, that is, the provision of resources for capital purposes by one party without anything of economic value being supplied as a direct return to that party (IMF, 2009, p. 9, §2.16)
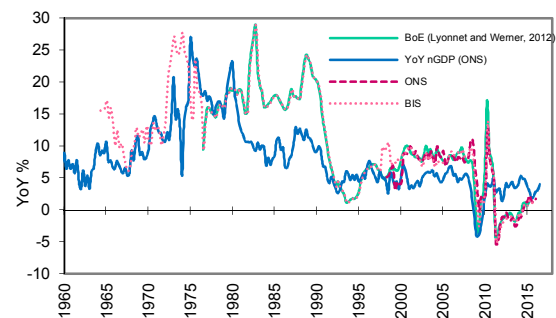
- *Panel E.* In the case of the household component of the proxy, excluding mortgage lending and including housing equity withdrawal (HEW) seems to impoverish the proxy. This might be due to indirect, non-HEW, wealth effects no registered in the HEW data, as I have explained above.
- *Panel E.* Regarding the treatment of the real estate sector, excluding it from the proxy does not seem to make much of a difference.
- *Panel F.* When compared to a non-disaggregated measure of total MFI credit, the proxies correlate much better with nominal GDP growth.
- *Panel G.* Including foreign lending to government has a neutral effect on the proxy.
- *Panel H.* Including net exports seems to improve the proxy considerably, particularly in the 2000-2010 period, getting the timing and scale of the recession roughly right. One could argue that this is inevitable, since net exports (NX) enter directly into the GDP identity, $Y = C + I + G + NX$. However, the reasons for including NX in the proxy have already been given and are sound. This proxy performs poorly after the recession; however, this pattern is common to all the proxies. Adding net exports to Ryan-Collins, Werner and Castle's (2016) proxy seems to improve it for the whole 1965-2016 period.
- *Panel I* shows the growth rates of different monetary aggregates (liability side of bank's balance sheets). They generally do not resemble nominal GDP growth.

Overall, the proxy that seems to perform best in terms of how close it follows nominal GDP growth—measured by the area between the two curves but also by their pattern—is the one that includes all non-financial units (*panel D*), that is, the one that includes private non-financial corporations (PNFC), households (GG), non-profit institutions serving households (NPISH), and the general government (GG), excluding from it financial corporations (FCs). Adding net exports and foreign lending to government (panels *G* and *H*) to this proxy improves it for the pre-recession years, but degrades it for the subsequent years.
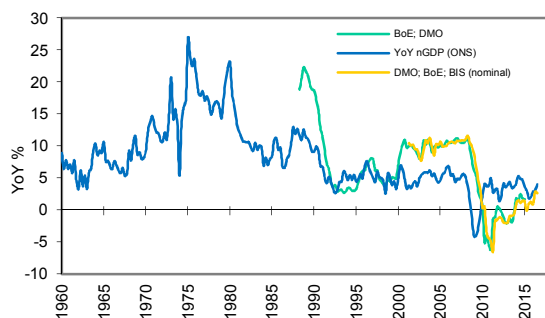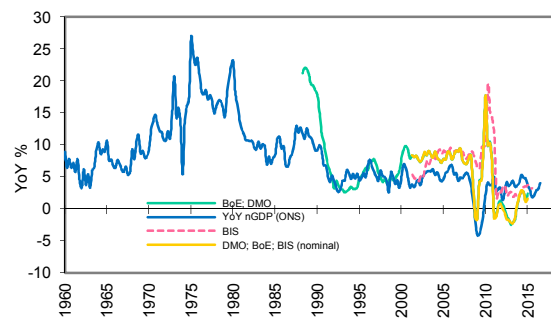
A. PNFCs + HH

B. PNFCs + HH + NPISHs

C. PNFC + HH + GG

D. PNFC + HH + NPISH + GG

E. Excl. Real Estate, incl. Housing Equity Withdrawal

YoY %

Legend:
- PNFCs + HH - Real Estate
- YoY nGDP (ONS)
- PNFCs + HEW + consumer credit

F. All instruments, all sectors

YoY %

Legend:
- All-to-all, all instruments (ONS)
- YoY nGDP (ONS)
- Banks-to-all, all instruments (ONS)

G. Foreign lending to GG combinations

YoY %

Legend:
- PNFC+HH+NPISH+GG+RoW_GG
- YoY in GDP (ONS)
- PNFC+HH+RoW_GG
- PNFC+HH+NPISH+RoW_GG
- PNFC+HH+NPISH+GG+RoW_GG

H. Net Exports combinations

YoY %

Legend:
- BoE (Ryan-Collins, Werner and Castle, 2016)
- YoY nGDP (ONS)
- PNFC+HH+NX
- PNFC+HH+NPISH+NX
- PNFC+HH+NPISH+GG+NX

I. Flow of money and lending

YoY %

Legend:
- M4L
- M3/M4/M4ex
- M0
- YoY nGDP (ONS)
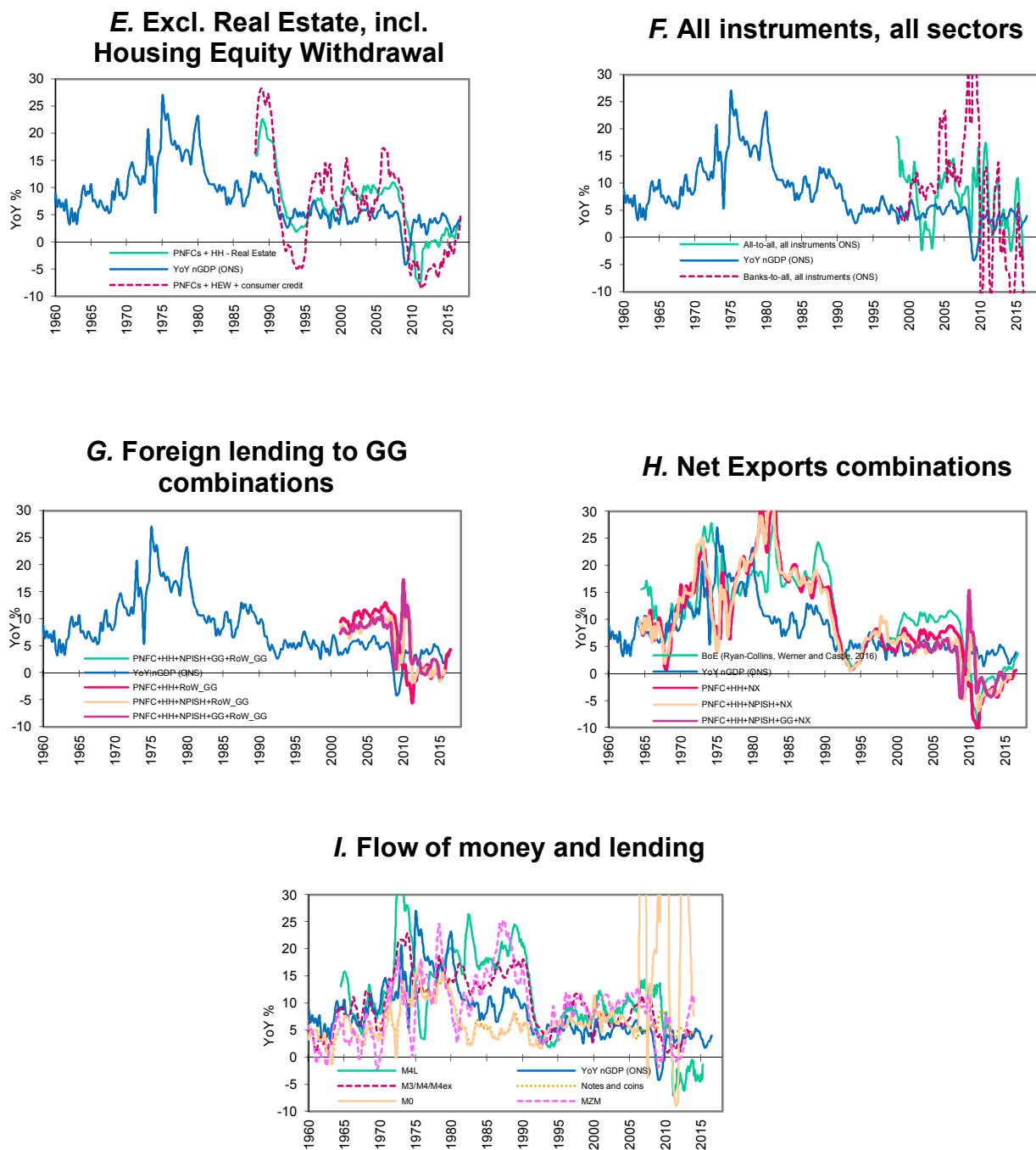- Notes and coins
- MZM

Fig. 15. Comparison of different empirical proxies of 'bank credit for GDP transactions' vis-à-vis nominal GDP growth. GG = general government; HH = households; NPISH = non-profit institutions serving households; PNFC = private non-financial corporations; OMFI = other monetary financial institutions; ICPF = investment corporations and pension funds. Notes and coins = Notes and coin in circulation outside the Bank of England. M0 = Notes and coin plus central bank reserves. MZM = Notes and coin plus all sight deposits held by the non-bank private sector. M3 = Notes and coin plus all sight and time deposits held with banks (excluding building societies) by the non-bank private sector. M4 = Notes and coin, deposits, certificates of deposit, repos and securities with a maturity of less than five years held by the non-bank private sector. M4ex = M4 excluding the deposits of intermediate other financial corporations (IOFCs). M4L = bank and building society lending to the UK private sector. Source: UK Office for National

Fig. 16 shows the income velocities of some of the best proxies and the various monetary aggregates, for comparison. Importantly, although the velocities of the proxies do not show big swings, they are far from constant or for that matter stationary around a constant trend. On the contrary, they display a continuous downward trend, with some sporadic breaks. On the other hand, the velocities of the proxies show considerable less variation than the traditional, monetary aggregate velocities, except for the M3/M4/M4ex velocity, which appears to be the closest to a constant velocity.

$$V_R = \frac{P_R Y}{M} = \text{monetary aggregate velocity}$$
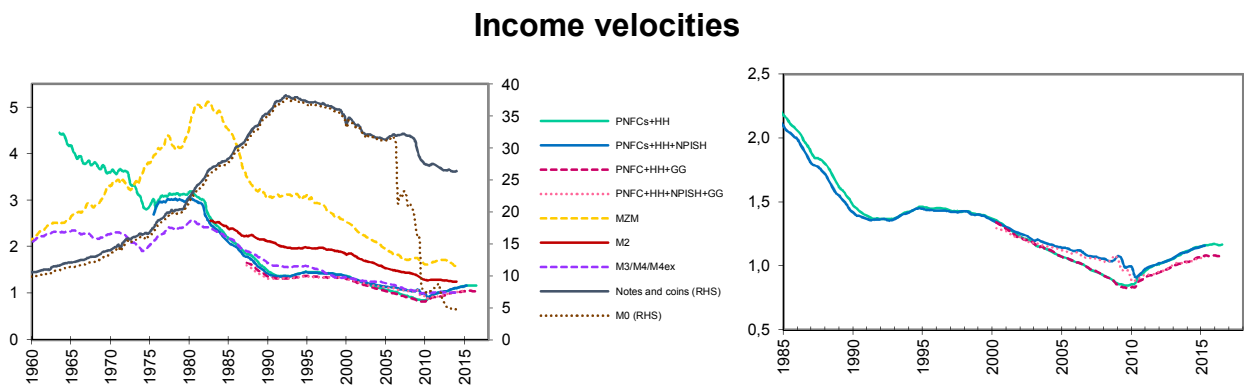
$$V_R = \frac{P_R Y}{C_R} = \text{proxy velocity}$$

Income velocities

Fig. 16. Income velocity of monetary aggregates and proxies. Notes: M2 = Notes and coin plus all retail deposits (including retail time deposits) held by the non-bank private sector (McLeay, Radia and Thomas, 2014). See Fig. 15 for the rest of monetary aggregates.

4. Final remarks

In this paper I have attempted to remove the major obstacles that get in the way of the *Quantity Theory of Credit* becoming less controversial, less misunderstood, and more credible, by exploring the foundations of the theory, its various instantiations, and how well its theoretical predictions fare against the empirical data and the results of various econometric tests.

In the first section I have explored the soundness of the main premise of the theory, i.e., banks create credit, money and purchasing power *ex nihilo* when they lend to non-banks, by extension of loans or by the purchase of assets. I have explored the literature and the conclusion I reach is clear: textbook descriptions of banking and money creation are misleading, and the quantity theory of credit rests on a correct premise.

In the second section I have analysed the theory's internal logic and the empirical evidence supporting its predictions. I have also performed a complementary test by 'dis-disaggregating' bank credit for GDP transactions into total credit and used BIS data of a sample of countries to test it, showing

the empirical evidence does not contradict the theory. The results of econometric tests performed by various authors are impressive and, though preliminary, provide good reasons to be optimistic.

In the third section I have revised the methodological choices in the process of constructing empirical proxies for bank credit for GDP transactions. I have shown that this process is arduous and open-ended. I have suggested that the external sector (net exports and foreign lending to the general government) and the public sector (changes in gilt holdings by monetary financial institutions) are missing from most of the proxies constructed so far. I have also delved into the details of the household sector expenditures (housing equity withdrawal, etc.) and shown that there are considerable expenditures due to 'wealth effects' that are not captured by HEW data, and therefore mortgage lending should be included in the proxy, although strictly speaking no 'mortage lending money' is allocated to GDP expenditures. I have also argued that the central bank purchase of government securities in the secondary market should be excluded from the proxy if there is no data on the time lag between their issuance in the primary market and their purchase in the secondary market.

Overall, the conclusion I reach is the following: the quantity theory of disaggregated credit (cf. Werner, 1997, 2005) is in the stage of maturation, and there is a long way to go. The results, though preliminary, are very encouraging. I believe it is a matter of focus and fine-tuning to eventually get to velocities that oscillate midly around a constant trend line.

Future work should focus on finding better empirical data and constructing more refined proxies. In particular, better and more granular data on (1) firm-level expenditures and their financing sources (external versus internal, bank versus non-bank) and expenditure-types (GDP versus non-GDP); (2) household expenditures and the spill-over from increased house prices to increased consumption through a 'wealth effect'; (3) the timing and lags between non-bank purchase of gilts and the purchase of those same gilts by the central bank afterwards. Absent such data, one must try to approximate the best proxy. One possible strategy—one that I have not pursued in this paper—is do a sub-sectoral decomposition by types of industries (e.g., agriculture, transport, construction, real estate) and multiply its component of the proxy by some factor, derived from the relative gross value added of each sub-industry, instead of applying a 'binary' discarding method.

I repeat here the properties an 'ideal' proxy would have:

1. An ideal proxy would make use of highly disaggregated data on the *sources* of funding, both external and internal, that institutional units resort to to finance their expenditures; this data would ideally include cross-sectoral financial positions for a broad range of instruments, for a long period of time, in particular distinguishing between MFI and non-MFI sectors;

2. An ideal proxy would make use of highly disaggregated data on the *uses* given by businesses to those funds (internal and external), for a broad range of expenditure types, for a long period of time, particularly discriminating those expenditures that contribute to GDP and those that do not;

3. An ideal proxy would be incorporating possible *indirect effects* of bank lending on the spending behavior of each sector (e.g., households increasing consumption out of existing money balances due higher house prices induced by higher mortgage lending)

4. Overall, an ideal proxy would include the sum of all expenditures that contribute to GDP, made by all sectors and subsectors, that have been financed by liabilities that represent assets for the banks.

For a policy application of the theory, see Clavero (forthcoming).

Appendix — Data sources

The following are the details of the various components of the proxies:

PNFC (private non-financial corporations):
Source #1: Bank of England *Bankstats*
> **Name:** Quarterly amounts outstanding of monetary financial institutions' sterling net lending to private non-financial corporations (in sterling millions) not seasonally adjusted
> **Code:** LPQB9Y2
> **Period:** 1963Q1-2016Q3

Source #2: UK Office for National Statistics (ONS)
> **Data file name:** 'The enhanced financial accounts (flow of funds): Updated financial accounts', published 8 August 2016
> **Data series description:** this series is constructed as the changes in the holdings of loans and debt securities by the PNFC sector as liabilities vis-à-vis MFIs
> **Period:** 1997Q1-2015Q4

HH (households):
Source: Bank of England *Bankstats*
Name: Quarterly amounts outstanding of monetary financial institutions' sterling net lending to household sector (in sterling millions) not seasonally adjusted
Code: LPQB9Y3
Period: 1963Q2-2016Q3

NPISH (non-profit institutions serving households):
Source: Bank of England *Bankstats*
Name: Quarterly amounts outstanding of monetary financial institutions' sterling net lending (historical measure) to unincorporated businesses and non-profit institutions serving households (in sterling millions) not seasonally adjusted
Code: LPQVVXT
Period: 1975Q2-2015Q1

GG (general government):
Source #1: UK Office for National Statistics (ONS)
> **Data file name:** 'The enhanced financial accounts (flow of funds): Updated financial accounts', published 8 August 2016
> **Data series description:** this series is constructed as the changes in the holdings of loans and debt securities by the GG as liabilities vis-à-vis MFIs. I have consolidated out the intra-sectoral positions, e.g., loans from the central government to the local government are eliminated.
> **Period:** 1997Q1-2015Q4

Source #2: UK Debt Management Office (DMO); Bank of International Setttlements
> **Data file name:** 'Gilt holdings data historical' (DMO); 'Long series on total credit to the non-financial sectors' (BIS)
> **Data series description:** the series is constructed as the changes in general government liabilities holdings vis-à-vis MFIs excluding the central bank, using the DMO data set. These values are then converted from market value to nominal value using the nominal-to-market ratio calculated using the BIS data set.

Source #3: Bank of England *Bankstats*
> **Name:** Quarterly amounts outstanding of monetary financial institutions' sterling net lending to public sector (in sterling millions) not seasonally adjusted

Code: LPQVWGL
Period: 1990Q2-2016Q3

NPISH + HH:
Source: UK Office for National Statistics (ONS)
Data file name: 'The enhanced financial accounts (flow of funds): Updated financial accounts', published 8 August 2016
Data series description: this series is constructed as the changes in the holdings of loans and debt securities by the HH and NPISH sectors as liabilities vis-à-vis MFIs
Period: 1997Q1-2015Q4

PNFC + HH + NPISH:
Source: Bank of International Settlements
Data file name: 'Long series on total credit to the non-financial sectors', 8 September 2016
Data series description: United Kingdom - Private non-financial sector - Banks, total - Market value - Domestic currency - Adjusted for breaks
Code: Q:GB:P:B:M:XDC:A
Period: 1963Q1-2015Q3

Real estate:
Source: Bank of England *Bankstats*
Name: Quarterly amounts outstanding of UK resident monetary financial institutions' sterling net lending to companies undertaking the buying, selling and renting of real estate (in sterling millions) not seasonally adjusted
Code: RPQTBUY
Period: 1987Q1-2016Q3

HEW (housing equity withdrawal):
Source: Bank of England *Bankstats*
Name: Quarterly changes of total sterling housing equity withdrawal (previously called mortgage equity withdrawal) by individuals (in sterling millions) seasonally adjusted
Code: LPQBE92
Period: 1990Q1-2016Q2

Consumer credit:
Source*:* Bank of England *Bankstats*
Name*:* Quarterly amounts outstanding of UK resident monetary financial institutions' sterling consumer credit (excluding credit card) loans to individuals (in sterling millions) not seasonally adjusted
Code: RPQTBVY
Period: *1987Q1-2016Q3*

NX (net exports):
Source*:* UK Office for National Statistics (ONS)
Name: 'Balance of Payments: Trade in Goods & Services: Total exports: CP SA £m'; 'Balance of Payments: Trade in Goods & Services: Total imports: CP SA £m', 11-01-2017
Period: 1955Q1-2016Q3

Foreign lending to GG:
Source: UK Debt Management Office
Name: 'Gilt holdings data historical'

Data series name: overseas holdings (rest of world)

Details: the overseas holdings of UK general government gilts is converted to flow by applying year-over-year changes, and then is converted from market value to nominal value by multiplying by nominal-to-market ratio (calculated using BIS data)

Period: 1987Q1-2016Q2

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