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Making Money from Making Money

Seigniorage in the Modern Economy

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NEW ECONOMICS FOUNDATION

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

MAKING MONEY FROM MAKING MONEY

SEIGNIORAGE IN THE MODERN ECONOMY

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SUMMARY

Who has control over the supply of new money and what benefits does it bring? There is now widespread acceptance that in modern economies, commercial banks, rather than the central bank or state, create the majority of the money supply.

This report examines 'seigniorage' – the profits that are generated through the creation of money.

We show that in the UK, commercial bank seigniorage profits amount to a hidden annual subsidy of £23 billion, representing 73% of banks' profits after provisions and taxes.

Seigniorage has traditionally been understood as the difference between the cost of physically producing money and its purchasing power in the economy – a £10 note for example costs just a few pence to produce so seigniorage profits are likely to be close to £10. Historically it was sovereign states who had the exclusive power to create and *spend* money in to the economy: the term seigniorage derives from the French *seignior* which means sovereign ruler or feudal Lord.

In modern economies, such as the UK, however, money in circulation created by the state – physical cash – only represents around 3% of the total money supply. The remaining 97% is *lent* in to economies as the digital IOUs of commercial banks – the deposits that are entered in to our bank accounts when banks make new loans.

This report develops a model of commercial bank seigniorage based on the reality that banks, unlike other financial intermediaries such as Peer2Peer (P2P) lending platforms, do not have to acquire funds in the first instance before making loans. This is because banks' IOUs – bank deposits – have been privileged by the state as having the status of money which people must hold to make payments in the economy.

For the UK, we calculate that this privilege has provided commercial banks with seigniorage profits amounting to an annual average of £23 billion per year in the 1998–2016 period. This is equivalent to 1.23% of GDP. In contrast, state seigniorage – profits generated by central banks via the issuance of banknotes – has only amounted to £1.2 billion a year. We also examine commercial bank seigniorage in three other countries where there are active debates about monetary reform: Denmark, Switzerland, and Iceland (Table 1).

TABLE 1. COMMERCIAL BANK SEIGNIORAGE ACROSS FOUR COUNTRIES

COUNTRY	PERIOD STUDIED	AVERAGE ANNUAL COMMERCIAL BANK SEIGNIORAGE	AS % OF GDP	CUMULATIVE COMMERCIAL BANK SEIGNIORAGE
UK	1998–2016	£23.3 billion	1.23%	£443 billion
Denmark	1991–2015	DKK11.7 billion	0.7%	DKK293.4 billion
Switzerland	2007–2015	CHF2.8 billion	0.6%	CHF34.8 billion
Iceland	2004–2015	ISK14.1 billion	0.9%	ISK169.7 billion

The findings suggest that a large proportion of banks' profits are underpinned by their control over the money supply, an essential piece of public infrastructure. Should the public take back some control over the creation of money? A number of economists and civil society groups have argued that the central bank should create a higher proportion – or all – of the money supply. And a number of central banks, including the Bank of England and the Swedish central bank, are examining whether they should begin issuing central bank digital currency (CBDC). This would allow households and firms to directly hold digital money with central banks rather than with commercial banks.

Such a move could lead to a major increase in central bank seigniorage profits that would normally be reimbursed to the tax payer along with a corresponding decline in commercial bank seigniorage. For example, in the UK case, we find that £182 billion of cumulative seigniorage profits would have accrued to the public purse since 1998 if 30% of the money supply had been in the form of digital central bank currency rather than commercial bank deposits. This profit would have been paid to HM Treasury and could have been used to support public priorities or reduce the government deficit.

Commercial banks might argue that reductions in their seigniorage profits would lead them to contract their lending or charge higher interest rates. However, most bank lending in advanced economies flows in to commercial and domestic property and other financial assets rather than to businesses. Seigniorage profits could be seen as another form of public subsidy for the banking sector, supporting excessive pay and non-value-creating lending that contributes to rising house price and financial-asset prices.

This means there is a strong case for returning a portion of seigniorage profits to the public purse by introducing CBDC. Such a move could also provide other advantages. It would create some genuine competition for the commercial banks in the payment services sector, levelling the playing field for non-bank financial intermediaries such as P2P lenders and the 'Fin-tech' sector and giving the public a genuinely safe way of holding its money. And it would give central banks a new channel to more directly stimulate the economy when necessary, for example via crediting households with 'helicopter money' or governments via 'monetary financing'. Finally, it could help make the payments system and broader financial system more resilient to economic shocks.

Overall, such a reform would be a step towards democratising a monetary system which – via seigniorage profits – gives commercial banks a major subsidy that puts them in a uniquely privileged position in the economy.

1. INTRODUCTION

Creating new money is a profitable business. Money costs very little to produce, and yet it commands a value many times this in the economy.

A £10 note costs just a few pennies to print but can be used to purchase £10 worth of goods and services. For digital money, created by simply tapping numbers into a computer, the difference between the cost of creating money and its purchasing power is even greater.

Those organisations to whom society has granted the power to create new money therefore have a privilege not enjoyed by anyone else in the economy.

Historically, issuing money has been a royal prerogative, and the resulting purchasing power accrued to the *seigneur*[1] or ruler. The revenue earned from the issuance of new money – the difference between the purchasing power and the cost of producing the money – was referred to as *seigniorage*.[2,3] It can be viewed as revenue in the sense that it increases the spending power of the sovereign in the same way as an increase in taxation does. This terminology survives to this day, and in discussing seigniorage, most economists still work on the assumption that the state has a monopoly on the creation of money.

This concept of seigniorage is no longer adequate to explain the modern monetary system. For in modern economies, most money is created not by central banks or any other state body, but by private commercial banks. Because commercial banks create money in the act of lending, the profits generated from money creation are different from the traditional notion of seigniorage. They instead relate to the interest profits banks make due to their ability to issue debt that is used as money, in contrast to every other person and organisation in the economy whose liabilities are not money. This report examines who benefits from the modern process of money creation and the scale on which they benefit.

This question is important and topical. There is currently a lively debate about the 'end of cash' with an increasing number of payments being conducted by commercial banks online, via mobile phones, or with debit or credit cards.[4,5] In the UK, the Bank of England is conducting research into whether it might be appropriate for a central bank to issue digital cash rather than limit itself to the production of physical notes and coins.[6,7,8]

The financial crisis of 2008/2009 raised serious questions over whether commercial banks should be the primary determinants of the creation and allocation of the money supply. Much of the money created by commercial banks went into supporting the purchase of real estate and financial assets rather than to businesses supporting the real economy and creating growth and jobs. This led to the build-up of unsustainable levels of debt in these sectors, which is now preventing a return to stronger economic growth.[9] Thus, the question of who should create money and benefit from its creation have been rising the political agenda in several countries.

The UK, the Netherlands and Iceland have all had parliamentary debates on the subject and both the latter countries have appointed government-sponsored commissions to investigate the issue. Campaign groups,[10] think-tanks,[11] and financial commentators[12] have argued that there is a strong case for 'sovereign money', where the right to create money is returned from commercial banks to the central bank. In Iceland, the Prime Minister's office has been investigating the matter for several years and recently commissioned a report by KPMG[13] to investigate the potential of sovereign money. A working paper published by the IMF argued that a sovereign money transition would have major economic benefits.[14] In Switzerland, following the collection of over 110,000 signatures, there will be a public referendum in the coming years to vote on an amendment to the constitution which would prevent banks from creating new money.

This report is intended to be a helpful addition to these international debates.

Given that seigniorage is revenue accrued through the creation of money, any concept of seigniorage necessarily has to make an assumption about what money is and how it is created. We therefore begin by examining the question of what money is and how it is introduced into the economy.

1.1 WHAT IS MONEY?

Most people use money every day, and many go to great lengths to acquire it. Yet despite its central nature in our lives, very few people think about what money is, how it is created, how its design impacts our economy, or whether the monetary system could be improved.

Most economists define money in terms of what it does, and that is usually divided into the four core functions that it performs.

1. A medium of exchange allowing us to pay for goods and services.

2. A unit of account, allowing us to understand the relative price of several different things.

3. A store of value, giving people security that the money will still be worth the same in the future.

4. A means of making final payment or settlement.[15]

The physical form that money takes has evolved over time across different parts of the world, and has included tally sticks, clay tablets, cattle, and various forms of precious metal, such as gold and silver.[16]

Today, however, money takes the form of what is referred to as 'fiat' money – money that derives its value from state regulation and law, rather than any physical commodity. In modern economies, money takes one of three forms.

Cash (notes and coins)
The simplest form is cash – the £5, £10, £20, and £50 notes and the metal coins that most of us have in our wallets at any time. Paper notes are created under the authority of the Bank of England and printed by specialist printer De La Rue. Metal coins are produced under the authority of the Treasury by the Royal Mint. Although cash is being used for fewer and fewer transactions as electronic payment becomes more popular, the Bank of England expects the total amount of cash in circulation in the economy to keep increasing over time because prices tend to rise and the population keeps on growing. It is estimated that there are currently £67,818 million in notes[17] and £4,011 million in coins in circulation.[18]

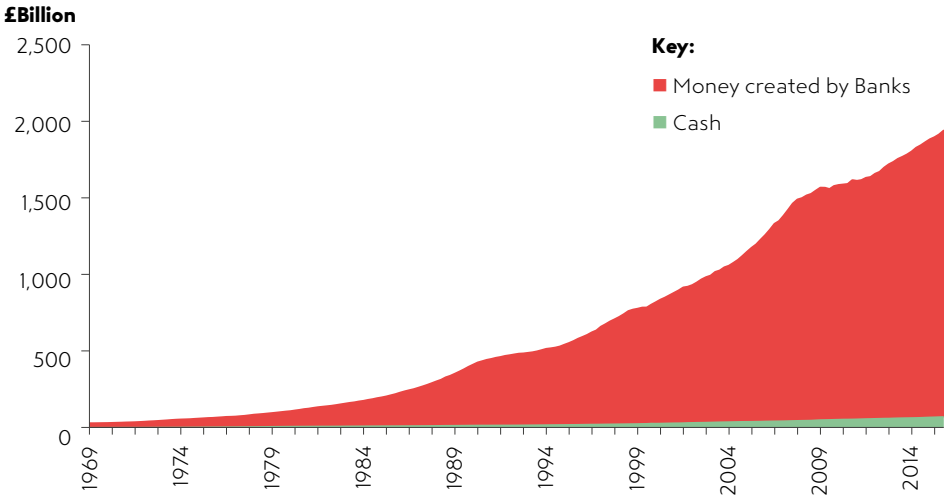
Central bank reserves
Central bank reserves are an electronic form of money created by the Bank of England. Unlike cash, however, members of the public cannot access or use central bank reserves. Only high-street and commercial banks, building societies, and a small number of systemically important financial institutions that have accounts with the Bank of England can use this type of money. Commercial banks use central bank reserves to settle payments with other banks at the end of each day. Whenever payments are made between the accounts of customers at different commercial banks, they are ultimately settled by transferring central bank money (reserves) between the reserves accounts of those banks.[19]

Commercial bank deposits
The third type of money is what is in your bank account. In banking terminology, it is referred to as bank deposits, or demand deposits. Whenever you make a purchase in a shop using your debit card, you are doing so using bank deposits. In such an instance, your bank will debit your current account according to the value of your purchase, and will tell the shop's bank to credit its account by the same value.

In technical terms, bank deposits are simply a number in a computer system; in accounting terms, they are a liability of the bank to you. The terminology is slightly misleading, as a bank deposit is not a deposit in the sense that you might store a valuable item in a safety deposit box. Instead, it is simply an electronic record of what the bank owes you. Although not widely recognised, any cash you deposit in a bank does not legally belong to you – it belongs to the bank.

As will be discussed in the next section, this third type of money is not created by the Bank of England, the Royal Mint, or any other part of government. Instead, it is created by commercial banks such as Barclays, Lloyds, RBS, and HSBC, in the process of making new loans.

FIGURE 1. MONEY SUPPLY IN THE UK, 1969–2015



Note: Money created by banks relates to quarterly amounts outstanding of UK resident monetary financial institutions' sterling M4 liabilities to the private sector excluding intermediate OFCs (other financial corporations), seasonally adjusted.

BOX 1: IS THE MONEY IN MY BANK ACCOUNT LEGAL TENDER?

Bank deposits are not legal tender in the strict definition of the term. Legal tender has a very narrow and technical meaning in the settlement of debts. It means that a debtor cannot successfully be sued for non-payment if they pay in court in legal tender. In England and Wales, only notes and coins are legal tender. In Scotland and Northern Ireland, notes are technically not considered legal tender, leaving coins as the only form of legal tender in these parts of the UK.[20]

In modern economies, however, bank deposits function as money – they can be used to pay for things, including government taxes, and banks will usually convert them into cash on demand. In addition, in most countries a large sum of an individual depositor's holdings of money is guaranteed by the government – in the UK it is currently the first £75,000. For this reason, most members of the public would consider bank deposits to be as good as cash.

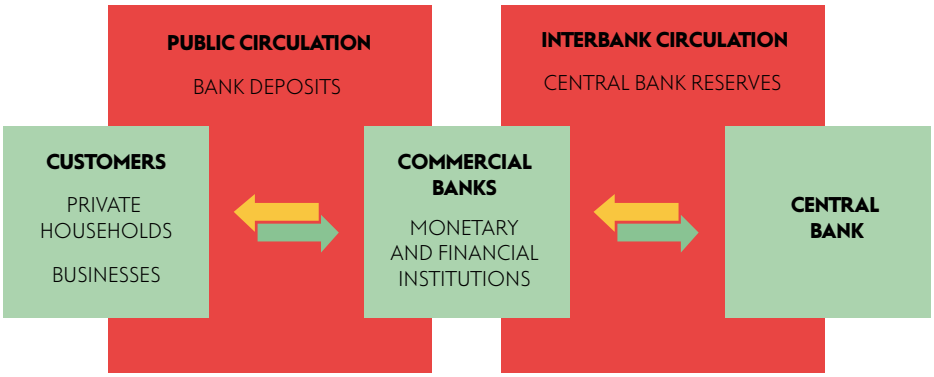
Traditionally, economists have only focused on the first two types of money – cash and reserves (hereafter referred to as 'central bank money') in considering the level of seigniorage in the economy. However, as Figure 1 shows, using the Bank of England's standard definition of the money supply, bank deposits now make up 97.4% of all the money used in the economy. As a result, aside from a tiny fraction of cash, today money is mainly digital information. Huge volumes of money are moved around our economies simply by people typing data into computers.

The current monetary system is therefore characterised by two separate 'circuits':

1. The (relatively small amount of) central bank reserves which are created by the Bank of England and used by commercial banks to settle payments with each other.

2. The (much larger amount of) bank deposits which are created by commercial banks in the process of making loans and used by the public to make transactions.

FIGURE 2. THE DUAL CIRCUITS OF THE MODERN MONETARY SYSTEM



This dual-circuit aspect of the modern monetary system is illustrated in Figure 2. Commercial banks sit at the centre of these two circuits. For commercial banks, central bank reserves are assets and bank deposits are liabilities. Cash operates outside of these circuits as it is used by both commercial banks and the general public as a form of money (i.e., it is a liquid asset used as a means of payment). As we will see, this is because commercial banks will convert bank deposits into cash on demand (e.g. through ATM withdrawals), and the Bank of England will convert central bank reserves into cash so that commercial banks can meet the public's demand for cash. As the Bank of International Settlements notes:

> *Contemporary monetary systems are based on the mutually reinforcing roles of central bank money and commercial bank monies. What makes a currency unique in character and distinct from other currencies is that its different forms (central bank money and commercial bank monies) are used interchangeably by the public in making payments, not least because they are convertible at par.*[21]

In order to fully understand how this system operates in practice, it is helpful examine how new money is created and introduced into the economy.

1.2 HOW IS MONEY INTRODUCED INTO THE ECONOMY?

The way money is created and introduced into the economy has profound implications for how money is conceived, as well as for the definition and measurement of seigniorage. Orthodox economic theory has conceptualised money as a form of commodity which circulates as a way of optimising exchange by enabling people to avoid having to engage in barter. The state is envisaged as having a monopoly over the creation of new money and when it spends newly created money in to the economy, it accrues seigniorage as the cost of producing new money is less than its purchasing power.

However, historical evidence shows that money has always been a form of *credit* – a social relationship between creditor and debtor – rather than a commodity. The first documented 'money' systems were in fact centralised accounting systems overseen by temples or palaces that recorded credits and debits, typically in the form of agricultural commodities such as cattle, grain, and tools.[22] The later development of metallic money – gold and silver coins – was due to the onset of wars when the networks of trust required for credit systems broke

down and coinage was a simpler way of paying soldiers, themselves poor credit risks.[23] Over time, technological developments have meant that today's money system is a digital accounting system – a system of recording credits and debits – which is overseen by central and private commercial banks. In this section, we outline how new money is introduced into the economy under this system, with reference to the three types of money discussed in the previous section.

Notes

As noted earlier, paper notes are created under the authority of the Bank of England. If a commercial bank decides that it is expecting an increase in demand for cash – for example, over a busy weekend – then it would inform the Bank of England that it would like to increase its holdings of cash. The bank would then exchange some of its (electronic) central bank reserves for newly created (physical) notes at face value.[24] The process by which it does so is very simple – the commercial bank simply exchanges central bank reserves for the same amount of newly created cash with the Bank of England. This does not change the size of the balance sheet of either the Bank of England or the commercial bank. Notes can therefore be thought of as a physical embodiment of central bank reserves.[25]

The economic significance of banknotes in the economy is small, even though they are used for a large proportion of smaller transactions, as shown in Figure 1.

Coins

Coins are produced by the Royal Mint, a company which is 100% owned by HM Treasury. On average around 1,500 million new coins are issued every year.[26] The Royal Mint issues new coins to a small number of cash centres which are operated on behalf of the major banks and post offices. The banks then exchange some central bank reserves for newly created (physical) coins at face value. These cash centres in turn distribute coins to local branches of banks and post offices in order to satisfy demand from business customers and members of the public. Unlike notes, coins are not expected to suffer damage or become severely worn in circulation, and the government does not replace old coins with new ones.

Central bank reserves

As discussed in Section 1.1, commercial banks use central bank reserves to settle payments with other banks at the end of each day. A commercial bank must also hold sufficient reserves to meet the demands of the general public for physical cash which, as described earlier, the Bank of England provides in exchange for central bank reserves.

To continue with the example from the previous section of making a purchase from a shop, after your bank debits your current account and tells the shop's bank to credit its account, your bank would then settle the payments by transferring a corresponding amount of central bank money (reserves) to the other bank's reserve account at the Bank of England. However, because there are only a few major banks, in any given day it is highly likely that there will also be a similar number of transactions going the opposite way. As a result, most of the transactions cancel each other out on aggregate, and only a small amount of central bank money is needed to settle the difference between banks at the end of each day.

If a commercial bank does not have enough reserves to settle its payments with other banks or meet the demands of the general public for cash, it can acquire reserves in two ways. The first way is to borrow reserves from

another bank which has more than it needs to settle its payments. Because the aggregated banking system is a closed loop, if one bank has insufficient reserves to settle its payments, then by definition another bank must have more reserves than it requires. Banks that have excess reserves will typically lend them to banks in need of reserves on the interbank money market at the interbank market rate of interest, known as LIBOR (the London Interbank Offered Rate).

If there are not enough reserves in aggregate to settle payments between banks and meet the demands of the general public for cash, or if banks are not willing to lend to each other, the Bank of England can inject new reserves into the system. It can do this in several ways. It can purchase assets – usually government bonds – from the commercial bank using newly created central bank reserves. This is referred to as 'open market operations' as the assets are bought on the secondary market from investors. When this happens, the Bank of England's expands its balance sheet by the amount of the new reserves – the new reserves are recorded as a liability and the newly purchased bonds are recorded as an asset. However, the size of the commercial bank's balance sheet does not change because it has merely swapped one form of asset for another (government bonds for reserves). It is through this process also that the Bank of England conducted its quantitative easing (QE) programme (Section 2.3).

The other method is for the Bank of England to create reserves through what is known as a 'sale and repurchase agreement' (or 'repo'), which is similar in concept to a collateralised loan. Under this approach, a commercial bank sells an asset to the Bank of England (usually a government bond) in exchange for new central bank reserves, while agreeing to repurchase the asset for a specific (higher) price on a specific future date.[27]

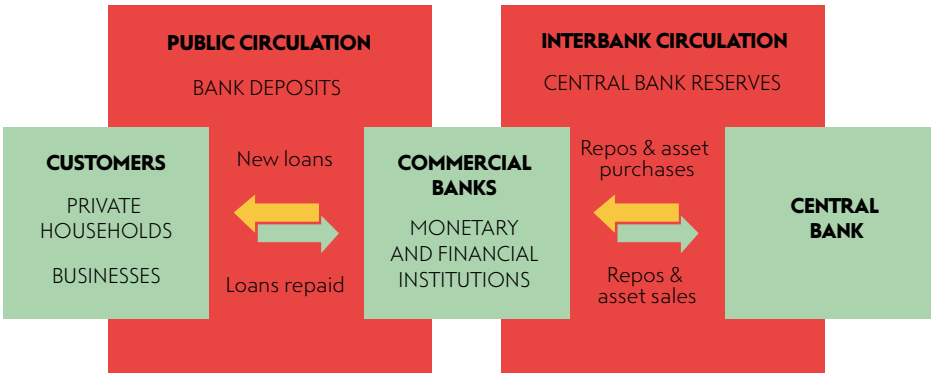
Prior to the Bank of England's QE programme, this was the most common method for introducing new central bank reserves to the system. However, since QE involved a massive (£375 billion) increase in the quantity of reserves in the banking system, commercial banks have had more than enough reserves to settle payments with each other, and thus repo activity has reduced dramatically since 2009.

Commercial bank deposits

The process by which bank deposits are created has long been a source of confusion. Part of this stems from a common misunderstanding of what banks do. A prevalent view among the general public and some economists is that banks are financial intermediaries that take money from savers and lend it to borrowers. Another general view is that banks borrow central bank reserves from the central bank and then lend them out to the public. Both views, however, are incorrect.

The reality is that banks create new money in the form of bank deposits when they make new loans. If you take out a new mortgage from a bank, the money is not taken from someone else's savings, nor is it taken from the bank's own reserves. Rather, the bank simply *creates* the money electronically via the keystroke of a computer and credits your bank account with additional deposits. When banks issue new loans, they expand both sides of their balance sheet simultaneously, creating an asset (the loan) and a liability (the customer's deposit in the bank account).[28]

FIGURE 3. THE DUAL CIRCUITS OF THE MODERN MONETARY SYSTEM



As a result, the money supply increases when banks make new loans and decreases when loans are repaid as bank deposits are destroyed. A survey of the history of economic ideas reveals that this is anything but a new insight. The process by which commercial banks create money when they issue new credit was central to the thinking of prominent figures of the discipline such as Knut Wicksell, Friedrich Hayek, Irving Fisher, John Maynard Keynes, and Joseph Schumpeter, and was an integral aspect of theories on banking and money at the beginning of the twentieth century.[29,30]

However, as the twentieth century wore on, banks' main role was viewed as intermediating between savers and borrowers. They were not granted any privileged position in orthodox theories and models of the economy. Figure 3 presents a version of the diagram presented in the previous section, this time updated to include the way that money is introduced and destroyed in the economy.

2. STATE SEIGNIORAGE: NOTES, COINS, AND RESERVES

In most studies of seigniorage, the underlying economic model is one in which the state has a monopoly on the creation of money and therefore is the sole beneficiary of seigniorage profits.

As such, the vast majority of the literature on seigniorage only includes bank notes, coins, and in some cases central bank reserves as the basis for seigniorage[31-34] In most countries this seigniorage is generated by the central bank and then remitted to the government underarrangements which vary by country.

In this section, we show how this type of seigniorage is generated in the economy and calculate the revenue that this has provided for the government. In the next section, we do the same for commercial bank seigniorage.

As already noted, the way money is created and introduced into the economy has profound implications for how money is conceived, as well as for the definition and measurement of seigniorage. If we think of new money as being *spent* directly into the economy, seigniorage profits are the nominal difference between the cost of producing money and its purchasing power. Although this is often how seigniorage is described in books and academic papers, it is not a correct depiction of how seigniorage accrues in modern economies.

The reason for this is that money is not spent into the economy; rather, it is lent into the economy. When money – i.e., physical cash and electronic reserves – is lent to commercial banks by the central bank, it is created as a liability or an IOU. Traditionally, both forms of liability were non-interest bearing; however, as discussed in Section 2.3, in recent years central bank reserves have become interest-bearing in many countries, usually at the central bank base rate. This liability is matched by the asset which is received in exchange for the new money, which the central bank can invest and earn interest on.[35] Central bank or state-seigniorage income is the *interest earned on the assets that corresponds to the level of non-interest bearing (or low-interest bearing) money.*[36]

From the commercial bank's perspective, this can be seen as a form of interest income foregone. This is because if the commercial bank did not have to hold central bank money, it could instead have held interest-

bearing assets, such as bonds. But because commercial banks have to hold central bank money (either as a regulatory requirement or for liquidity management purposes) which is remunerated at a lower rate than the market would otherwise provide, it is not able to earn this interest. The need to hold the central bank's money is thus an opportunity cost to a commercial bank, equivalent to the seigniorage profit of the central bank.

2.1 BANKNOTES

The process just described is most apparent in the case of banknotes, which is the basis of most of the seigniorage that accrues to the state. As already mentioned, when a commercial bank wants to increase its holdings of cash, it sells notes to the central bank in exchange for reserves and then exchanges those reserves for newly created (physical) notes. The process for how commercial banks initially acquire central bank reserves is discussed in Section 2.3.

The Bank of England maintains two balance sheets: one for its Issue Department and one for its Banking Department. The banknotes issued to the commercial bank are recorded as liabilities of the Issue Department and the reserves released by the commercial bank (which are liabilities of the Banking Department) are credited as assets of the Issue Department.

The Issue Department then invests these funds in interest-bearing assets, typically government bonds. Seigniorage is calculated as *the interest the Bank of England earns on these assets minus the cost of issuing, distributing, and replacing those notes.*[37] Thus, the seigniorage arises not from the notes themselves, but from the assets financed by the note circulation.

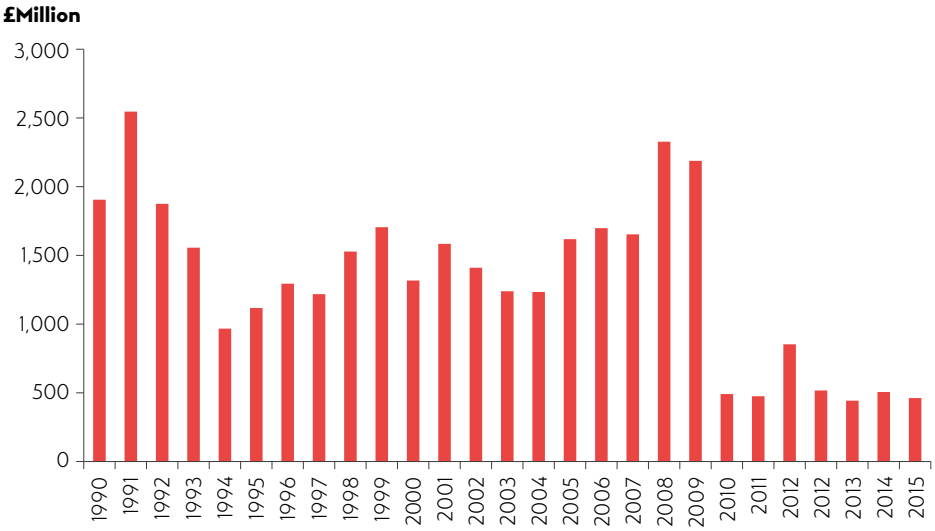
To illustrate, imagine the Bank of England issues £1 million of £20 notes in exchange for £1 million of central bank reserves. The Bank of England then invests the proceeds from issuing the £20 notes in a government bond generating 2.5% interest. This would yield £0.50 of interest revenue per year for each £20 note.

If we assume the overall production cost for the note is about £0.15, then given an average life of about 7.5 years for a new bank note, the production cost of the note averages out to £0.02 per year. If average distribution expenses of about £0.01 per year are added to this, the total average annual cost of putting this note into circulation and replacing it when it is worn is approximately £0.03. Thus, the Bank of England earns an annual net revenue of about £0.47 for each £20 note in circulation – a total of £23,500 for the £1 million issued in this example.

Most of this seigniorage profit is paid to HM Treasury, as the Bank's shareholder, which uses it for day-to-day spending purposes. Figure 4 shows the amount of seigniorage that the Bank of England has paid to HM Treasury since 1990. The fall in seigniorage profits after the financial crisis in 2008 was not due to a decline in the demand for physical cash – this has continued to rise in absolute terms – but rather to the fall in interest rates on government bonds, the main asset from which the Bank invests the reserves it receives when it sells banks notes.

Surprisingly, very few other central banks report the profits they make on the issuance of banknotes as seigniorage.

FIGURE 4. BANK OF ENGLAND SEIGNIORAGE REVENUE FROM NOTE ISSUE – 1990 TO 2015



Source: Bank of England annual reports

2.2 COINS

The process of generating seigniorage from coins is different to that of notes. This is because the Royal Mint does not replace worn or damaged coins due to the long life span of coins. As a result, seigniorage is generated immediately at the time of sale and is calculated as *the face value of new coins issued into circulation minus the cost of issuing and distributing the coins plus any interest the Royal Mint earns on its central bank reserves.*

The Royal Mint does not publish data on the amount of seigniorage generated; however the income earned from seigniorage contributes towards the Royal Mint's profit. In 2014/2015, the Royal Mint reported profit of £9 million, of which £4 million was paid as a dividend to HM Treasury.[38] Because the cost of producing coins is high relative to notes, and the face value much lower, the amount of seigniorage generated from coins is very limited. For these reasons, we do not include seigniorage from coins in the figures reported in the rest of this report.

2.3 CENTRAL BANK RESERVES

Unlike banknotes, there is no physical cost to producing reserves. When a central bank such as the Bank of England creates new reserves, it does so by pressing a key on a keyboard to credit a commercial bank's account (usually in exchange for an asset, such as a government bond as discussed in Section 1.2). Seigniorage can be derived from the creation of central bank reserves if the central bank does not pay interest on reserve holdings (in the same way that it does not pay interest on holdings of banknotes). In this case, seigniorage income would be the interest earned on the asset received in exchange for the new central bank reserves.

However, since 2006, the Bank of England has paid interest to commercial banks on their holding of central bank reserves, which is equal to the rate of interest it earns on the assets that correspond to the reserves (typically the Bank rate).[39] As a result, the current framework for central bank reserves is broadly revenue-neutral, and there is no formal seigniorage income earned on the creation of new central bank reserves.[40]

Although no formal seigniorage income is declared from the creation and management of central bank reserves, it can be argued that a form of seigniorage is generated in the form of the Bank of England's cash ratio deposit requirements and QE programme.

The cash ratio deposit rules require eligible institutions (i.e., banks and building societies), to place a set percentage of reserves at the Bank of England which are not remunerated with interest.[41] The Bank of England then invests these funds in interest-yielding assets (mainly in government bonds), and the interest earned is used to fund the costs of its monetary policy and financial stability operations.[42] Although the Bank of England does not formally define this as seigniorage income, it is clear that it is a financial benefit that derives from its control of the monetary system. If the Bank of England did not impose this requirement, the government would have to fund the cost of monetary policy and financial stability operations in some other way (e.g. via taxation). The cash ratio deposit requirements are set by HM Treasury through a Statutory Instrument every five years. In 2016, there were £4,136 million cash ratio deposits at the Bank of England,[43] and the Bank aims to make around £100 million a year from investing these funds to pay for its monetary policy and financial stability operations.[44]

BOX 2. QUANTITATIVE EASING AND SEIGNIORAGE PROFITS

Since 2009, the Bank of England has operated a policy of QE. Under QE the central bank purchases financial assets, like government bonds, from the private sector using newly created central bank reserves. To facilitate this, the Bank of England, together with the Treasury, created a new vehicle for carrying out the QE programme of asset purchases –the Asset Purchase Facility (APF). When the Bank of England conducts QE, it creates new electronic central bank reserves and lends them to the APF which, in turn, uses this money to purchase government bonds from the secondary market. At the time of writing, the Bank of England had purchased £415 billion of government bonds, most of which attract regular coupon payments from the Exchequer. As a result, over time, the APF has accumulated a surplus from these coupon payments.

In November 2012, the government agreed with the Bank of England to transfer to the Exchequer the surplus funds held in the APF. These changes ended the arrangement whereby the government was borrowing money to fund coupon payments to the Bank of England. Commencing in January 2013, the APF transferred £34.7 billion to HM Treasury over a nine-month period. A subsequent process was established whereby funds accumulated after 1 April 2013 would be transferred to HM Treasury on a quarterly basis. The total amount transferred under this arrangement was £26.9 billion as at February 2016, meaning that, overall, the APF has transferred £61.6 billion to HM Treasury as a result of the Bank of England's QE programme.

This could also be viewed as a form of state seigniorage, as the creation of new central bank reserves through the QE programme has effectively cancelled out £61.6 billion of government interest payments. However, it is possible that some of the cash transfers will be reversed in some point in the future when monetary conditions normalise. The ultimate net amount that will be transferred is uncertain, and a wide range of outcomes is possible.[45] Moreover, because the newly created reserves were created as a loan to the APF, the intention is that at some point the loan will be repaid and these new reserves will be withdrawn from the economy. However, this does not change the fact that seigniorage was earned while the reserves were in existence.

In addition, it remains far from certain whether this will ever happen, and many prominent commentators have questioned whether QE will ever be unwound.

3. MODERN COMMERCIAL BANK SEIGNIORAGE

As outlined in Section 1.2, in modern economies most money is created by private commercial banks and other deposit-taking institutions rather than central banks or any other state body. In the UK, only 3% of the money is physical notes and coins whereas 97% is commercial bank deposits.

The same figures for Denmark are 5% and 95%, for Iceland 3% and 97%, and for Switzerland 13% and 87%. Surprisingly, there is very little research on the seigniorage profits that commercial banks generate from their ability to create money.[46]

Because commercial bank money is lent rather than spent into existence it requires a creditworthy person or business to accept the loan and agree to pay an agreed interest rate on it.[47] At the same time, banks also require customer deposits to manage the liability side of their balance sheets (Appendix I). Therefore, banks also pay interest on customer deposits. The traditional source of profits for banks comes from the fact that the interest rate charged on loans is almost always higher than the amount the banking system pays to depositors for the holding of deposits. To some extent, this profit can be justified by the fact that banks take on a credit risk when they make loans (if many loans default, they can become insolvent) and they must generate a profit to build up their capital to cover such defaults. Regulators oblige banks to hold a level of capital that corresponds to the riskiness of their loan portfolio.

Banks' seigniorage profits (as distinct from their general profits) can be seen to arise from the fact that the banks' liabilities (the debt they issue) must be held by all actors in the economy because they act as money. This allows banks to offer a lower rate of return on their borrowing than non-banks that wish to borrow. An obvious comparison is with a P2P lender. In other words, as with central bank seigniorage, commercial bank seigniorage is derived not from increasing the spending power of the bank but because households and firms are prepared to hold a bank's liabilities at a below-market interest rate. Having to hold a proportion of their savings in the form of bank deposits creates an 'opportunity cost' for non-bank money users. They have to do this because, as with the central bank's liabilities, commercial banks' liabilities are money.

3.1 THEORY OF COMMERCIAL BANK SEIGNIORAGE

Commercial bank seigniorage can be understood as the additional costs a bank would have had to incur if, rather than being able to create money with virtually no cost, it was instead forced to first borrow the money it itself then lends out in the market.[48] This is in fact how any non-bank financial intermediary has to operate. For example, a P2P lending platform borrows money from savers, paying a competitive market rate of interest to attract such funds, and then lends this on to borrowers. We can also make a parallel with non-bank companies that borrow and lend to other firms or households. Assuming that a company does not have a surplus of cash reserves to loan out, it could go to the corporate bond market to source the funds it requires to lend on. The profit it generates would now be the interest rate spread between the loan rate (to the household or firm) and the corporate bond rate.

Our model of commercial bank seigniorage is therefore determined by the difference between the interest rate that banks pay holders of their IOUs (deposits) and a benchmark market interest rate that non-bank issuers of debt pay on their IOUs. We calculate the value of commercial bank opportunity-cost seigniorage (henceforth just 'commercial bank seigniorage') in a given time period as commercial bank money outstanding (deposits) multiplied by the spread between the market rate of interest the bank would have incurred had it been a non-bank and the customer deposit rate the bank offers.

Written out, the formula is:

$$S = M\,(i_{mb} - i_d) \quad (1)$$

where:

S = commercial bank seigniorage

M = commercial bank deposits

i_{mb} = market benchmark interest rate

i_d = interest paid on deposits

Two other elements need to be accounted for to accurately reflect the reality of the seigniorage accruing to commercial banks.

First, as explained in Section 2, commercial banks are not free simply to only hold interest-bearing assets in the form of customer loans. They must also hold central bank reserves and cash in order to settle payments with other banks, manage their liquidity, and comply with regulations. Commercial banks thus also forgo some of their potential seigniorage because they are unable to invest those assets in interest-bearing vehicles, like bonds.

If a bank is forced to hold more cash or central bank reserves, the result is an increase in the accrual of seigniorage profits to the central bank and a decrease in seigniorage profits to the commercial bank. This is because the central bank can invest the funds it receives in return for lending out cash and its reserves in interest-bearing assets, as described in Section 2. Several authors have noted that this constitutes a means for the central bank to reclaim some of the seigniorage accrued by commercial banks.[49,50]

When commercial banks' demand for central bank money is lowered, for instance by the implementation of electronic payment infrastructure, an increase in the use of credit cards, or by relaxation of legal reserve requirements, the commercial banks' share of total

seigniorage revenue is increased. In other words, the trade-off between the two creators of money is shifted to the benefit of the commercial banks.

Further complicating matters, however, is the fact that major central banks like the US Federal Reserve and the Bank of England have recently started to pay interest on central bank reserves held by commercial banks. Meanwhile, other countries have implemented negative interest rates on central bank reserves. These reserves are generally remunerated at the central bank rate. Although this rate is very low at the present time, this new development means that the overall opportunity cost to commercial banks of holding reserves is decreased and their seigniorage profits are thus increased.

As well as providing savings products and loans, banks also provide payments services through current accounts. This requires a protocol for allowing payments to be validated, and a network that allows different payment systems, payment terminals, and banks to communicate with each other. It could be argued that the costs of running the payment system should be considered in the commercial bank seigniorage calculation. While running the payments system has costs, however, it also provides a source of profit. UK banks earn over £8 billion each year from providing personal current accounts (PCAs) and a further £2 billion each year from business current accounts (BCAs).[51] As a result, in the commercial bank seigniorage calculation, we have not included costs associated with the payment system.

Taking into account all of these factors leads us to a formulation of commercial bank seigniorage comprising three parts. First, we calculate the cost saved by the bank by virtue of its ability to create money as being the total deposits held at the bank multiplied by the difference between the reference bond interest rate and the customer deposit rate (as in Equation (1)). From this, we subtract the opportunity cost of holding base money. This is calculated by multiplying the total base money, comprising central bank reserves together with notes and coins, by the reference bond interest rate. Finally, to account for the interest accruing to banks for holding central bank reserves, we add the multiplication of reserves by the central bank base rate. The final formula is thus:

$$S = M\,(i_{mb} - i_d) - (M_{cb} * i_{br}) + M_r * i_{br} \quad (2)$$

where:

S = commercial bank seigniorage

M = commercial bank deposits

i_{mb} = market benchmark interest rate

M_{cb} = central bank reserves and cash

i_d = interest paid on deposits

M_r = central bank reserves

i_{br} = central bank base rate

What, then, is the appropriate benchmark market interest rate to use in our calculation of commercial bank seigniorage profits? There is no obvious answer to this question, since banks are unique institutions – they are not governments, or corporations, and they make loans that are both secured (often against real estate) and unsecured. We employ two reference interest rates to highlight that the seigniorage would be within a range depending on the governance of the bank, the type of loan, the quality of the loan book, and how the bank is perceived in the market. At the lower rate, we try and establish what the lower-bound potential for seigniorage could be, while the upper rate represents the highest the seigniorage could be. The average between the two can be taken as our overall figure.

Using the model described, we now calculate commercial bank seigniorage across four countries. We start with a detailed analysis and explanation of variables that we are using for the UK, followed by a briefer analysis of the seigniorage for Denmark, Switzerland, and Iceland. The full data sources used in the calculations are provided in Appendix II.

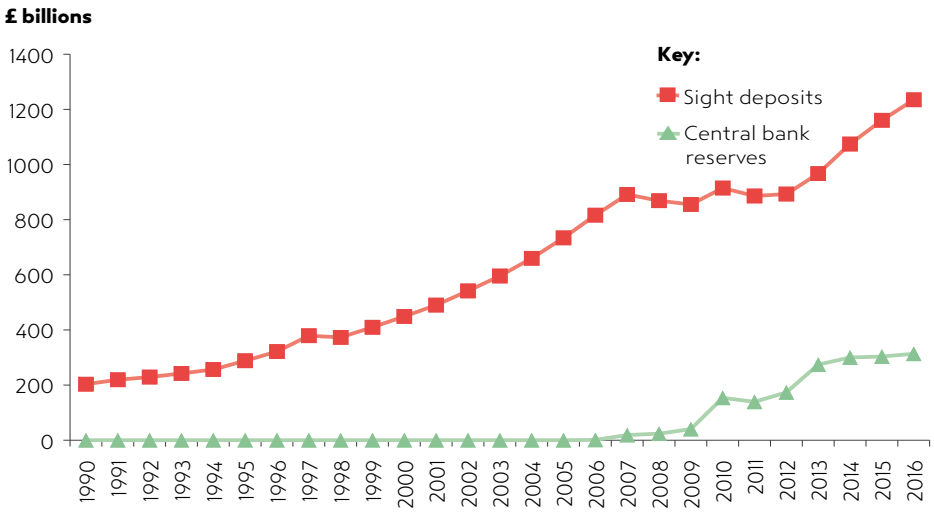
3.2 COMMERCIAL BANK SEIGNIORAGE IN THE UK

We use current account sight deposits as our measure of commercial bank money. This measure is available in all the countries that we are analysing and represents the most conservative measure of commercial bank money, ensuring that our calculation of seigniorage is also conservative.[52] Figure 5 shows the growth of current account deposits since 1990 in the UK alongside the growth of central bank reserves, the two main types of money that inform our seigniorage analysis (physical notes and coins are not shown – they account for only a very small fraction of the total money supply as discussed in Section 1).

The UK had seen a steady growth in bank deposits from 1990 up until the onset of the financial crisis in 2007 relative to central bank reserves, meaning commercial bank seigniorage was likely growing during this period. After 2007, there was a levelling off, as banks contracted their lending and households and firms lost their appetite for taking on additional debt, whilst also paying down outstanding debt. In 2009, the Bank of England began its QE programme, which led to a sharp rise in central bank reserves being held by the banking system and a decline in seigniorage profits, somewhat mitigated by the fact that the Bank started paying interest to banks for holding these reserves at the base rate. In the last few years, however, commercial bank deposits have increased sharply and the gap between deposits and reserves has widened again.

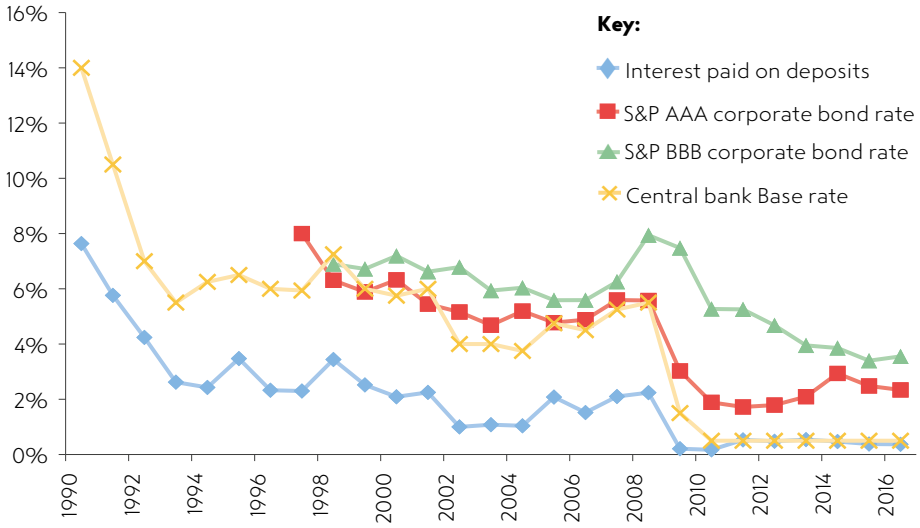
To establish our upper- and lower-bound reference market interest rates for commercial bank seigniorage, we used the S&P Corporate Bond Index. For the lower-bound we used the triple A (AAA) rating index, reflecting the

FIGURE 5. UK CURRENT ACCOUNT SIGHT DEPOSITS HELD AT PRIVATE BANKS AND CENTRAL BANK RESERVES



Source: Bank of England. Data were break adjusted and quarterly data were aggregated by averaging across the four quarters.

FIGURE 6. UK KEY INTEREST RATES (ANNUAL AVERAGES)



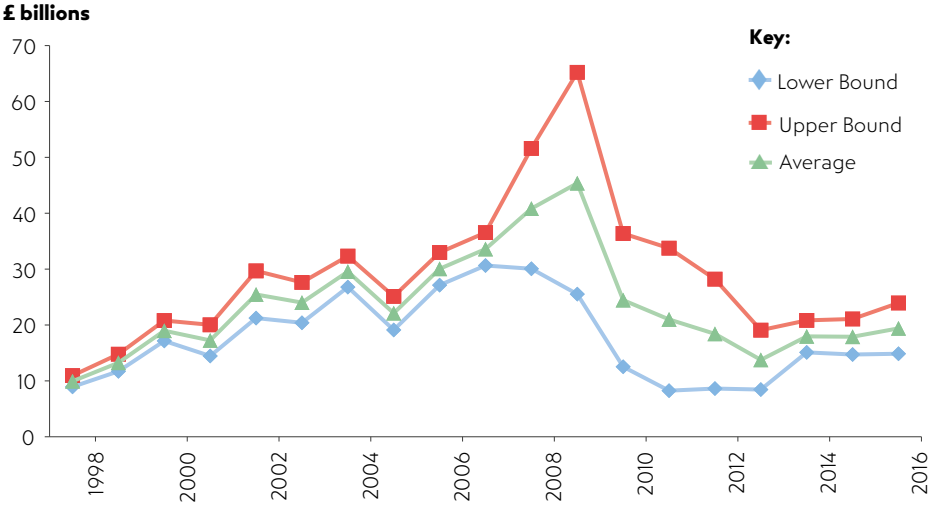
Source: Bank of England, Standard and Poor (S&P) Corporate Bond Indexes

fact that a well-run bank that could not create money would be able to borrow money at a rate similar to the most reputable large companies operating today. We use the triple B (BBB) index as the upper- bound reflecting the lowest investment grade rating and a floor below which a bank could struggle to operate effectively or raise money on the market.

Figure 6 shows how the key interest rates that we have selected have evolved over the last 25 years. The central bank base rate has been dramatically below the long-term average rate of 7%, with a rate of just 0.5% persisting from 2008 to 2016, when it was again reduced to a historic low of 0.25%. It is interesting to note that the base rate had, prior to 2008, never been below 3.5% in the 350-year history of the Bank of England.

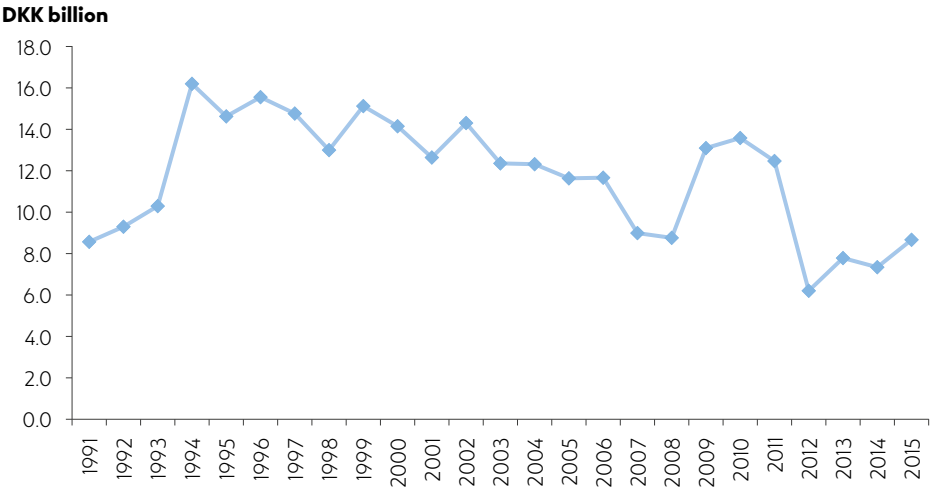
Figure 7 shows our estimate of commercial bank seigniorage going back to 1998, the earliest period that we had data available from the S&P. For the UK, the average lower-bound seigniorage for the period 1997–2016 was £17.6 billion, peaking in 2007 at £30.6 billion. The average upper-

FIGURE 7. COMMERCIAL BANK SEIGNIORAGE IN THE UK, 1998–2016



Source: Authors' calculations

FIGURE 8. COMMERCIAL BANK SEIGNIORAGE IN DENMARK, 1991–2015



Source: Authors' calculations using data from Danish Statistics database.

bound for the same period was £29 billion, peaking in 2009 at £65.2 billion. Averaged across both measures and across all 18 years, commercial bank seigniorage amounted to £23.3 billion per year – 1.23% of average GDP across the period – and a cumulative total of £443 billion.

It is the spread between the selected upper- and lower-bounds and the deposit rate that is one of the main drivers of the seigniorage calculation. The widening gap after the 2007 crisis, especially the rise in BBB interest rate, meant that the post-crash environment saw commercial bank seigniorage rise sharply before falling back to pre-crisis levels.

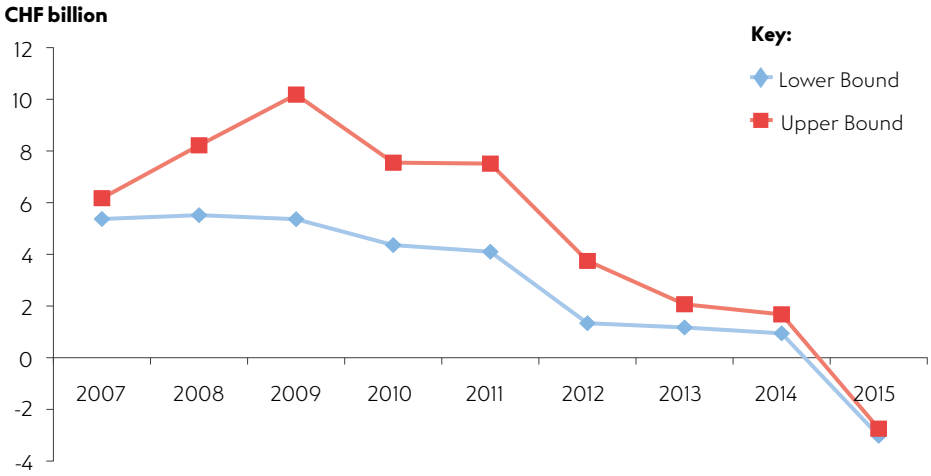
3.3 COMMERCIAL BANK SEIGNIORAGE IN DENMARK, SWITZERLAND, AND ICELAND

Denmark

For Denmark, the average commercial bank seigniorage was 11.7 billion Danish Krona (DKK) a year in the period that we analysed from 1991 to 2015, i.e., 0.7% of GDP averaged across the period. Commercial bank seigniorage profits peaked in 1994 at DKK16.2 billion and has been steadily declining, except for a short period at the start of the financial crisis, to DKK8 billion in 2015.

Denmark does not have a mature corporate bond market, so we were unable to find an equivalent to the reference interest rates that we used in the UK. In Denmark, however, most mortgage debt is issued by banks in the form of bonds which are then purchased by domestic institutional investors.[53] So instead we used the average mortgage bond rate to act as our benchmark interest rate.[54] The decline in Danish seigniorage profits can mainly be explained by the steady fall in the spread between the commercial bank deposit rate and the mortgage market rate – the one exception being the 2009–2011 period when the Danish central bank rapidly reduced the base rate, leading commercial banks to cut the amount they were paying on deposits to a greater extend than a fall in the mortgage bond market rate. Since 2012, the Danish central bank has moved its deposit rate into negative territory, meaning commercial banks now must pay to keep money on deposit with the central bank.

FIGURE 9. COMMERCIAL BANK SEIGNIORAGE IN SWITZERLAND, 2007–2016



Source: Authors' calculations using data from Swiss National Bank.

Switzerland

For Switzerland, the average lower-bound commerical bank seigniorage between 2007 and 2015 was 2.8 billion Swiss Francs (CHF) peaking in 2008 at CHF 5.5 billion. The upper-bound averaged at CHF4.9 billion with its peak in 2009 at over CHF10.1 billion. Averaged across both measures and across all nine years, commercial bank seigniorage amounted to CHF 3.9 billion per year – 0.6% of average GDP across the period – and a cumulative total of CHF 34.8 billion.

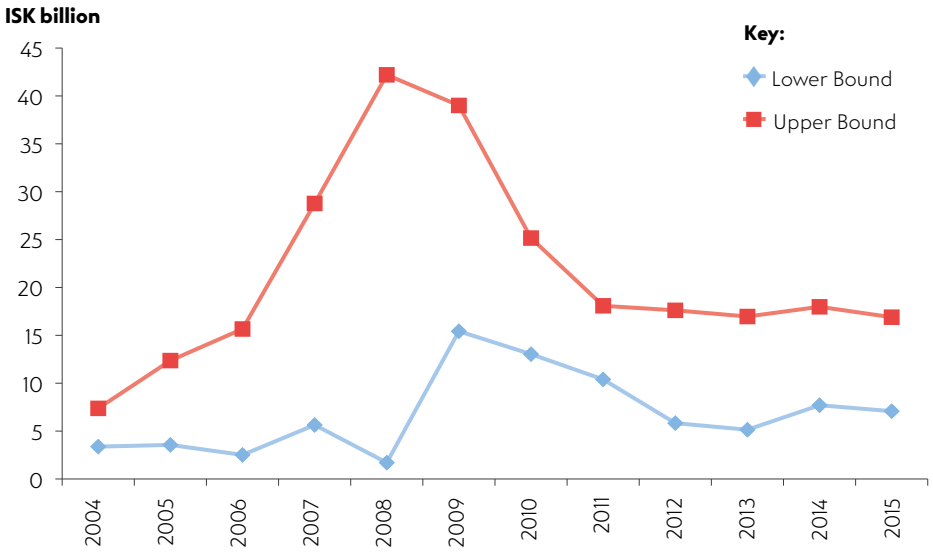
The reference interest rates that we have used for Switzerland are taken from the Swiss Bond Index. Publically available information is only available for the last 10 years, which prevented us from calculating the seigniorage back to the 1990s. In 2015 and 2016, seigniorage was actually negative, as the Swiss National Bank (SNB) implemented negative interest rates on commercial bank deposits and the SBI bond index also fell in to marginally negative territory.

Iceland

Finally, for Iceland, the average lower-bound commercial bank seigniorage from 2004 to today has been 6.8 billion Icelandic Krona (ISK) peaking in 2009 at ISK15.4 billion (Figure 10). The upper-bound averaged at ISK21.5 billion with its peak in 2008 at over ISK42.2 billion. Averaged across both measures and across all 12 years, commercial bank seigniorage amounted to ISK14.1 billion per year – 0.9% of average GDP across the period – and a cumulative total of ISK169.7 billion.

Iceland lacks a sizeable corporate bond market upon which to calculate a benchmark market interest rate. We therefore used 10-year government bonds as a conservative lower-bound. The refusal of Iceland to compensate international depositors due to bank failures should have seen bond yields increase dramatically. However, the contemporaneous imposition of capital controls meant that a lot of capital was locked within Iceland and chasing the safest assets possible. This meant that there was an unnaturally strong market for Icelandic government bonds leading to lower-than-expected bond yields.

FIGURE 10. COMMERCIAL BANK SEIGNIORAGE IN ICELAND, 2004–2016



Source: Authors calculations using data from Central Bank of Iceland

The reference interest rates that we have used for upper bound are taken from the Central Bank of Iceland and relate to the interest rates at which commercial banks made loans to customers on average in the corresponding year.[55]

Although there are problems with using this rate, not least that since it is a loan from a bank it involves money creation, we believe that as an upper-bound, it reflects the absolute maximum seigniorage possible. Taking the average of these two rates gives ISK17.7 billion across the period peaking in 2009 at ISK27.2 billion

A summary of our findings is reported in Table 2.

3.4 DISCUSSION OF RESULTS

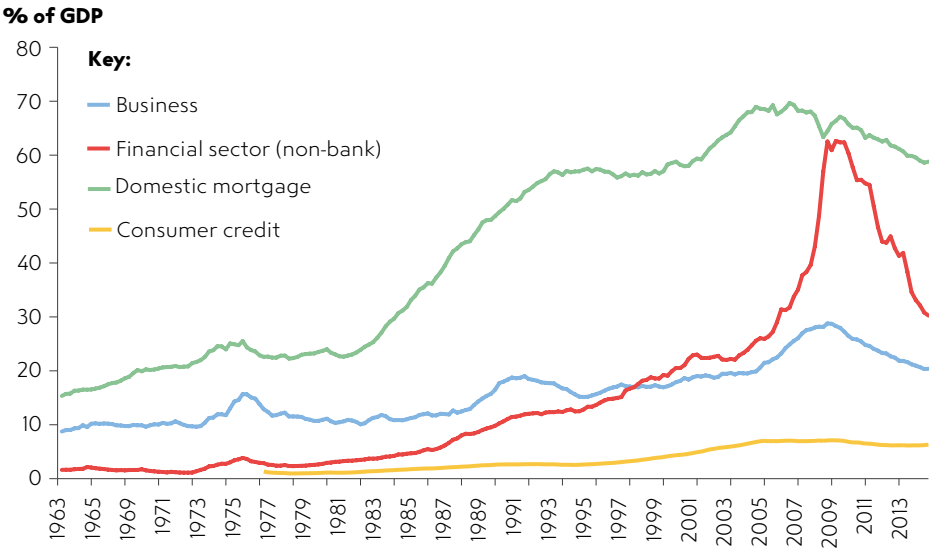
How important a part of modern banks' business models are seigniorage profits? The profitability of the banking sector has been under intense scrutiny since the crisis and the seigniorage gains are part of that profitability, although seigniorage profits are not distinguished in commercial banks' financial statements.

We examined banks' average costs and after-tax profits in the UK and Denmark. In the UK, the average commercial bank seigniorage between 2004 and 2014 represents 73% of banking sector profits, before provisions and tax.[56] We found that commerical bank seigniorage made

TABLE 2. COMMERCIAL BANK SEIGNIORAGE –A SUMMARY OF FINDINGS

COUNTRY	PERIOD STUDIED	AVERAGE ANNUAL COMMERCIAL BANK SEIGNIORAGE	AS % OF GDP	CUMULATIVE COMMERCIAL BANK SEIGNIORAGE
UK	1998–2016	£23.3 billion	1.23%	£443 billion
Denmark	1991–2015	DKK11.7 billion	0.7%	DKK293.4 billion
Switzerland	2007–2015	CHF2.8 billion	0.6%	CHF34.8 billion
Iceland	2004–2015	ISK14.1 billion	0.9%	ISK169.7 billion

FIGURE 11. UK SECTORAL CREDIT STOCKS TO GDP RATIO, 1963–2015



Source: Bank of England and Office of National Statistics.

up 84% of the average profits of the Danish banks (DDK11 billion of DDK13.3 billion between 1991 and 2014).[57] Clearly the banking sector business models of both countries are heavily dependent on commercial bank seigniorage profits.

Should the subsidy banks earn from seigniorage therefore be reduced? Reductions in seigniorage profits could have a negative economy-wide effect if they led to a contraction in bank lending that supports small and medium-sized enterprises (SMEs), for example. However, the historical pattern in most advanced economies and in particular the UK, has been a fall in the proportion of such productive lending relative to total lending, with more and more money flowing to real estate and other financial assets. Indeed, in the UK today, less than 10% of all money flows to non-financial firms. In other words, the majority of commercial bank seigniorage profits are made on money creation that does not support non-financial firms in the real economy.

The trend in the type of credit creation (and thus money creation) by commercial banks is shown in Figure 11, showing total UK outstanding debt versus GDP across several different categories of loan. The figure shows that since the 1980s there has been a significant increase in non-business lending like mortgages relative to GDP, rising from about 20% in 1980 to almost 70% in the early 2000s. In contrast, the level of productive lending to non-financial companies has been stable at between 10 and 20% of GDP.

Increased lending for mortgages can have positive short-term economic effects as people feel wealthier, more financially secure, and can access capital via equity withdrawal. This kind of lending, however, has been shown to have little long-term positive effect on economic growth. A recent study looking at 46 economies found a significant negative correlation between GDP growth and the stock of bank lending for mortgages but positive effects for flows of lending to non-financial corporations.[58] Rapid

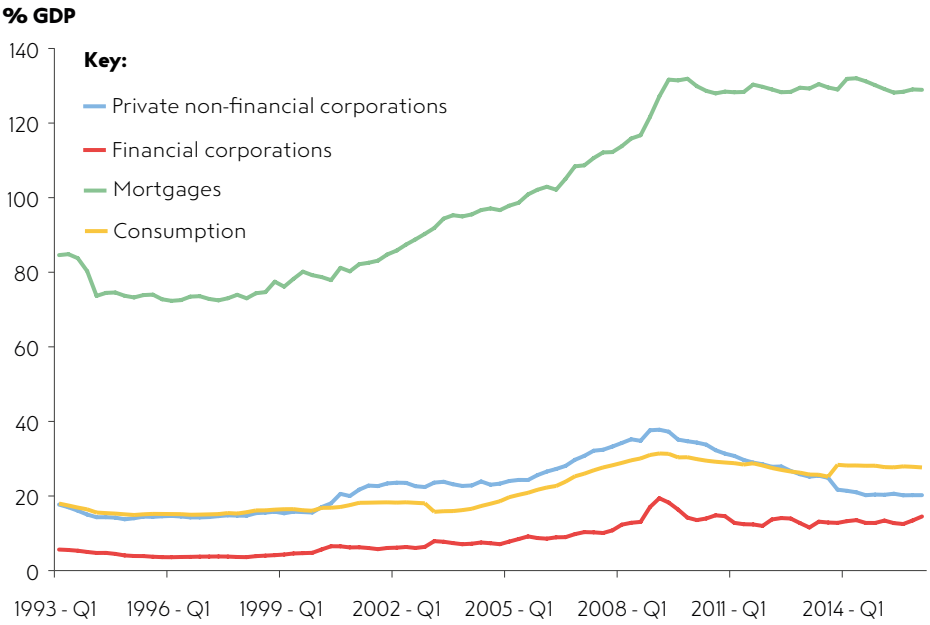
rises in mortgage credit and household credit more generally are also strongly associated with housing bubbles and subsequent bursts and longer and deeper recessions than other forms of financial crisis, for example stock market bubbles.[59]

In Denmark (Figure 12) we see a similar story – a rapid rise in money created for mortgage debt relative to funding to support non-financial firms or consumption. Indeed, Denmark now has the highest levels of household debt (mortgage debt and consumer debt) relative to net disposable income across advanced economies at 284%, suggesting it is highly vulnerable to economic shocks.[60] Having said this, its mortgage market is different from the UK's in that a large proportion of mortgage debt is purchased by institutional investors, making banks less vulnerable to liquidity risk.

In summary, it is not clear that the large commercial bank seigniorage profits are commensurate with the value they are generating in the real economy, given that most of the money they create does not support productive enterprise. This is to say nothing of the very high salaries and bonuses paid out to employees and senior executives in the financial sector and other subsidies the banking sector enjoys, not least the 'Too Big to Fail' subsidy enjoyed by large, systemically important banks. This subsidy arises from the fact that such banks can borrow more cheaply than non-systemic banks because investors know that governments cannot allow them to fail. In the UK, NEF calculated that this subsidy was worth £5.8 billion in 2015.[61] This is perhaps also a form of seigniorage because it is the implicit state guarantee relating to the banks' importance in the monetary system that enables banks to borrow at below market rates.

In the final section of this report, we consider what the implications for seigniorage would be, if a larger proportion of money was created not by commercial banks, but by central banks.

FIGURE 12. DANISH SECTORAL CREDIT STOCKS TO GDP RATIO, 1993–2014



Source: Danish Statistics

4. DIGITAL CENTRAL BANK CURRENCY: IMPLICATIONS FOR SEIGNIORAGE

"The privilege of creating and issuing money is not only the supreme prerogative of government, but it is the government's greatest creative opportunity."

Abraham Lincoln, 1865.

As we have seen, today the majority of money is created not by central banks or any other state body, but by private commercial banks. This means that, contrary to popular wisdom, most seigniorage revenue does not accrue to the public sector but rather to private commercial banks in the form of commercial bank seigniorage, as discussed in Section 3. Because it is not permitted to create money, the government can be seen to forgo a substantive source of income as it must borrow at interest from the private sector when it wishes to spend more money than it receives from taxation.

Between 1990 and the eve of the financial crisis in 2007, the UK government borrowed a total of nearly £500 billion (gross) from the private sector – most of it from commercial banks, insurance companies, pension funds and other financial institutions.[62] The government has paid (or will pay) an estimated £400 billion of interest on this debt – money which is being diverted from other government priorities such as health, education, housing, and infrastructure investment. Since 2007, an increasing proportion of UK government debt has been purchased and held by foreign investors, as the UK has become a safe haven relative to perceived instability in the Eurozone. Interest on this debt is unlikely to flow back to the UK.

In this final section, we consider what economic benefits might arise if a lower proportion of money in the economy was created by private banks and a higher proportion by the state or central bank. One option would simply be to have the entire money supply created by central banks under a 'sovereign money' system.[63] Under this system, the central bank, not commercial banks, would create all electronic money, just as it creates physical banknotes today. Customers would own the money in their bank

accounts, and banks could only loan money that is already in existence. As such, banks would become the true intermediaries that they are often wrongly thought to be today.

Decisions around the creation of new money would be made by the central bank who would aim to maintain price stability and promote economic growth. New money could be injected into the economy by financing government spending in place of taxes or borrowing, by making direct payments to citizens, by paying off outstanding debts, or by making new loans through banks or other intermediaries. All seigniorage profits would flow to the state. As Martin Wolf, Chief Economics Commentator at the Financial Times, explains:

> *"It would also transfer seigniorage – the benefits from creating money – to the public. In 2013, for example, sterling M1 (transactions money) was 80 per cent of gross domestic product. If the central bank decided this could grow at 5 per cent a year, the government could run a fiscal deficit of 4 per cent of GDP without borrowing or taxing. The right might decide to cut taxes, the left to raise spending. The choice would be political, as it should be."*[64]

Another option would be for the central bank to 'recapture' some of the seigniorage that currently accrues to the commercial banking sector by introducing a competing form of electronic money to bank deposits. This issue is particularly relevant because a number of central banks, including the Bank of England and the Swedish central bank, are currently researching the idea of issuing "central bank digital currency" (CBDC) that could be held by households and firms. In February 2015, the Bank of England set out a new research agenda which included the following:[65]

> *"There are several different ways in which a central bank might make use of a digital currency. It could be used as a new way of undertaking interbank settlement, or it could be made available to a wider range of banks and NBFIs. In principle, it might also be made available to non-financial firms and individuals generally, as banknotes are today... From a monetary and financial stability point of view, what are the costs and benefits of making a new form of central bank money accessible to a wide range of holders?"*

A staff working paper published by the Bank in summer 2016 attempted to model the impact of introducing CBDC equivalent to 30% of GDP in the United States.[66] The authors suggested CBDC could be introduced in the same way that central banks have been issuing central bank reserves via QE – the central bank would buy government bonds that would back newly created CBDC that in turn would be held in non-bank, private sector customer accounts. The authors found several potential advantages to such a scheme, including a general reduction in interest rates across the economy, savings to the government that would enable it to reduce taxation, cost savings from more efficient transactions, and greater financial stability. In total, they found that the introduction of CBDC equivalent to 30% of GDP could result in a 3% increase in GDP growth.

What then, would be the impact on the quantity and distribution of commercial bank seigniorage, if digital central bank currency made up a larger proportion of total money in the economy, and what would be the savings realised by the state?

4.1 CALCULATING STATE SEIGNIORAGE WITH CENTRAL BANK DIGITAL CURRENCY

To recap, under current arrangements state seigniorage is only earned on the issuance of physical notes.[67] This seigniorage is limited by the extent to which the public wants to hold cash as opposed to bank deposits. Although cash is still used widely, the demand for it is limited by the fact that it can be impractical to hold and is not connected to the electronic payment system.

At present, if households and businesses want to use electronic money (and access the payments system), they must hold their money in the form of commercial bank deposits – they do not have a way of holding electronic central bank money (i.e., digital cash). As a result, private commercial banks have been able to capture all of the seigniorage income arising from the creation and use of electronic money.

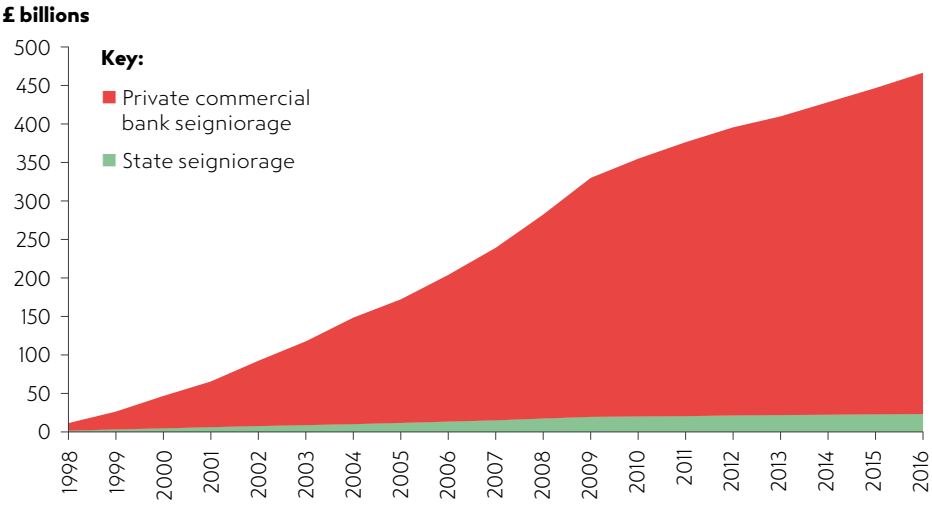
Figure 13 shows the total cumulative seigniorage that has been generated in the UK economy (split by the state and private commercial banks) since 1998, based on the figures reported in Sections 2 and 3 of this report.

Introducing CBDC could allow the state to recapture some of the seigniorage that currently accrues to the commercial banking sector by providing a competing form of electronic money to bank deposits.

To estimate the impact of this, we constructed a simple historical counterfactual which assumed that during the 1998–2016 period, 30% of the money supply each year was held in the form of CBDC rather than bank deposits.[68]

There are several reasons why households and businesses would choose to hold CBDC over commercial bank deposits. While both are forms of electronic money, bank deposits have a credit risk above the amount covered by the government deposit guarantee that is protected by the Financial Services Compensation Scheme (currently £75,000 in the UK). This guarantee only covers private individuals and small businesses; therefore, larger businesses that are not covered by the guarantee (including pension funds and insurers) might find digital cash appealing as it would provide a genuinely risk-free asset while at the same time being more practical than holding physical cash.[69]

FIGURE 13. CUMULATIVE SEIGNIORAGE IN UK ECONOMY – 1998 TO 2015



Note: *Figures in nominal prices. State seigniorage relates to that from note issuance only.*

Since CBDC would be a liability of the Bank of England, it would need to be balanced on the Bank of England's balance sheet by equivalent assets. The Bank of England might well choose to back the digital cash with UK government bonds, just as it has introduced new electronic reserves and commercial bank money in to the financial system via the purchase of (mainly) government bonds through the programme of QE (Box 2, Section 2). The difference would be that rather than creating new electronic commercial bank money backed by central bank reserves in place of government bonds, non-interest-bearing digital central bank cash would be credited to the government and/or customer accounts directly at the Bank of England.[70]

Recall from Section 2 that state seigniorage income is defined as the interest earned on the assets that correspond to the level of non-interest-bearing money.[71] The Bank of England would therefore generate seigniorage income from interest earned on the government bonds which back the CBDC on the Bank of England's balance sheet. As with QE, the interest payments made by the government to the Bank of England would be remitted back to HM Treasury, therefore generating significant cash savings for the government.

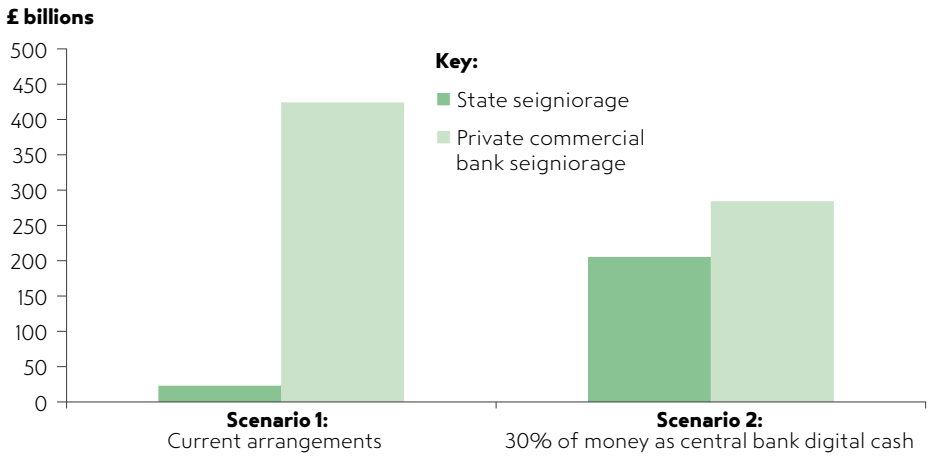
On this basis, we estimate that the government would have saved a total of £182 billion in interest payments between 1998 and 2016, if 30% of the money supply had been held in the form of CBDC rather than bank deposits in each year. On average, these savings amount to 1.8% of total government expenditure each year. Further detail on this calculation is provided in Appendix III.

At the same time, commercial bank seigniorage profits would have fallen from a total of £424 billion over the period to £284 billion. This is because commercial bank seigniorage is based on the amount of commercial bank deposits outstanding, as shown by Equation 2. By swapping commercial bank deposits for new CBDC, some of the seigniorage that currently accrues to the commercial banking sector is recaptured for the public sector.

Figure 14 shows the total amount of state and private seigniorage that accrued between 1998 and 2016 in the UK, along with the counterfactual scenario whereby 30% of the money supply each year was held in the form of CBDC rather than bank deposits. Figure 15 shows the same scenario for Denmark. Here we can see an increase in state seigniorage from DKK32.6 billion to DKK103 billion.

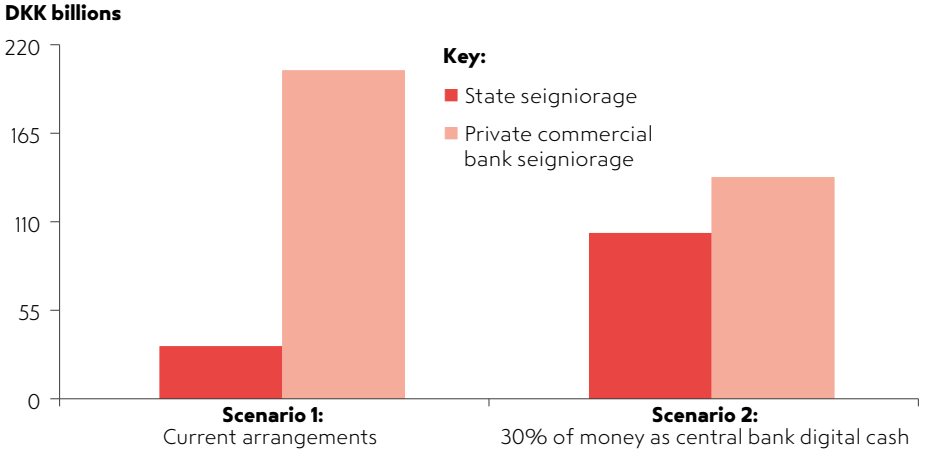
A reduction in commercial bank lending and seigniorage profit might cause a shock to the supply of credit, and in particular mortgage finance, since this is where the majority of modern bank lending flows. This could lead to financial stability issues, if it led to a rapid fall in house prices and household wealth. But such a development might be mitigated if new money created by the central bank supported investment in the real economy and helped to boost productivity. Overall, a reduction in household debt to GDP ratios enabled by a switch away from interest-bearing debt is likely to have long-term beneficial effects on the economy.[72]

FIGURE 14. TOTAL SEIGNIORAGE BETWEEN 1998 AND 2016 – UK



Note: *Figures in nominal prices*

FIGURE 15. TOTAL SEIGNIORAGE BETWEEN 1998 AND 2016 – DENMARK



Note: *Figures in nominal prices*

CONCLUSION

Debates about the future of money, and who creates money, need to consider the unique profits than can be generated from money creation.

For example, if we were to abolish cash so that all money was digital bank money and all transactions done with credit cards, mobile phones, or online, the result would be a significant increase in commercial bank seigniorage as banks would no longer need to hold cash in case people withdrew their deposits as physical notes and coins. A greater proportion of banks' assets would be interest-bearing loans.

In contrast, if central banks were to commence issuing digital cash and allow households, firms, and the state to hold accounts directly with them, rather than payments being intermediated through the banking system, this would lead to a major increase in state seigniorage profits, resulting from a fall in interest payments on borrowing and a corresponding decline in commercial bank seigniorage. Indeed, commercial banks' entire business model would likely have to change. If central banks increased their seigniorage profits, more of this money would be returned to the state to support public spending and taxation priorities.

Of course, reductions in seigniorage profits could have a negative economy-wide effect, particularly if they led to a contraction in bank lending that supports investment by SMEs, for example. However, given that in many advanced economies, the proportion of newly created commercial bank money that directly supports the non-bank business sector is very small (e.g. in the UK it is less than 10%), a more mixed economy of money creation, with a larger role for public money seems feasible.

Therefore, it is encouraging to see the Bank of England considering the option of CBDC. We believe such an option would be beneficial, and not only in terms of reducing the stock of interest-bearing debt facing future generations. Such an option would also give central banks an additional policy tool to help boost demand when interest rates are already very low. If the central bank credited government accounts with digital cash in exchange for government bonds, for example, these funds could then be used to

support governments to invest in much needed capital projects – for example, affordable housing and greener transport and energy infrastructure.[73] Alternatively, the central bank could directly credit the accounts of households enhancing consumption or enabling households to reduce debt overhang – so-called helicopter money.

Having direct access to digital cash might also enable greater financial inclusion (many poorer households lack access to digital payment platforms), reduce financial instability (there would not be runs on central bank digital deposits), and reduce transaction costs. Ultimately, these proposals could help in a shift to a more democratic control of our monetary and banking system as well as breaking up the commercial bank control over money creation and related seigniorage profits.

APPENDICES

APPENDIX I: BANK SOLVENCY AND LIQUIDITY

If banks can create money, then how do they sometimes go bust? After all surely they can just create more money to cover their losses? There are two ways that banks can get into trouble: insolvency and a liquidity crisis.

A bank is deemed solvent when its assets are greater than its liabilities. If some of the customers the bank has granted loans to default on their loans, this reduces the bank's assets. Initially this is not a problem – the bank can absorb loan defaults up to the value of its shareholder equity without depositors suffering any losses (although the shareholders will lose the value of their equity). However, if more and more of the bank's borrowers default on their loans, the bank's assets may fall below the value of its liabilities as its shareholders' equity gets wiped out and the bank becomes insolvent. This means that even if the bank sold all its assets, it would still be unable to repay all its depositors. Creating new money by extending new loans will not help this, because doing so creates both an asset (the loan) and a liability (the customers' deposit in the bank account) and does not create any net new assets.

A bank can also become insolvent through a liquidity crisis, or what is commonly referred to as a bank run. This can happen if a bank experiences a rapid increase in demand for cash withdrawals, perhaps due to a panic caused by a news story. Because banks only hold a small amount of physical cash relative to the total amount of bank deposits, they can quickly run out. If this happens, a bank can exchange some of its holdings of central bank reserves for cash with the Bank of England (Section 1.2). However, because banks only hold a small amount of central bank reserves relative to the total amount of bank deposits too, the bank can easily run out of both cash and central bank reserves.

At this point, the bank may have liquid assets, such as bonds and shares, which it could sell quickly to raise additional cash and central bank reserves to continue meeting the demand for cash withdrawals. Once these liquid assets have been depleted, however, the bank will no longer be able to meet the demand for withdrawals. At this point the bank may still technically be solvent; however, it will be unable to facilitate any further withdrawals as it has literally run out of cash. If the bank is unable to borrow additional cash or reserves from other banks or the Bank of England, the only way left for it to raise funds will be to sell off its illiquid assets; for example, its loan book. If the bank has to sell in a hurry, it may have to sell its loan book at a significant discount which may result in the bank's assets falling to below the value of its liabilities, thereby making it insolvent. Again, creating new money by extending new loans will not help this because the problem stems from a lack of central bank money, not a lack of commercial bank deposits.

APPENDIX II: DATA SOURCES

UK

	DESCRIPTION	SOURCE
COMMERCIAL SIGHT DEPOSITS	Quarterly levels/changes of monetary financial institutions' sterling and all foreign currency M1 (UK estimate of EMU aggregate) liabilities to private and public sectors (in sterling millions) not seasonally adjusted.	Bank of England statistical database codes LPQVWYE and LPQVWXS
CENTRAL BANK RESERVES AND CASH	Monthly average of amounts outstanding (on Wednesdays) of Bank of England Banking Department sterling reserves balance liabilities (in sterling millions) not seasonally adjusted, and Monthly average amount outstanding of total sterling notes and coin in circulation, excluding backing assets for commercial banknote issue in Scotland and Northern Ireland total (in sterling millions) not seasonally adjusted	Bank of England statistical database code LPMBL22 and LPMAVAA
INTEREST RATE PAID ON DEPOSITS	Monthly interest rate of UK monetary Financial institutions (excl. Central Bank) sterling instant access deposits from households (in percent) not seasonally adjusted	Bank of England statistical database code IUMTHAK
CENTRAL BANK RESERVES	Monthly average of amounts outstanding (on Wednesdays) of Bank of England Banking Department sterling reserves balance liabilities (in sterling millions) not seasonally adjusted	Bank of England statistical database code LPMBL22
CENTRAL BANK BASE RATE	Bank of England Official Bank Rate	Statistical Interactive Database - official Bank Rate history
MARKET BENCHMARK INTEREST RATE – UPPER BOUND	S&P U.K. BBB Investment Grade Corporate Bond Index	S&P Dow Jones Indices
MARKET BENCHMARK INTEREST RATE – LOWER BOUND	S&P U.K. AAA Investment Grade Corporate Bond Index	S&P Dow Jones Indices
CREDIT STOCKS AS A % OF GDP	Quarterly amounts outstanding of Monetary Financial Institutions sterling net lending to...', seasonally adjusted (sterling millions). Credit levels are break adjusted recursively using the flows data. Nominal GDP	Bank of England statistical database, Table A4.1, series' LPQ ONS, code YBHA, 'GDP at market prices' series

DENMARK

	DESCRIPTION	SOURCE
COMMERCIAL SIGHT DEPOSITS	Monthly levels. Before oct. 2013 calculated as M1 – coins and notes in circulation. After oct. 2013 Sight deposits independent stated in DNMNOGL.	Danish statistics, www.statistikbanken.dk, codes DNMNOGL and DNM1KOR
CENTRAL BANK RESERVES AND CASH	Monthly levels. Monetary-policy deposits, Net current accounts and notes and coins in circulation.	Danish statistics, www.statistikbanken.dk, codes DNSNB1, DNMNOGL and DNM1KOR
INTEREST RATE PAID ON DEPOSITS	Estimated as average interest rate from quarterly rates before 2003, and monthly rates from 2003.	Danish statistics, www.statistikbanken.dk, codes MPK9 (before 2003) DNRUIPI (from 2003)
CENTRAL BANK RESERVES	Monthly levels. Monetary-policy current account deposits.	Danish statistics, www.statistikbanken.dk, codes DNSNB1.
CENTRAL BANK BASE RATE	Monthly certificate of deposit rate.	Danish statistics, www.statistikbanken.dk, codes MPK3.
MARKET BENCHMARK INTEREST RATE – UPPER BOUND	N/A	N/A
MARKET BENCHMARK INTEREST RATE – LOWER BOUND	Monthly rate on unit mortgage bonds.	Danish statistics, www.statistikbanken.dk, codes MPK3.
CREDIT STOCKS AS A % OF GDP	Mortgage, financial and secured lending Unsecured lending subtracted from mortgage lending. Quarterly nominal GDP	Danish statistics Table DNMUD and DNSEKT3 Table DNSEKT2 and DNRUDDKI. Table NKN1

ICELAND

	DESCRIPTION	SOURCE
COMMERCIAL SIGHT DEPOSITS	Broad money – Current accounts	Central Bank of Iceland Monetary statistics
CENTRAL BANK RESERVES AND CASH	Broad money – DMBs' deposits + Notes and coins	Central Bank of Iceland Monetary statistics
INTEREST RATE PAID ON DEPOSITS	Deposit Money Banks' rates and penalty rates in percent p.a. – General savings accounts	Central Bank of Iceland Monetary statistics
CENTRAL BANK RESERVES	Broad money – DMBs' deposits	Central Bank of Iceland Monetary statistics
CENTRAL BANK BASE RATE	Central Bank of Iceland's current account interest rates	Central Bank of Iceland Monetary statistics
MARKET BENCHMARK INTEREST RATE – UPPER-BOUND	Central Bank of Iceland Deposit Money Banks' rates and penalty rates in percent p.a.: Non-indexed loans – lowest rate	Central Bank of Iceland Monetary statistics
MARKET BENCHMARK INTEREST RATE – LOWER-BOUND	Central Bank of Iceland Deposit Money Banks' rates and penalty rates in percent p.a.: Non-indexed loans – highest rate	Central Bank of Iceland Monetary statistics

SWITZERLAND

	DESCRIPTION	SOURCE
COMMERCIAL SIGHT DEPOSITS	Monetary aggregate M1 minus currency in circulation	Swiss National Bank
CENTRAL BANK RESERVES AND CASH	Banknotes in circulation and sight deposit accounts of domestic banks	Swiss National Bank
INTEREST RATE PAID ON DEPOSITS	Published interest rates for new business – sight deposits	Swiss National Bank
CENTRAL BANK RESERVES	Sight deposit accounts of domestic banks	Swiss National Bank
CENTRAL BANK BASE RATE	Swiss Average Rate Overnight (SARON)	Swiss National Bank
MARKET BENCHMARK INTEREST RATE – UPPER-BOUND	Swiss Bond Index (SBI®) – BBB corporate bond	Six Swiss Exchange
MARKET BENCHMARK INTEREST RATE – LOWER-BOUND	Swiss Bond Index (SBI®) – AAA corporate bond	Six Swiss Exchange

APPENDIX III: CALCULATING STATE SEIGNIORAGE WITH CENTRAL BANK DIGITAL CURRENCY

TABLE A1. 30% OF THE MONEY SUPPLY HELD AS CENTRAL BANK DIGITAL CURRENCY

YEAR	SIGHT DEPOSITS (£ BILLION)	SIGHT DEPOSITS REDUCED BY 30% (£ BILLION)	REPLACED BY EQUIVALENT AMOUNT OF CENTRAL BANK DIGITAL CURRENCY (£ BILLION)	CENTRAL BANK GOVERNMENT BOND HOLDINGS REQUIRED TO BACK CENTRAL BANK DIGITAL CURRENCY (£ BILLION)
1998	373	261	112	112
1999	410	287	123	123
2000	449	314	135	135
2001	490	343	147	147
2002	542	379	162	162
2003	596	417	179	179
2004	660	462	198	198
2005	734	514	220	220
2006	816	571	245	245
2007	891	624	267	267
2008	869	608	261	261
2009	855	599	257	257
2010	915	640	274	274
2011	886	620	266	266
2012	893	625	268	268
2013	967	677	290	290
2014	1,074	752	322	322
2015	1,161	812	348	348
2016	1,235	864	370	370

To estimate the impact of introducing CBDC on the level of state and private seigniorage, we construct a simple historical counterfactual which assumes that during the 1998–2016 period, 30% of the money supply each year was held in the form of CBDC rather than commercial bank sight deposits. Since CBDC would be a liability of the Bank of England, it would need to be balanced on the Bank of England's balance sheet by equivalent assets. The Bank of England would back the digital cash with UK government bonds which it would purchase on the secondary market, just as it has done through the programme of QE. Table A1 shows the data used in constructing this historical counterfactual.

Recall from Section 2 that state seigniorage income is defined as the interest earned on the assets that correspond to the level of non-interest-

TABLE A2. SEIGNIORAGE FROM CENTRAL BANK DIGITAL CURRENCY

YEAR	GENERAL GOVERNMENT GROSS DEBT*	CENTRAL BANK GOVERNMENT BOND HOLDINGS (£ BILLION)	PROPORTION OF GOVERNMENT DEBT OWNED BY CENTRAL BANK	TOTAL INTEREST PAID ON GOVERNMENT BONDS+ (£ BILLION)	INTEREST PAYMENTS PAID TO CENTRAL BANK AND REMITTED BACK TO HM TREASURY (£ BILLION)
1998	408	112	27%	29	8
1999	411	123	30%	25	8
2000	403	135	33%	26	9
2001	388	147	38%	22	8
2002	407	162	40%	21	8
2003	446	179	40%	22	9
2004	507	198	39%	25	10
2005	553	220	40%	26	11
2006	597	245	41%	29	12
2007	643	267	42%	31	13
2008	785	261	33%	32	11
2009	980	257	26%	32	8
2010	1,194	274	23%	47	11
2011	1,329	266	20%	50	10
2012	1,425	268	19%	49	9
2013	1,500	290	19%	49	9
2014	1,605	322	20%	45	9
2015	1,666	348	21%	45	9
2016	1,705	370	22%	48	10
TOTAL	-	-	-	-	**182**

*** Source:** ONS code BKPX
+ Central government gross debt interest payments, net of Asset Purchase Facility.

bearing money.[74] The Bank of England would therefore generate seigniorage income from interest earned on the government bonds which back the CBDC on the Bank of England's balance sheet. As with QE, the interest payments made by the government to the Bank of England would be remitted to HM Treasury, therefore generating significant cash savings for the government. As shown in Table A2, we assume that the amount of interest paid that is remitted to HM Treasury is proportional to the amount of government bonds owned by central bank, relative to the total outstanding stock of government bonds.

On this basis, we estimate that the government would have saved a total of £182 billion in interest payments between 1998 and 2016 if 30% of the money supply had been held in the form of CBDC rather than bank deposits in each year. On average, these savings would have amounted to 1.8% of total government expenditure each year. At the same time, commercial bank seigniorage profits would have fallen from a total of £424 billion over the period to £283 billion.

ENDNOTES

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46. Exceptions include Huber, J. & Robertson J. (2000). *Creating New Money*, London: NEF; Baltensperger, E. & Jordan, T. J. (1997). Seigniorage, banking, and the optimal quantity of money. *Journal of Banking & Finance*, 21(6), 781–796; Huber, J. (2014). *Monetäre Modernisierung: Zur Zukunft der Geldordnung: Vollgeld und Monetative, 4th Edn*. Marburg: Metropolis Verlag.
47. In addition, banks often require some form of collateral, such as property, in order that their risk is covered.
48. Richard Werner explains the legal and institutional framework that enables banks liabilities to simultaneously be money. Banks are exempted from 'Client Money Rules' legislation, which means, unlike other firms, they do not have to segregate client money from their own funds. This 'enables banks to classify their accounts payable liabilities arising from bank loan contracts as a different type of liability called "customer deposits".' Werner, R. A. (2014). How do banks create money, and why can other firms not do the same? An explanation for the coexistence of lending and deposit-taking. *International Review of Financial Analysis, 36*, 71–77.
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67. As we discuss in Section 2.2, benefits arising from the cash deposit ratio and quantitative easing could also be classified as seigniorage income. However, in this section we continue to use the Bank of England's own definition of seigniorage, which relates to note issuance only.
68. If users simply switch from holding physical cash to holding the equivalent amount of digital cash, this will have no impact on the seigniorage collected by the Bank of England (since the amount of outstanding non-interest bearing liabilities of the Bank of England will not change). However, if users who currently hold bank deposits choose to switch to holding digital cash, this will increase the level of seigniorage revenue.
69. For other reasons why private sector agents would choose to hold central bank digital currency over commercial bank deposits. Dyson, B. & Hodgson, G. (2016). *Digital Cash: Why central banks should start issuing electronic money*. London: Positive Money.
70. There are several ways in which central bank digital currency could be introduced into the economy. Dyson, B. & Hodgson, G. (2016). *Digital Cash: Why central banks should start issuing electronic money*. London: Positive Money.
71. While commercial banks pay interest on deposits, it is assumed that CBDC would not be non-interest bearing in the same way that physical cash is. If, however, the central bank decided to pay interest on CBDC, then this would reduce the amount of seigniorage that would accrue to the public purse.
72. Dyson, B. & Jackson, D. (2012). *Modernising Money.* London: Positive Money, provides an outline for how a transition from commercial bank money to central bank issued digital currency could be managed smoothly (p. 219–235).
73. Adair Turner has argued that this kind of 'monetary financing' is appropriate in economies with very high levels of public and private debt and low growth and inflation –Turner, A. (2016). *Between Debt and the Devil*. Princeton: Princeton University Press.
74. While commercial banks pay interest on deposits, it is assumed that CBDC would not be non-interest bearing in the same way that physical cash is. If, however, the central bank decided to pay interest on CBDC, then this would reduce the amount of seigniorage that would accrue to the public purse.

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