Money as Debt in REA and POA

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"Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist." - Kenneth Ewart Boulding, system scientist and economist.

Abstract. When issuing loans to their customers, banks seemingly create money, i.e. value, out of nothing. This represents an interesting challenge to REA modeling, where creating value out of nothing violates the second REA axiom. This paper presents a brief analysis of money-creation processes and REA and POA models of these processes.

1 Introduction

Economists (McLeay et al. 2014, Ryan-Colllins et al. 2013, Wikipedia: Money Creation) recognize three types of broad money that represent the overall money supply to the economy: (i) bills and coins, also called fiat money, (ii) central bank reserves (deposits of banks at the central bank), and (iii) bank demand deposits. Bills and coins plus central bank reserves are created by a central bank and are often called base money. Bank demand deposits are money created by commercial banks via credit (loans) to their customers.

Regulators in most countries specify conditions under which commercial banks may provide loans to their customers. Best known are probably Fractional Reserve Requirements, which specify how much money a bank has to hold as a function of its liabilities. Commercial banks may typically lend their customers several times more than the bank's "high powered money", which are the bank's deposit at the central bank plus bills and coins at the banks vault. This ratio, also called money multiplier, depends on a country and time period, for example, in the USA the ratio is believed to be around ten, but in the UK there is no limit since 1971. In the absence of regulation, the real limitation of how much money the banks create is just the confidence and incentives of the banks.

These rules allow commercial banks to provide liquidity to their customers (Diamond, Dybvig 1983, Diamond 1997), i.e. to create new money, up to the limit set by the regulators. Regulators often impose additional requirements limiting the amount of money the banks can create. For example, Basel III global regulatory standard (Basel III, 2014) imposes capital requirements calculated as a function of risk-weighted assets, which also limits the maximum amount that banks can lend.

In this paper we focus on the actual mechanism of creating money by commercial banks *at the operational level*. Specification of the rules the regulators impose on banks, such as the formulas specifying fractional reserve requirements or Basel III capital requirements can be modeled at the policy level, and for the time being is out of scope of this paper.

2 How Banks Create Money

A loan is a contract between a bank and a customer, where the customer promises to repay the loan plus interest in the agreed period of time in the future. The bank considers a loan an asset, worth at least the loaned amount. Therefore, the bank posts

the loan on an asset account, and balances this asset by an entry on a liability account of customer's deposit; these accounts are also called demand deposits, deposit liabilities, sight deposits, bank credit, bank liabilities, and these terms are often used in the banking jargon interchangeably. A simple accounting example of this mechanism is illustrated in Fig. 1., where a loan to a customer of 10.000 currency units is posted as a debit (an increase) of an asset account, and liability of 10.000 currency units is a credit (also an increase) of that customer's deposit account.

ASSETS Loan account	LIABILITIES Deposit account
10.000	10.000

Fig. 1. Balance sheet entries illustrating mechanism of money creation

The money the bank created represent real value, the balance on the deposit account can be exchanged for goods and services or converted to bills and coins. To summarize, the money creation process encompasses two steps: (i) customer signs a loan contact, (ii) bank increases the balance of the deposit account by the loaned amount. This increase of the deposit account balance represents new money, which the bank created, seemingly out of nothing[1].

3 The REA Model of Money Creation

The mechanism described above, allowing commercial banks to create new money seemingly out of nothing, represents an interesting challenge in REA modeling, as it violates the second REA axiom (Geerts, McCarthy 2002).

The second REA axiom states that "All events effecting an outflow must be eventually paired in duality relationships with events effecting an inflow and vice-versa." (Geerts, McCarthy 2002, page 12). The second axiom applies for both exchange and conversion processes, as inflow encompasses REA relationships take and production, and outflow encompasses use, consumption and give (Geerts, McCarthy 2002, Fig. 3). Consequently, the second REA axiom specifies that an economic resource can only be created by using or consuming another economic resources, but not out of nothing.

The *Loan contract* in Fig. 2., is a contract containing a commitment *Loan*, with reciprocal commitments *Repayment* and *Interest payment*. The main idea of the REA model in Fig. 2., illustrating the money creation process, is that at the economic event *Loan*, an economic agent *Bank* provides and a *Customer* receives economic resource *Money*, and in the same transaction the *Bank* receives and *Customer* provides the same *Money* in a *Deposit* event. This is a purely accounting operation that does not change the aggregated quantity of the resource *Money*, but increases quantity of the materialized claim *Deposits*, representing *Customer's* deposit account, compensated by a corresponding change in the materialized claim *Loans*.

In other words, a *Customer* can at any time deposit his own money to the *Bank*, as an economic event *Deposit*, which increases balance of his deposit account. Balance of his deposit account can also be increased by taking a loan, using the mechanism described above. This process does not create any new money, because the *provide* and *receive* stockflows occurring simultaneously cancel each other's effect on the resource *Money*.

[1] This statement will be later refined.

When a claim *Deposits* exists, representing liability of a *Bank* to the *Customer*, the *Customer* can at any time withdraw the *Money*, thus reducing the quantity of the claim *Deposits*. However, the *Withdrawal* event does transfer *Money* from the *Bank* to the *Customer*, therefore, a *Bank* needs enough *Money* for the eventual *Withdrawal* event. As the total balance of the deposit accounts can be unlimited (limited only by policies, as shown earlier), the *Bank* needs a *Seemingly Endless Source of Money*. This concept will be analyzed later.

To summarize – the REA model shows that banks do not create money, literary speaking. Banks create credit (in the REA model a materialized claim representing Bank's liabilities). This credit is settled when the customer withdraws money from the bank.

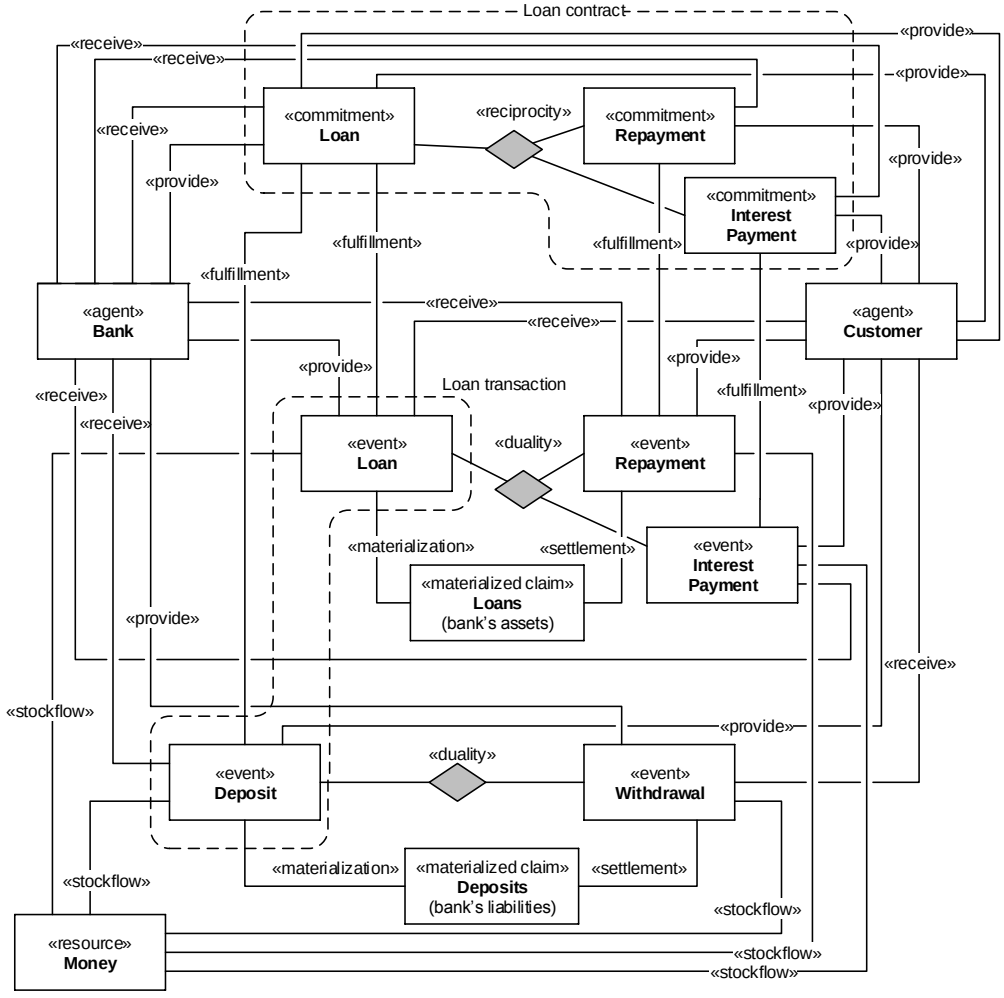

Fig. 2. REA model of money creation

The REA model above has several features worth noting for future development of the REA ontology. As the *Deposit* and *Loan* events must occur simultaneously, and REA ontology does not have a concept of transaction (a group of events occurring simultaneously) these events are bound by the commitment *Loan*. However, the commitment *Loan* is a promise of both an increment and decrement; it is fulfilled both by an increment and by a decrement event. This model does not violate any REA axioms yet (REA axioms only exist for economic events, but not for commitments),

but if axioms at the commitment level would ever be formulated, they should allow for this case. Consequently, the commitment axioms should allow for a single commitment to be related by both «provide» and «receive» relationships to a single agent. Also, note the *Loan* commitment is fulfilled by events in different processes, which is also unusual, although it does not violate any REA modeling rules. An alternative, perhaps more elegant solution would be to introduce transactions to the REA ontology (as groups of events occurring simultaneously), then the "hybrid" commitment could be split into an increment and a decrement commitment.

4 The POA Model of Money Creation

Note that although all POA models (Possession, Ownership, Availability) (Scheller, Hruby, 2016) are constructed in the independent-view, that is, from a perspective of an independent observer, the corresponding actions of the roles can be named differently, such as Lend and Borrow. In the model in Fig. 3. we used the same names for the corresponding actions, such as Loan, as it makes comparison with the REA model easier.

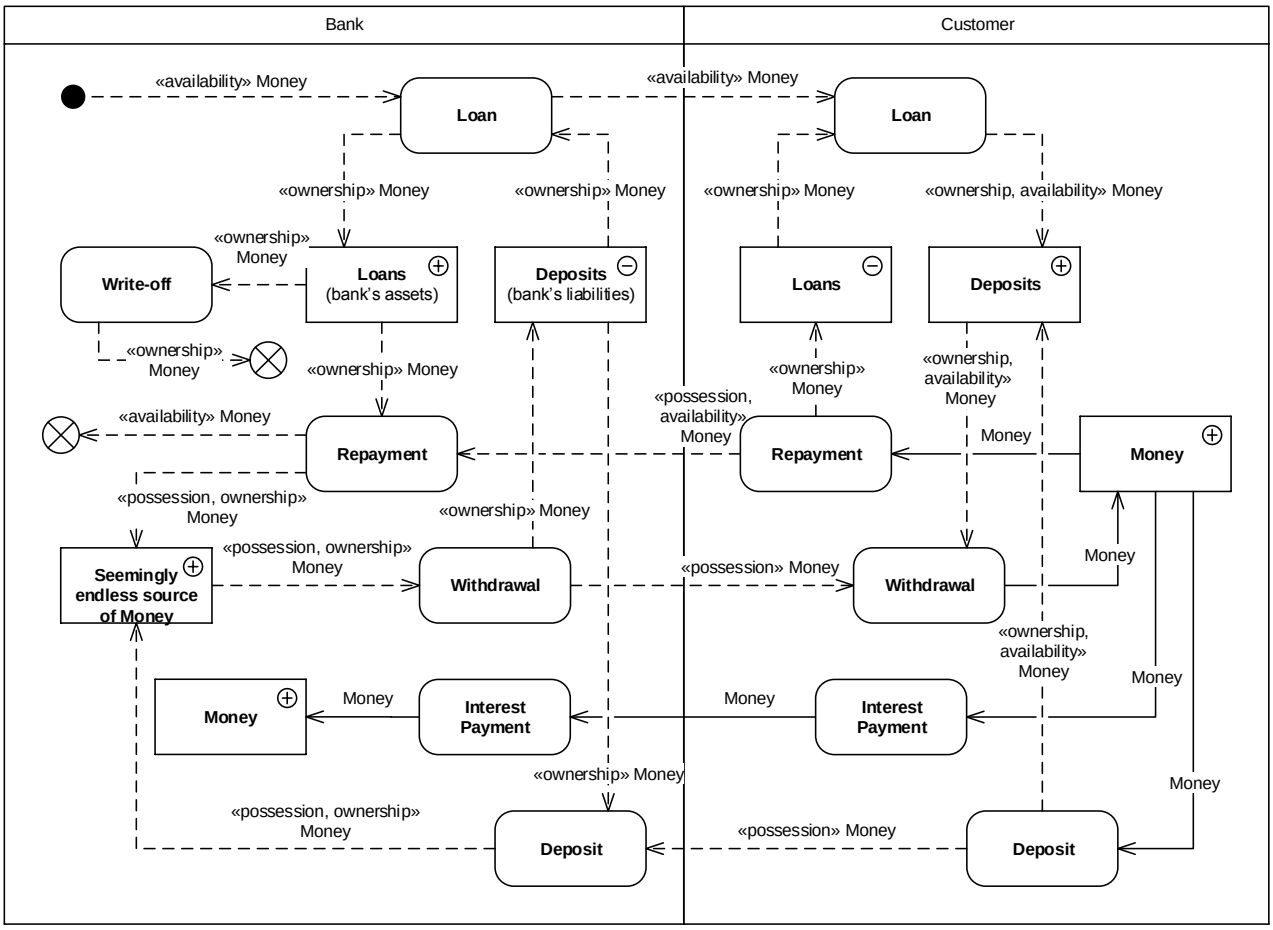

Fig. 3. POA model of money creation

The main idea of the POA model, representing the same scenario and illustrated in Fig. 3., underlines liquidity creation as one of the main functions of banks. Liquidity is represented as availability of the economic resource *Money*, and the *Loan* action transfers it from the *Bank* to the *Customer*.

As explained by (Scheller, Hruby, 2016), POA defines claim as a difference between possession and ownership; a liability or negative claim exists if an agent possesses something he does not own, and a positive claim exists if an agent owns something he does not possess. Therefore, the bank's repository *Deposits* represents *Money* that *Bank* owes to the *Customer*, and the repository *Loans* represents *Money* the *Customer* owes to the *Bank.* Besides of providing liquidity, the *Loan* action represents transfer of *Money* ownership from one repository to another (similarly to the REA model), which does not influence the total quantity of *Money,* neither for the *Bank* nor for the *Customer*, but creates claims that balance each-other out.

During the *Withdrawal* action, money is transferred from the bank's seemingly endless source of money to the customer. However only possession of money is transferred. The ownership of money is used to decrease the bank's liability represented by the deposit repository. Like in the REA model, a *Customer* can deposit his own *Money* to the bank; the *Deposit* action transfers possession of *Money* to the bank, but not ownership or availability of *Money*. The *Loan* event transfers ownership from one repository to another, therefore the balances of the *Loans* and *Deposits* repositories are not limited at the operational level (in POA, balance of a possession repository cannot be negative, but there are no constraints for ownership and availability repositories). Therefore, the amount of availability of money created can be limited only at the policy level, by the regulators of the financial markets, or by the banks themselves.

The POA model can easily illustrate what happens when a Customer cannot repay the loan in full, by the *Write-off* action, which destroys *Bank's* ownership of *Money*. We leave the solution on how to represent the write-off action in the REA model for the discussion at VMBO.

5 Seemingly Endless Source of Money

The POA model (but not the REA model) shows that the seemingly endless source of money represents ownership and possession of money, but not availability. Therefore, there must exist a repository of money, which banks can own and possess, typically in the electronic form, as a balance of an account, but which is not available to the banks.

The existence of a seemingly endless source of money is a defining characteristic of a bank. The knowledge that the bank has access to a seemingly endless source of money gives customers the confidence to put their money in the bank. If customers lose their faith in the bank, they may make a run on the bank, and the bank may go bankrupt.

Under normal circumstances the seemingly endless source of money is just that: seemingly endless, similarly as escalator is a seemingly endless source of stairsteps. The reason is that the bank system is a closed system. The withdrawal event of one bank is usually also a deposit of the same amount of money to another bank. The mechanism called multi-lateral net settlement reduces the number of necessary transfers between banks by settlements of the opposing transactions, also called netting. The rest – the net amounts banks need to transfer among each other – is settled by transferring banks' reserves at the central bank. These transfers require only a very small fraction of money compared to what has been withdrawn from their deposit accounts. In cases a bank would temporarily not have enough reserves for the

transfer, it can borrow money from other banks on the inter-bank lending market or in extreme situations even from the central bank itself. If even central banks get into difficulties, the International Monetary Fund may act as a lender of last resort.

It is an interesting observation that the seemingly endless source of money contains ownership and possession of money, but not availability. The reason for this is that availability is kept by the customers who have made deposits. Banks need to maintain the seemingly endless source of money to limit the risk of a run on the bank. Therefore, the seemingly endless source of money is not available to the banks for their own use, although the banks can create availability by making loans.

6 Comparison of the REA and POA Models

Both REA and POA models can express the mechanism of creating debt and can show the accounts for Loans and Deposits; materialized claims in the REA model, and repositories in the POA model.

The POA model can explicitly model creation of liquidity, which is one of the main functions of a bank (Shiller, 2014). The POA model can express explicitly the seemingly endless source of money, and only in POA we could discover that the "endlessness" is only needed for ownership and possession, but not for availability. Modeling the loan writing-off is easier in POA than in REA.

The POA model can easily express that two or more events occur simultaneously by the concept of Activity, which as a collection of flows, withdrawals and deposits occurring simultaneously. It is uncertain how to express it in the REA model at the operational level. REA has a related concept of congruency, characterized as "two classes and the association between them are simply combined into one class" (McCarthy, Geerts, Gal, 2016). However, in our case there is no direct association between these events (Loan and Deposit), and we do not want to combine them into one, because one is an increment and the other one decrement. Therefore, congruency does not seem to be applicable. Introducing a concept of transaction to the REA ontology would solve this problem.

In the REA model, deposit event, representing customer's own money being deposited to the bank, must be in the REA model because of consistency. However, the POA model does not guide a user towards discovery of the Deposit action.

7 Conclusions

Some popular materials such as (Money as Debt, 2013) might indicate that money is debt, that is, they represent a view on money as a claim rather than an economic resource. Our analysis showed that money is an economic resource. Creating debt explains how liquidity is created by commercial banks, however, liquidity is not the same as new money; thus, commercial banks do not create new money as an economic resource. Our analysis does not reveal how money is created, but the assumption is that it is created by central banks. However, due to the mechanism of the seemingly endless source of money, only a very small amount of actual money is needed compared to the volume of transactions among commercial banks and their customers.

This process only works under the condition that a seemingly endless source of availability and possession of money is available, and that the mechanism of inter-bank settlements together with inter-bank lending market can provide it.

Comparison between the REA and POA model revealed different expression power of both models.

Authors' experience from writing this paper seems to confirm it as well; thinking about the mechanism of money creation took many iterations over several months, during which the initial POA model led to the improved REA model, which again lead to the improved POA model, and so on. Neither the REA nor POA model is a subset of another, and they have different ability to guide a modeler to discover missing information.

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