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What do aggregate saving rates (not) show?

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Abstract
The aggregate saving indicator does not directly reflect changes in individuals' microeconomic behavior. From the official statistics' point of view, households choosebetween spending, which generates additional income and consumption in the economy, and setting money aside, which does not. Formally, households may not (if the authors disregard housing investment) choose to save, because the aggregate saving statistical indicator is a residual concept defined as the ensuing difference between aggregate disposable income and consumption. It measures the change in net worth, which, in a closed economy, may only be generated by the production of capital goods and an increase in inventories. Using an agentbased model, the authors show that shocks unrelated to structural changes in households' behavior may generate positively correlated fluctuations in the aggregate saving rate, productivity growth and lending. Meanwhile, a genuine increase in the average individual propensity to save is not necessarily associated with a higher aggregate saving rate.

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1 Introduction

Saving plays many different roles in economics. Depending on the school of thought, its fluctuations may be regarded as a core driver of long-term economic development, an indication of aggregate demand cycles or a key source of global imbalances. One particular strand of literature emphasizes the correlation between the aggregate saving rate and the long-term growth rate (see e.g. Carroll et al., 2000, Aghion et al., 2016 for a review). After carefully controlling for possible endogeneity, some studies confirm that an increase in saving rates in fact causes an acceleration of growth.

In the neighboring strand of research on the determinants of fluctuations in the aggregate saving rate, the latter are often regarded as direct representations of individuals' propensity to consume out of their income. Changes in the aggregate saving rate are interpreted as a reflection of changes in individuals' behavior that are associated with, for example, the intention to maintain a certain living standard after retirement, taking precautionary measures for future uncertainties or simply transformation in traditional cultural and social norms (e.g. Grigoli et al., 2014). This kind of analysis is conducted particularly often in relation to China and other Asian countries (see e.g. Ma and Wang, 2010, Curtis et al., 2017 for a review). Furthermore, in recent research these findings are used to make predictions about the effects of changes in the institutional and demographic environment on the aggregate saving and growth (Zhang, 2016).

We believe that the application of such economic intuition is seriously impeded by the apparent conceptual discrepancy between aggregate[1] saving measures and individuals' average propensity to save out of their income. The latter is not observed. The former is a residual concept defined as the difference between aggregate disposable income and consumption. Obviously, changes in a household's spending decisions will directly affect the aggregate consumption but are likely to affect other households' income as well. Therefore, there is no a priori reason to assume the existence of a mechanical link between the aggregate saving rate and individuals' average propensity to save.

The call for caution of this kind is not new. In comprehensive surveys Deaton (1992), Browning and Lusardi (1996) and Attanasio (1999) point out that only under demanding assumptions may the aggregate version of the consumption/saving indicators match the microeconomic form and stress that micro-founded theories should be tested using micro data. We contribute to this discussion by employing an agent-based model. This modeling strategy

[1] We focus on the aggregate saving measure throughout the paper. However, we do not think that using sectoral measures significantly enhances the economic interpretability. In fact, such interpretation may be impeded even more severely, since in reality the sectoral distribution of saving is determined by complex financial decisions in different sectors (for details see Fan and Kalemli-Özcan, 2016, Gruber and Kamin, 2016, Chen et al., 2017).

allows us to use the bottom-up approach to calculate aggregate indicators from individual transactions without having to rely on the representative agent concept. We apply the model to the analysis of the financial development, saving and growth nexus (as outlined by Beck et al., 2000, Madsen and Ang, 2016) and show the potential for misinterpretation of results obtained using aggregate data. Namely, we show that shocks unrelated to structural changes in households' behavior may generate positively correlated fluctuations in the aggregate saving rate, productivity and lending. Meanwhile, a genuine increase in the average individual propensity to save is not associated with such developments in observed macro variables.

The rest of the paper is structured as follows. Section 2 discusses the flows of funds that generate aggregate saving. Section 3 outlines the set-up of the agent-based model. Section 4 presents the results of experiments that illustrate the potential effects of different aspects of financial development on growth. Section 5 concludes.

2 Measurement of aggregate saving

In this section we will discuss which economic transactions generate aggregate saving as defined by conventional national accounting concepts (e.g. System of National Accounts 2008). Here we present a simplified closed economy with the household sector and two types of corporations (consumption goods producers and capital goods producers). For illustrative purposes we describe the process of aggregate saving determination in terms of balance sheets and flows. In the balance sheet view the aggregate saving is represented by the change in the economy's net worth.

Our simplified approach disregards transfers, taxes, property income and intermediate consumption and measures households' saving as wages and dividends received less consumption. Corporate saving is measured as revenue less wages and dividends paid. We will review each type of transaction following a step-by-step approach and record the resulting saving measure at each stage in Tables 1 and 2.

In the first step, a consumption goods-producing firm borrows 10 monetary units from a bank. When a bank grants a loan, it books the loan as an asset and the newly created deposit as a liability.[2] Therefore, when banks lend, they create deposits (initially held by the borrowers in the consumer goods producers' sector). Deposits may later be used as payment media and thus may be spread among customers of different banks. However, at the moment of loan extension, no income is generated and nothing is consumed. Lending is a financial transaction that by

[2] See ECB (2011), McLeay et al. (2014) and Jakab and Kumhof (2016) for a detailed description of the money creation process.

definition cannot result in a change in net worth. Therefore, no saving is created by (or required for) loan extension. Also note that, in our simplified economy, subsequent decisions of firms and households on spending/saving only imply redistribution of the existing deposits without changing the overall amount.

In the second step, capital goods that are worth 10 monetary units are produced and purchased by consumption goods producers. At this stage, new non-financial assets are created and the net worth of the economy is increased. Capital goods producers receive undistributed revenues and thus generate saving. Notably, this shows that saving does not create (or finance) investment.[3] From the national accounting point of view, capital formation itself is part of saving. New assets (and accordingly net worth) may only be created by producing capital goods. Households' decisions on how much to spend from their income do not immediately affect saving.

We illustrate this by presenting two alternative examples of consumers' behavior in the third step. In both examples the households receive their wage from consumption goods- and capital goods-producing firms (20 and 10 monetary units, respectively). In Case A households spend all their wages on consumption. The consumption goods producers end up with profits and pay them out as dividends (specifically 30 units of revenues – 20 units of wages result in 10 units of dividends). In Case B households do not consume anything and consumption goods-producing firms make losses. Importantly, in both cases no aggregate saving is generated and no additional net worth is produced. Accordingly, the saving rate (i.e. the aggregate saving to income ratio) equals 25% in Case A and 100% in Case B (for simplicity in our examples all profits are paid out as dividends, meaning that all saving is attributed to the household sector).

Table 1. Flows of funds and aggregate saving determination

	Consumption goods-producing firms	*Capital goods-producing firms*	*Households*	*Aggregate saving*
Step 1: Loan extension	-	-	-	Aggregate saving: 0
Step 2: Investment	-	Revenues: 10 Wages and dividends paid: 0 Saving: 10	-	**Aggregate saving: 10**

[3] See Borio and Disyatat (2015) and Lindner (2015) for a detailed discussion of the relationship between finance and saving indicators.

Step 3A: Consumption	Revenues: 30 Wages and dividends paid: 30 Saving: 0	Revenues: 0 Wages and dividends paid: 10 Saving: -10	Wages and dividends received: 40 Consumption: 30 Saving: 10	Aggregate saving: 0
Step 3B: Consumption	Revenues: 0 Wages and dividends paid: 20 Saving: -20	Revenues: 0 Wages and dividends paid: 10 Saving: -10	Wages and dividends received: 30 Consumption: 0 Saving: 30	Aggregate saving: 0

Table 2. Balance sheets and changes in the economy's net worth and money stock

	Consumption goods-producing firms		*Capital goods-producing firms*		*Households*		*Aggregate net worth*
	Assets	*Liabilities*	*Assets*	*Liabilities*	*Assets*	*Liabilities*	
Step 1: Loan extension	+ 10 deposits	+ 10 debt Change in net worth: 0	-	-	-	-	**Change in money stock: + 10** Change in net worth: 0
Step 2: Investment	- 10 deposits +10 capital goods	Change in net worth: 0	+ 10 deposits	Change in net worth: +10	-	-	Change in money stock: 0 **Change in net worth: +10**
Step 3A: Consumption	-	Change in net worth: 0	-10 deposits	Change in net worth: -10	+10 deposits	Change in net worth: +10	Change in money stock: 0 Change in net worth: 0
Step 3B: Consumption	- 20 deposits	Change in net worth: -20	-10 deposits	Change in net worth: -10	+30 deposits	Change in net worth: +30	Change in money stock: 0 Change in net worth: 0

In summary, the aggregate saving in a simple closed economy is determined by the value of the capital goods produced. The saving ratio is determined by the relation of the values of capital and consumption goods produced.

In our simple static example, the decision of households to cut spending on consumption goods has no effect on the aggregate saving but increases the saving rate. However, once we allow for dynamic interactions between agents, the expected outcome becomes ambiguous, as it depends on whether spending on consumption or investment is more sensitive to demand shocks in a given real economy.

There is ample empirical research on the link between saving and other macroeconomic developments. Notably, these studies frequently report large differences in findings. Nevertheless, the results generally indicate that higher saving rates are associated with higher growth rates of income and productivity (Beck et al., 2000, Grigoli et al., 2014, Aghion et al., 2016).

Another aspect of interest is the link between saving and financial development. The empirical results concerning this relationship are even more inconclusive. For example, Grigoli et al. (2014) and Madsen and Ang (2016) find that saving is positively correlated with measures of financial development (i.e. the size of the financial sector or credit flows), while Beck et al. (2000) do not find a clear link between saving and financial variables. Nevertheless, for the purpose of building a model economy, we assume that this correlation is true.

In the next section, we employ an agent-based model to replicate these two stylized facts about the relationship between saving rates and macroeconomic variables.

3 Model set-up

We employ an agent-based approach, which we think is the most appropriate strategy for our objectives. The merits of agent-based models are discussed in detail by Caiani et al. (2016), Turrell (2016) and Fagiolo and Roventini (2017). Among them are several that are particularly relevant to our case. Firstly, we find it easier to set up a stock flow-consistent model that can be useful in analyzing the effects of financial development following the agent-based approach. Secondly, by employing an agent-based model, we can calculate the aggregate indicators from individual transactions without having to rely on the representative agent concept. In this way we may fully mimic the way in which observed official statistics are compiled.

Our model’s specification is mostly based on Ashraf et al. (2017) and Popoyan et al. (2017). We also add several simplified elements from Dosi et al. (2010) to model endogenous productivity growth.

In the model, there are *N* agents. They have three skills that may be learned or forgotten. The first (entrepreneurial) skill allows an agent to own a shop. The other two skills allow an agent to engage in consumption or capital goods production (i.e. to set up or be employed by a shop in the respective industry).

The agents own deposits (shop owners have two separate – personal and corporate – accounts) and may take out loans. They gauge their permanent income $Y_{n,t}^{p}$ depending on their current income $Y_{n,t}$, which is wages or dividends received in the current period for workers or shop owners, accordingly, or zero for unemployed individuals:

$$I_{n,t}^{p} = \lambda_a I_{n,t-1}^{p} + (1 - \lambda_a)\, I_{n,t}$$

There is one consumption and one capital good in the economy. In the model, time steps correspond to months. In every time period *t*, the sequence of events runs as follows:

1. Agents attempt to improve the current labor productivity of the existing shops and set up new ones;
2. Loans are extended;
3. Workers are hired and wages are paid;
4. Capital goods are produced and sold;
5. Consumer goods are produced and sold;
6. Shop owners set prices and wages; shops enter and exit the market;
7. Agents determine which shops they will buy products from and loans are repaid.

At the end of each time step, aggregate variables (e.g. GDP, saving, prices, etc.) are computed, summing the corresponding microeconomic variables. Let us now turn to a more detailed description of these events.

3.1 Shop entry

Shop owners may try to improve the labor productivity of their enterprise, and employees with entrepreneurial skill may try to set up a new shop for the consumer or capital goods industry (in the case that they have the needed skill). With probability p^{e} they randomly draw the labor productivity value:

$$lp_n^{*} = \max\, [0, \sim N(lp_t^{max}, \lambda_e lp_t^{max})]$$

where lp_t^{max} is currently the best vintage of labor productivity in the industry.

Agents proceed by calculating the expected cash flows (CF_n) from the project in excess of their current income. Namely, agents that are presently shop owners compare the cash flows with those expected given their current labor productivity:

$$CF_n = (1 / lp_n - 1 / lp_n^*) \, Y_{n,t}^{trg} W_t$$

Workers compare the expected cash flows with their present permanent income:

$$CF_n = (P_t - W_t / lp_n^* - \lambda_c P_t^{cap}) \, Y_{n,t}^{trg} - I_{n,t}^{p}$$

where P_t is the current average price of the good (consumption or capital) that is planned for production, W_t is the current average wage in the industry under consideration, $\lambda_c P_t^{cap}$ is the cost of input of capital goods that are needed for production and $Y_{n,t}^{trg}$ is the target output. Shop owners use the actual current target, and workers draw the random value from

$$Y_n^{trg} = \max [0,\sim N(1 / (J + 1), \lambda_z] * YT_t$$

where J is the number of shops currently in the industry and YT_t is the trend output in the industry. The evolution of the trend[4] output is gauged from the current total output of the industry Y_t as:

$$YT_t = \lambda_a YT_{t-1} + (1 - \lambda_a) \, Y_t$$

The present value of cash flows over *h* years is calculated using the real interest rate *rr* as the discount factor.

$$CFR_n = CF_n \, \frac{1-(\frac{1}{1+rr})^h}{1-(\frac{1}{1+rr})}$$

The interest rate is transformed into real terms using the realized trend inflation of the average mark-up in the industry under consideration. The mark-up is defined as the price of the goods less the average labor and capital goods input costs.

To set up the project, an agent must buy Ω of capital goods (Ω is lower in the case that an agent is upgrading an existing shop). Accordingly, the cost of the project is the price of the required capital goods. An agent will decide to implement the project if the present values of the expected cash flows are larger (with a certain safety margin α_n that represents the agent-specific attitude towards risk taking) than the costs.

$$\frac{CFR_n}{\Omega P_t^{cap}} > \alpha_n$$

Once the decision is taken, the agent will calculate the funds needed to run the project. These are constituted by the set-up costs and the funds to cover the expected monthly labor and capital input costs (given the target output). If the amount of deposits owned by the agent is

[4] The evolution of all the trend variables in our model is determined using this law of motion.

insufficient and his current debt service ratio[5] is lower than threshold Ψ, he will attempt to obtain a loan in the next phase (he will try to borrow the insufficient amount times the factor Φ). Subsequently, the agent will attempt to buy capital goods on the market. If he is successful, he will implement the project at the end of the month. If not, he will check the profitability of the project again in the next month and continue to accumulate the required capital goods. If the project is no longer profitable, he will abandon the idea and discard this vintage of lp_n^*.

3.2 Credit market

Agents obtain loans with probability p^{L1} and p^{L2} depending on the state of the banking sector. There are three states. The banking sector may transition between states, and the probability of transition is p^T.

Loan extension creates money, and the amount of deposits is increased accordingly. The maturity of loans is set to M years and the interest rate to IR.

3.3 Labor market

At the start of this phase, shops will randomly fire workers if the current number of employees is higher than the target employment level.

Workers and unemployed individuals will ask a random shop (with an employment level lower than its target and from the industry for which the agent has the skill) for the wage offer. The agent will become employed by this shop if the offer is higher than the agent's current wage (unemployed agents accept the offer automatically).

The employed workers receive wages. Agents learn and forget industrial and entrepreneurial skills with probabilities p^{s1} and p^{s2} ($p^{s1} > p^{s2}$). An agent will not forget the skill required to work in his current industry but may forget the other industrial skill with probability p^{s1} and learn it with probability p^{s2}.

An unemployed agent will learn the skill in the industry with a higher average wage with probability p^{s1} and forget it with probability p^{s2}. He will forget the other industrial skill with probability p^{s1} and learn it with probability p^{s2}. If an agent does not own a shop, he will forget the entrepreneurial skill with probability p^{s1} and learn it with probability p^{s2}.

[5] The debt service ratio is calculated as the sum of the principal and interest payments on all of an agent's loans expected this month as the ratio to permanent income.

3.4 Production

Goods are produced using the following production function:

$$Y_{n,t} = \min\, [(L_{n,t} + 1\,)\ lp_n\ ,\ \ CI_{n,t} / \lambda_c]$$

where $L_{n,t}$ is the number of the shop's employees and $CI_{n,t}$ is the amount of capital goods purchased by the shop for input in the previous month. The output is accumulated in shops' inventories. Wages are paid to the workers in this phase by transferring deposits accordingly from shop owners to employees.

3.5 Goods market

There are two markets for capital and consumption goods. Capital goods are bought by shops for input and by agents wishing to set up a new shop or upgrade their existing one. Consumption goods are bought by all agents. The spending on consumption goods of an agent is determined as follows:

$$C_{n,t} = \beta_n I^p_{n,t} + \delta_n D_{n,t} + \varepsilon_{n,t} I^p_{n,t}$$

$D_{n,t}$ is financial wealth (deposits owned by the agent), β_n and δ_n are agent-specific elasticities that reflect the propensity to spend out of income and wealth and $\varepsilon_{n,t}$ is a random component of the demand. Agents' spending cannot be negative or exceed their stock of deposits.

Agents buy goods from the associated shop, but, if it does not have sufficient inventories, they will randomly choose another one. Transactions are settled by transferring deposits from buyers to sellers and decreasing sellers' inventories accordingly.

3.6 Price and wage setting

After trading takes place, shops adjust their prices and wages and set targets for output, capital goods input and employment.

Output targets $Y^{trg}_{n,t}$ are set based on the current inventories to output ratio ($\Lambda_{n,t}$) relative to the target level (Λ^*):

$$Y^{trg}_{n,t} = Y^{trg}_{n,t-1}(1 + \xi\,(\Lambda_{n,t} - \Lambda^*))$$

The target employment $L^{trg}_{n,t}$ and capital goods input $CI^{trg}_{n,t}$ are determined as:

$$L^{trg}_{n,t} = Y^{trg}_{n,t} / lp_n - 1$$

$$CI^{trg}_{n,t} = \lambda_c\, Y^{trg}_{n,t}$$

Wages $W_{n,t}$ are set as:

$$W_{n,t} = W_{n,t-1}\,(1 + \xi\,(L_{n,t}^{trg} - L_{n,t}) / L_{n,t}^{trg})$$

Prices $P_{n,t}$ are set as:

$$P_{n,t} = P_{n,t-1}\,(1 + \xi\,(\Lambda_{n,t} - \Lambda^{*}))$$

None of these variables may be negative. Price setting cannot result in negative mark-ups.

Shop owners will leave the amount needed to operate their shops (that is, to cover planned labor and capital input costs and debt service) in the corporate deposit account. The rest is transferred to the personal account and is considered as a dividend payment that affects the permanent income. Note that this amount may be negative, representing losses and requiring a transfer from the personal to the corporate account. If the funds in the personal account are insufficient, the shop owner exits the market (by transferring all deposits to the personal account and losing the inventories) and becomes unemployed.

At this stage agents who have bought enough capital goods upgrade their shops and set up new ones.

3.7 Other events

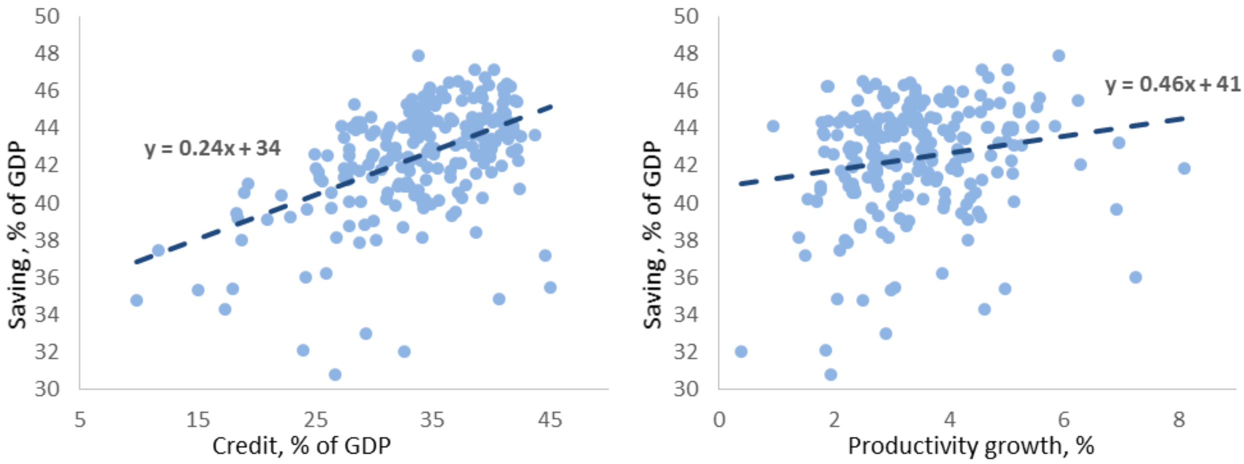
Agents make principal and interest payments on their loans (these transactions destroy deposits). If they do not have sufficient funds, they default (the loan is destroyed). Agents may also change their partner shop in each of the markets. With probability p^c they observe the prices in one of the other shops and change if they are lower than in their current shop.

3.8 Calibration

The parameters of the model are presented in Table 3 in the Annex. The model is just an illustration, and we had no objective to obtain realistic parametrizations that could be used to make accurate predictions for a real economy. Nevertheless, we ascertain that our model may generate a positive correlation between the credit to GDP ratio, the saving rate and the productivity growth (Figure 1) by running a series of simulations.[6] Note that in this exercise these variables are driven only by random financial, technological, demand and ensuing distributional shocks. There are no structural changes in households' behavior.

[6] These results were obtained with three independent model runs, each generating 1200 monthly observations (the first 300 observations from each run were discarded).

Figure 1. Simulated series (annual averages)



4 Results of the experiments

We use the outlined model to discuss the role of aggregate saving in analyzing the effects of financial development. Some studies suggest that an increase in saving may be viewed as a "channel" through which financial development may promote growth (Beck et al., 2000, Madsen and Ang, 2016). The narration for this channel can usually be summarized as follows: a developed financial system facilitates households' investment in financial assets and therefore can also potentially enhance their "savings." This implies that households are willing to consume less from their income and financial wealth. The observed correlation between financial and aggregate saving rates is meant to provide empirical confirmation of this proposition.

We will simulate the effects of financial developments on the economy by conducting several experiments and examine the pattern that is observed in the aggregate variables. The design of the experiments is as follows: we generate 850 monthly observations with our model. The first 600 are discarded, and, in the fiftieth period after the burn-in, the event of interest takes place. We conduct 100 independent runs and present the median as well as the twenty-fifth and seventy-fifth percentiles of the distribution for each variable. We compare the results with the benchmark simulation (100 model runs without the event taking place).

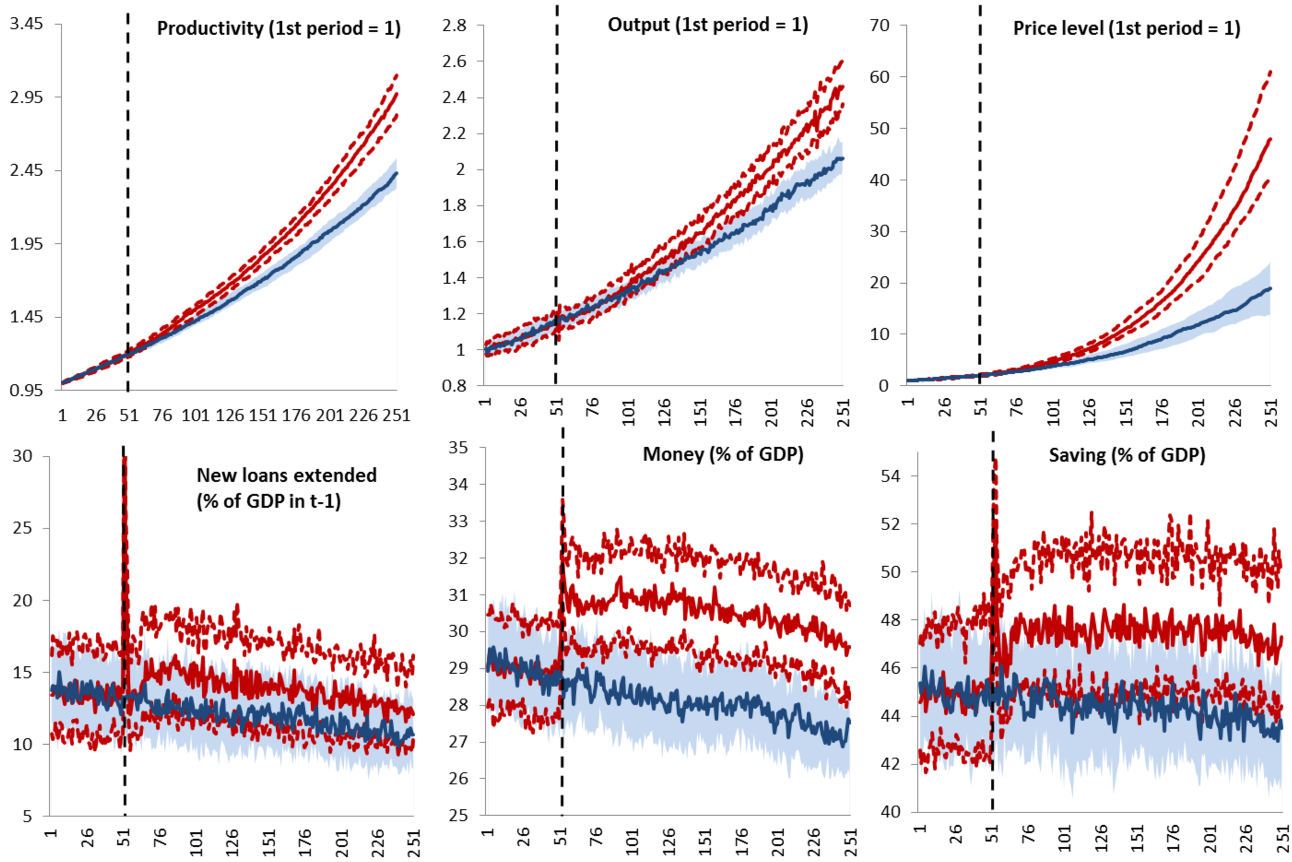
4.1 Experiment 1: an increase in credit availability

Firstly, we analyze the effect of enhanced access to financing, which is arguably the most typical effect associated with a financial system's development. We model this development by assuming that the economy's financial sector functions in State 1 until the fiftieth period, when it changes to State 2 and remains in it. The results of such simulations are shown in Figure 2.[7]

As expected, this change results in more frequent technological upgrades and higher productivity and output growth in the long run. The saving rate is also higher, as the economy rapidly reallocates its resources to the production of capital goods. Credit growth accelerates, and more money is created, resulting in higher money to GDP ratios.

Arguably, this pattern matches a typical financial expansion,[8] and the change in credit availability (unrelated to changes in consumers' behavior[9]) is likely to be the main reason for the existence of the correlation presented in Figure 1.

Figure 2. Simulation results for Experiment 1 (blue = benchmark, red = experiment)

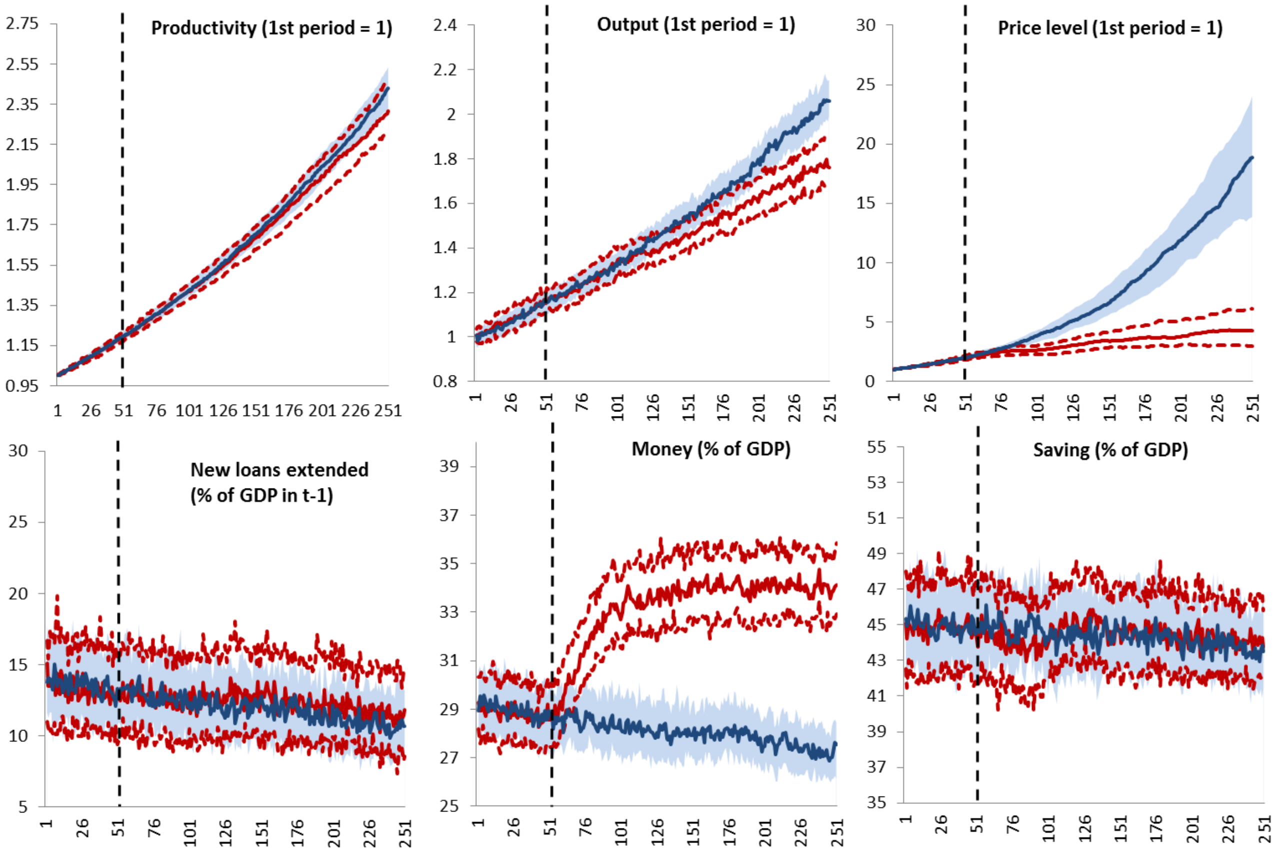


4.2 Experiment 2: increase in the individual propensity to save

[7] We calculate the aggregate output, price level and labor productivity by weighting the corresponding measures in the consumption and capital goods industries. We use the average relative prices as weights to calculate the aggregate output and the average nominal values of output to calculate the aggregate productivity and price level.
[8] Admittedly, this model is obviously incomplete and cannot account for the potential damage stemming from financial boom–bust episodes in the long run.
[9] Note that this outcome is not peculiar to the agent-based class of models. For example, it is not uncommon for technological shocks to lead to increased saving rates in the DSGE framework.

We proceed by analyzing the effect of an increased demand for financial assets that might also be associated with the financial system's development. In our experiment this is represented by agents' lower propensity to consume out of their income. We model this event by redrawing in the fiftieth period β_n from the distribution, which has a lower mean than the benchmark (see Table 3 in the Annex). The results of such simulations are shown in Figure 3.

Figure 3. Simulation results for Experiment 2 (blue = benchmark, red = experiment)



The results indicate that an increase in the propensity to save predictably leads to the accumulation of a larger stock of deposits relative to the volume of transactions. The price growth is slower. The impact on other variables is ambiguous. There is no indication that the saving rate increases. In fact, this experiment results in somewhat slower growth in productivity and output.

Our findings are based on a very simplistic model and do not indicate that households' increased demand for financial assets may not enhance economic growth. Obviously, it may.[10]

[10] One obvious simplification is that bank deposits are the only type of financial assets in our model. As we have discussed in Section 2, spending implies the transfer of deposits but does not change the total amount and therefore does not affect banks' ability to lend. However, the effect of households' purchase of bonds or shares directly from firms might have a very different effect. As pointed out by Villeroy de Galhau (2016), putting deposits aside is not the same thing as investing directly in the real sector's risky assets.

Our point is different. We have shown that, in a model economy, expansionary financial developments may be associated with higher saving rates. Nevertheless, that does not imply that the average individual propensity to save has increased. In fact, a genuine increase in the propensity to save does not result in a higher aggregate saving rate.

5. Conclusions

An increase in saving is sometimes regarded as a "channel" through which financial development may promote growth. The narration for this channel can usually be summarized as follows: a developed financial system facilitates households' investment in financial assets and therefore can also potentially enhance "savings." This implies that households will be willing to consume less from their income and financial wealth. The observed correlation between financial and aggregate saving rates is meant to provide empirical confirmation of this proposition. We believe that such an interpretation has the potential to be misleading and call for caution in using aggregate national accounts to analyze microeconomic developments.

Aggregate saving does not directly measure individuals' average propensity to save from their income. It measures the change in net worth, which, in a closed economy, may only be generated by the production of capital goods (although sectoral distribution of saving is the result of complex financial decisions). Accordingly, in a closed economy, fluctuations of the aggregate saving rate are linked to the relation of the values of capital and consumption goods produced. This effectively means that the impact of an economic shock on the saving rate is determined by the relation of sensitivities in the demand for consumption and investment to this type of shock (which in most cases is ambiguous).

To illustrate our point, we set up an agent-based model that endogenously generates correlated series of lending, productivity growth and saving rates. We show that this correlation may arise under individuals' constant propensity to save. Meanwhile, genuine structural change in individuals' behavior may not be associated with such a pattern in macro variables. We conclude that the observed correlation between financial development, growth and saving rates should not be interpreted as an indication that financial development enhances growth by altering the microeconomic behavior of households.

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Annex

Table 3. Parameters of the model

Description	Parameter	Value
Parameters		
Trend inertia	λ_a	0.9
Required capital input	λ_c (consumption goods industry) λ_c (capital goods industry)	1 0
Productivity growth variation	λ_e (consumption goods industry) λ_e (capital goods industry)	0.005 0.0025
Target market share variation	λ_z	0.01
Shop's target adjustment	ξ	0.05
Threshold debt service ratio	Ψ	1
Loan demand factor	Φ	1.33
Loan maturity	M	10
Interest rate	IR	10
Set-up cost	Ω (new shop) Ω (shop upgrade)	40 20
Horizon for project assessment	h	10
Target inventories to sales ratio	Λ^* (consumption goods industry) Λ^* (capital goods industry)	0.5 0.75
Risk taking	α_n	$\in (1,2)$
Consumption out of income	β_n (benchmark) β_n (Experiment 2)	max $[0,\sim N(0.75,0.025)]$ max $[0,\sim N(0.5,0.025)]$
Consumption out of wealth	δ_n	max $[0,\sim N(0.075,0.01)]$
Random consumption	$\varepsilon_{n,t}$	$\in (0,0.05)$
Probabilities		
Technology upgrade	p^e	0.33
Shop change	p^c	0.5
Credit availability	p^{L1} p^{L2}	0.2 0.5
Transition between financial states	p^T	0.02
Job skills learning	p^{s1} p^{s2}	0.05 0.025