The Size of the U.S. Finance Industry: A Puzzle?

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Abstract

I use the neo-classical growth model to study financial intermediation in the U.S. over the past 130 years. I measure the cost of financial intermediation on the one hand, and the production of financial assets and liquidity services on the other. The model suggests that the US financial system has become less efficient over time: the unit cost of intermediation is higher today than it was a century ago. Improvements in information technology seem to have been cancelled by increases in trading activities whose aggregate social value is difficult to measure.

Preliminary

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The role of the finance industry is to produce, trade and settle financial contracts that can be used to pool funds, share risks, transfer resources, produce information and provide incentives. Financial intermediaries are compensated for providing these services. The sum of all profits and wages paid to financial intermediaries represents the cost of financial intermediation. I measure this cost from 1870 to 2010, as a share of GDP, and find large historical variations. The cost of intermediation grows from 2% to 6% from 1870 to 1930. It shrinks to less than 4% in 1950, grows slowly to 5% in 1980, and then increases rapidly to almost 9% in 2010. The pattern remains the same if finance is measured as a share of services, and if net financial exports are excluded.

The financial system serves three functions:[1]

- (i) Transfer funds from savers to borrowers, both households and corporate. To do so, the financial system must pools funds, and screen and monitor borrowers.
- (ii) Provide means of payments, easing the exchange of goods and services.
- (iii) Provide insurance (diversification, risk management) and information (trading in secondary markets).

Services of type (i) involve the creation of financial assets. I measure the production of these assets. The most important contracts involve credit markets. I measure the production of credit separately for households, farms, non-financial corporate firms, financial firms, and the government. Surprisingly, the non-financial corporate credit market is smaller today than it was at its peak of the late 1920s. The most important trends in recent years are the increase in household debt, which exceeds 100% of GDP for the first time in history, and in financial firms' debt, which also exceeds non-financial corporate debt for the first time.

I then aggregate all types of non-financial credit, stock issuance, and liquidity services from deposits and money market funds. I find that the cost of intermediation per dollar of assets created has increased over the past 130 years. In other words, the finance industry that sustained the expansion of railroads, steel and chemical industries, and the electricity and automobile revolutions was more efficient than the current finance industry.

The remaining of the paper is organized as follows. In Section 1, I construct my measure of the cost of financial intermediation. In Section 2, I present simple models to organize the discussion. In Section 3, I construct my measures of output for the finance industry. In section 4, I discuss the role of information technology, price informativeness, financal derivatives, risk sharing, and trading.

1 Income Share of Finance Industry

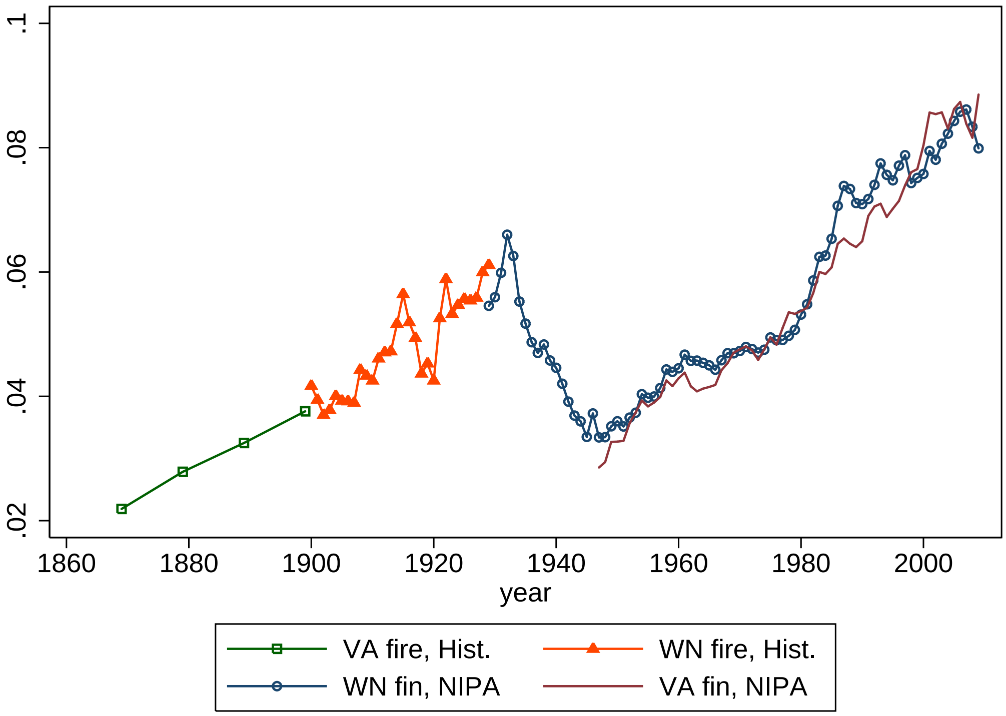
In this section, I present the first main empirical fact: the evolution of the total cost of financial intermediation in the US over the past 140 years.

[1] See Merton (1995) and Levine (2005) for discussions. My classification is motivated by the models and evidence presented below.

1.1 Benchmark Measure

Figure 1 displays various measures of the share of the Finance and Insurance industry in the GDP of the United States estimated from 1870 to 2009.

Figure 1: Income Share of Finance (non-farm civilian)



Notes: VA is value added, WN is compensation of employees, "fin" means finance and insurance, "fire" means finance, insurance, and real estate. For "NIPA", the data source is the BEA, and for "Hist" the source is the Historical Statistics of the United States.

There are various ways to define the size of the financial sector. Conceptually, the measure is

$$\phi = \frac{Finance\,Income}{Total\,Income}$$

The three most important issues are

- Definition of "Finance." For the most part, financial activities are classified consistently over time (but sub-sectors within finance are not). The main issue is with real estate. The value added of the "real estate" industry includes rents and imputed rents for home owners. Whenever possible, I exclude real estate. In my notations, all variables indexed with "fin" include finance and insurance and exclude real estate. This is not possible before 1929. In this case I use the compensation of employees whenever possible.

- Definition of "Income." The best conceptual measure is Value Added. In this case, ϕ is the GDP of the finance industry over the GDP of the US economy. However, this is only acceptable if we can exclude real estate, or at least imputed rents. When this is not possible, a good alternative is to use the compensation of employees. In this case, ϕ is the compensation of employees in finance over the total compensation of employees in the US. For the post-war period, the two measures display the same trends, even though annual changes can differ. This simply means that, in the long run, the labor share of the finance industry is the same as the labor share of the rest of the economy. In the short run, of course, profit rates can vary.

- Definition of "Total Income." During peace time and without structural change, it would make sense to simply use GDP. In the long run, two factors can complicate the analysis. First, WWI and WWII take resources away from the normal production of goods and services. Financial intermediation should be compared to the non-war related GDP. To do so, I construct a measure of GDP excluding defense spending. The second issue is the decline in farming. Since modern finance is related to trade and industrial development, it makes sense to estimate the share of finance in non-farm GDP. My benchmark measure of total income is therefore non-farm, non-defense GDP (or compensation, as explained above). This adjustment makes the series more stationary.

Figure 1 shows the various measures of the size of the finance industry. For the period 1947-2009, I use value added and compensation measures from the Annual Industry Accounts of the United States, published by the Bureau of Economic Analysis (BEA). For 1929-1947, I use the share of employee compensation because value added measures are either unavailable or unreliable. For 1870-1929 I use the Historical Statistics of the United States.[2] More detail regarding the various data sources can be found in Philippon and Reshef (2007).

The first important point to notice is that the measures are qualitatively and quantitatively consistent. It is thus possible to create one "extented" series simply by appending the older data to the newer ones.[3] The second key point is that finance was smaller in 1980 than in 1925. Given the outstanding real growth over this period, it means that finance size is not simply driven by economic development.

1.2 Adjusted Measures

Before discussing theoretical interpretations it is useful to present two adjusted series to deal with two questions: Is this just globalization? Is this just the rise in services?

Globalization and Trade in Financial Services

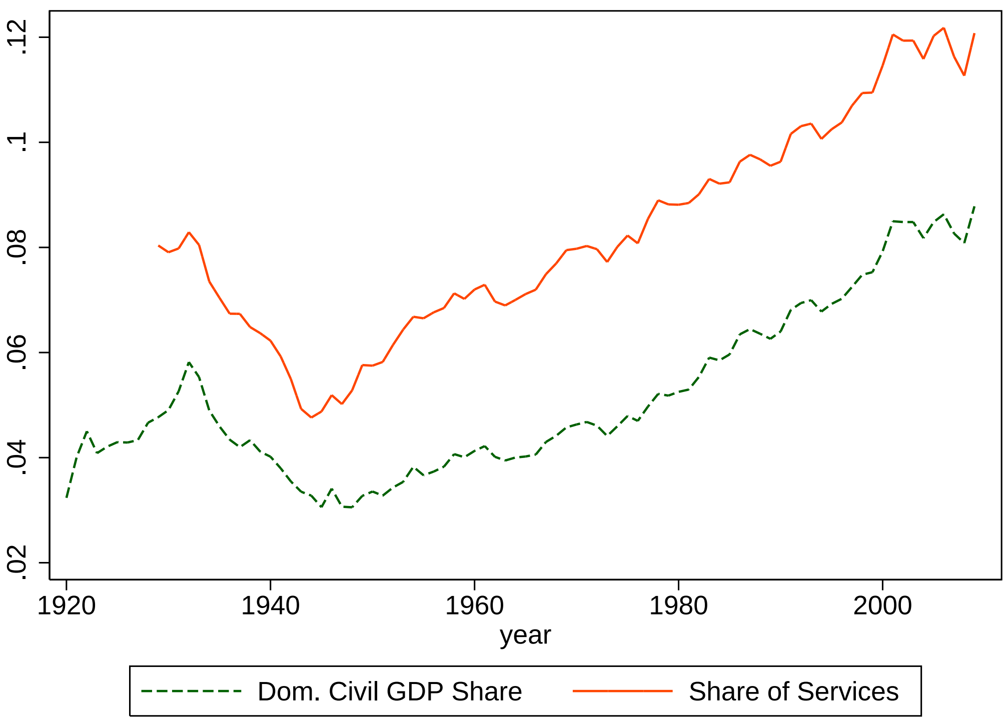
In equation (**??**), I divide by US GDP. This makes sense if financial services are produced and used locally. But in the recent part of the sample, the US presumably exports some investment banking services abroad. It turns out, however, that this adjustment is small.

Figure 2 displays the ratio of income minus net exports for finance over non-farm civilian GDP. The figure is almost identical to the previous one. The reason is that the U.S., unlike the U.K. for instance, is not a large exporter

[2]Carter, Gartner, Haines, Olmstead, Sutch, and Wright (2006).
[3]Other measures based on Martin (1939) and Kuznets (1941) give also give consistent values.

of financial services. According to IMF statistics, in 2004, the U.K. financial services trade balance was +$37.4 billions while the U.S. balance was -$2.3 billions: the U.S. was actually a net importer. In 2005, the U.K. balance was +$34.9 billions, and the U.S. balance was +$1.1 billions.[4]

Figure 2: Income Share of Finance (alternative measures)



Notes: Domestic shares excludes net exports of finance and insurance. Share of Services uses the BEA definition of services.

Globalization therefore does not account for the evolution of the U.S. financial sector. The timing is also different: financial globalization is a relatively recent phenomenon (see Obstfeld and Taylor (2002), and Bekaert, Harvey, and Lumsdaine (2002)), while Figure 1 shows that the growth of the financial sector has accelerated around 1980.

Finance versus Services

Is finance different from other service industries? Yes. Figure 2 also plots the share of finance in service GDP. It is of course (mechanically) higher than it is in total GDP, but the pattern is the same (the other fast growing service industry is health care, but it does not share the U-shaped evolution of Finance from 1927 to 2009).

2 Theoretical Benchmarks

The goal of this section is to build a simple model that can shed light on the following questions: Is finance a normal good? Should we expect finance to grow with income? How does productivity in the non finance sector affect the

[4]There is, of course, some trade within the financial sector, notably between the U.S. and the U.K., but the growth in the GDP share of finance is not due to large net exports.

size of finance? What should be the impact of technological progress in finance on the size of finance?

I use the neo-classical growth model as a benchmark. Since it is well known, the details are in the Appendix. Output is produced with Cobb-Douglass technology $Y_t = K_t^{1-\alpha} (A_t n_t)^{\alpha}$. There is a representative individual who makes all the inter-temporal decisions. She owns the capital stock K_t, which depreciates at rate δ, and she maximizes her expected lifetime utility $\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u(C_t)\right]$. The household as CRRA preferences $u(C) = \frac{C^{1-\rho}}{1-\rho}$, and inelastic labor suply $n = 1$. The economy is non-stationary. The driving force is the labor-augmenting technology shock $A_t = (1 + \gamma_t) A_{t-1}$. I use the convention that upper-case letters for variables with trends, and lower-case letters for variable without trends. For instance, for capital I write $k_t \equiv \frac{K_t}{A_t}$ and for consumption $c_t \equiv \frac{C_t}{A_t}$.

I focus on the balanced growth path with constant γ. The model is summarized by three equations. Let r be the interest rate received by savers. The Euler equation of consumer is:

$$r = \beta^{-1} (1 + \gamma)^{\rho} - 1. \tag{1}$$

Capital demand equates the marginal product of capital to its user cost:

$$(1 - \alpha) k_t^{-\alpha} = r + \delta. \tag{2}$$

Finally, we have the capital accumulation/resource constraint

$$(\delta + \gamma) k = y - c. \tag{3}$$

Detrended output is simply $y = k^{1-\alpha}$. On the balanced growth path the system is block diagonal since (1) pins down r, then (2) pins down $k^* = \left(\frac{1-\alpha}{r+\delta}\right)^{\frac{1}{\alpha}}$, and finally (3) pins down $c = y - (\gamma + \delta) k$. The capital output ratio is simple $\frac{k}{y} = \frac{1-\alpha}{r+\delta}$. The consumption output ratio can be written as $\frac{c}{y} = \alpha + (r - \gamma) \frac{k}{y}$. The consumption output ratio is labor income plus capital income in excess of growth.

The following two sub-sections modify the neo-classical model by introducing financial services for firms and for households.[5] Section 2.1 focuses on equation (2), while Section 2.2 focuses on equation (1). While very stylized, these extensions accomodate most leading theories of financial intermediation, such as Diamond (1984), Gorton and Pennacchi (1990), Holmström and Tirole (1997), Diamond and Rajan (2001), or Kashyap, Rajan, and Stein (2002).

[5]The neo-classical growth model can easily be extended to accomodate two sectors. It is well known that the properties of this model depend on the elasticity of subsitution between the two sectors (Baumol (1967)). The nominal GDP share of sector i increases with relative technological progress in sector i if and only if the elasticity of substitution is less than one. I argue, however, that the tradional multisector model is not useful to analyze financial intermediation because it is <u>not</u> the reduced form of any sensible model of financial intermediation (more details can be found in the appendix). This will become evident in the next two section. Section 2.1 introduces the simplest model of intermediation services to firms. In this model, the elasticity depends both on the shape of the distribution of borrowers and on the efficiency of the supply of financial services. Section 2.2 introduces financial services to households, and shows again that the standard multi-sector model is not useful to understand the finance industry. Instead, we must explicitly model financial intermediation.

2.1 Corporate Finance

There is a long tradition of modeling corporate financial services. I do not attempt to do justice to this rich coporate finance literature. Rather, I highlight the macroeconomic implication of technological progress in the finance industry on the size of credit markets and the GDP share of the industry.

Homogenous Coporate Borrower

Let ψ be the cost of financial intermediation per unit of asset. With competitive intermediation, ψ is also the price of intermediation. Industrial firms therefore solve the following program $\max_{n,K} A_t^{\alpha} K^{1-\alpha} n_t^{\alpha} - (r_t + \delta + \psi) K - W_t n$. Equation (1) is unchanged. The marginal product of capital (2) becomes

$$(1-\alpha) k^{-\alpha} = r + \delta + \psi$$

so detrended output is $y = k^{1-\alpha} = \left(\frac{1-\alpha}{r+\delta+\psi}\right)^{\frac{1-\alpha}{\alpha}}$. Consumption is still given by $c = \alpha y + (r-\gamma) k$, but the resource constraint (3) becomes

$$\frac{y-c}{k} = \gamma + \psi + \delta.$$

The finance share of GDP is

$$\phi = \frac{\psi k}{y} = (1-\alpha) \frac{\psi}{r+\delta+\psi} \tag{4}$$

The following Lemma summarizes the prediction of the model regarding the impact of improvement in financial intermediation

Lemma 1. *In the homogenous corporate borrower model, technological improvements in financial intermediation lead to an increase in the captial-output and consumption-output ratios, but a decrease in the GDP share of the finance industry.*

Proof. The consumption-output ratio is still given by $\frac{c}{y} = \alpha + (r-\gamma)\frac{k}{y}$ and we know that $\frac{k}{y} = \frac{r-\gamma}{r+\delta+\psi}$. If ψ goes down, k/y goes up, so c/y goes up (but consumption over capital goes down). Inspection of (4) shows that the GDP share increases with the intermediation cost ψ. □

In this model the real output of the finance industry is poportional to k, since each unit of k requires one unit of monitoring. The parameter ψ is the unit cost of monitoring, so ψk is the nominal output of the financial sector. There is an elasticity of demand, because the capital output ratio decreases with ψ, but this elasticity is less than one, therefore technological improvement in finance lowers the GDP share of the finance industry.[6]

[6] What is a plausible interpretation of the homogenous borrower model? The key assumption is that all financial flows are intermediated at the same cost. This model therefore applies either to an economy where firms are fairly homogenous, or, more realistically, it applies to the part of intermediation services that are required by all borrowers. A good example would be passively managed mutual funds that invest in stocks and bonds. They provide a cheap way for households to hold diversified portfolios of stocks and bonds. Progress in information technology have lowered the cost per unit of asset held. And they are used by (almost) all households and (almost) all firms. In this case the model predicts that mutual funds should increase the stock of corporate assets (measured at market

The homogenous borrower model is a useful benchmark, but it fails to capture an important idea in the financial development literature, namely that financial development gives access to credit to borrowers who were previously shut out of the markets. As we will see, modelling this feature is important when thinking about the GDP share of finance, technological progress, and shocks to credit demand.

Heterogenous Corporate Borrowers

Many important issues cannot be disccussed in a model with homogenous borrowers. Let us therefore consider a model with heterogeneity and decreasing returns at the firm level.[7]

Each firm operates A_t units of capital and hires n workers to produce $A_t n^{\alpha}$ units of output. Decreasing returns come from the fact that A_t is fixed at the firm level. Macroeconomic adjustement to the stock of capital takes place at the extensive margin, i.e. by firms' entry (and exit) decisions.

Firms differ in their need for intermediation services, characterized by the monitoring requirement μ per unit of capital. The mass of potential firms with monitoring requirements below μ is $G(\mu)$ and we assume that the of potential entrants would be enough to replicate the neo-classical benchmark. Recall that we have defined $k^* \equiv \left(\frac{1-\alpha}{r+\delta}\right)^{\frac{1}{\alpha}}$. Let us assume:

$$G_0 \leq k^* < G(\infty).$$

Note that $G_0 \equiv G(0)$ is simply the mass of (potential) firms that do not require intermediation services. I will use G_0 as an inverse measure of demand for financial intermediation. It is convenient to define the density $g(\mu)$ for $\mu > 0$. We can then write $G(\mu) = G_0 + \int_0^{\mu} g(x)\,dx$.

As before, the unit cost of monitoring is ψ. Firms maximize their profits $A_t n^{\alpha} - W_t n - (r_t + \delta + \mu\psi) A_t$. Each firm chooses the same labor demand $n_t = \left(\frac{\alpha}{w_t}\right)^{\frac{1}{1-\alpha}}$. Equilibrium profits (detrended) for each firm are $\pi_t(\mu) = (1-\alpha)\left(\frac{\alpha}{w_t}\right)^{\frac{\alpha}{1-\alpha}} - (r_t + \delta + \mu\psi)$. The marginal firm $\hat{\mu}$ is defined by $\pi_t(\hat{\mu}) = 0$, or:

$$\hat{\mu}_t \psi \equiv (1-\alpha)\left(\frac{\alpha}{w_t}\right)^{\frac{\alpha}{1-\alpha}} - (r_t + \delta).$$

Firms above the cutoff $\hat{\mu}$ do not enter. The number of firms (the detrended capital stock) is $k_t = G(\hat{\mu}_t)$, aggregate capital is $K_t = A_t k_t$. Clearing the labor market requires $k_t n_t = 1$, which we can write as: $k_t = \left(\frac{\alpha}{w_t}\right)^{\frac{-1}{1-\alpha}}$.

Households' preferences are unchanged but their budget constraint becomes $K_{t+1} + C_t \leq (1 + r_t) K_t + W_t + \Pi_t$, where Π_t are aggregate corporate profits. The Euler equation (1) is unchanged. Therefore, on the balanced growth

value) but at the same time decrease the GDP share of intermediation. Funds, trusts and other financial vehicles, however, account for only approximately 0.3% of GDP, which is small relative to the more than 8% share of GDP for finance and insurance as a whole.

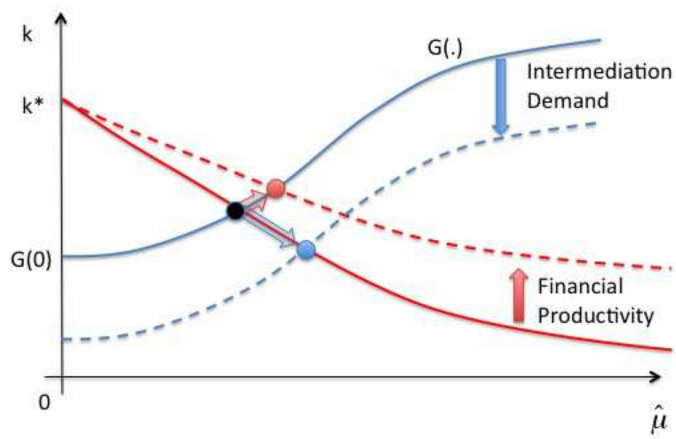
[7] Decreasing returns in production are required to make room for heterogeneity since with constant returns borrowers that have even a slight financial disadvantage would not be able to enter.

path, r is given by preferences, and we obtain the equilibrium condition

$$G_0 + \int_0^{\mu} g(x)\, dx = \left(\frac{1-\alpha}{r+\delta+\psi\hat{\mu}}\right)^{\frac{1}{\alpha}}. \tag{5}$$

The equilibrium is depicted on Figure 3.

Figure 3: Equilibrium Corporate Finance



This model nests the homogenous borrower case with $\hat{\mu} = 1$ and the neoclassical growth model with $\hat{\mu} = 0$. The finance share of GDP is now equal to

$$\phi = \frac{\psi}{y} \int_0^{\hat{\mu}} \mu g(\mu)\, d\mu. \tag{6}$$

We have the following proposition:

Proposition 1. ***Equilibrium Corporate Finance****. The income share of corporate finance is constant on the Balanced Growth Path, and depends on the growth rate only through the equilibrium real rate. Improvements in financial intermediation (a decline in ψ) increase the number of firms and the capital output ratio, but have an ambiguous impact on the GDP share of finance. Demand for intermediation (decrease in G_0) decreases the capital output ratio and increases the GDP share of finance.*

Proof. and the capital output ratio is $\frac{k}{y} = \frac{1-\alpha}{r+\delta+\psi\hat{\mu}}$. The comparative statics with respect to $\hat{\mu}$ and k are immediate from equation (5). The fact that ϕ decreases with G_0 can be seen from (6). Suppose G_0 goes up. Output goes up $y = k^{1-\alpha}$ and k is an increasing function of G_0. At the same time $\hat{\mu}$ goes down. Therefore ϕ goes down. ∎

In general, we see that ϕ is non monotonic in ψ. This property is intuitive. When finance is very inefficient (ψ

is very high), all would-be users are priced out: $\hat{\mu}_t$ is 0 and so is ϕ. Starting from this level, an improvement in financial intermedition must increase the GDP share of finance. The GDP share of finance reaches its maximum for intermediate levels of financial development. When finance is fully efficient (ψ goes to zero), we get the Walrasian benchmark with equality of lending and borrowing rates and ϕ tends to zero.

There are several interpretations of the model. For instance, it is straightforward to connect G to the correlation between cash flows and investment opportunities in a model with moral hazard and monitoring Philippon (2008). When the correlation is high, firms with investment opportunities also have high cash flows and there is no need to intermediation (this corresponds to a high value of G_0). The demand for corporate finance services increases when the correlation decreases.

2.2 Household Finance: Money and Credit

An important part of the recent increase in credit assets is due to household borrowing. In addition, the finance industry provides liquidity and payment services to households. We therefore need to extend the model to take into account household debt and liquidity. In practice, much of household debt has an important life-cycle component (i.e., mortgages), so we need to extend the model to overlapping generations. I consider a mixed model with two types of households: one type is infinitely lived, the other lives for two periods.[8] The first type of household is the neoclassical household depicted in the first section. The second type of household is part of an OLG structure where agents live for two periods.

Liquidity Services and Long-Lived Household

This long-lived household (index 0) owns the capital stock but has no labor endowment. Liquidity services can be modelled using a cash-in-advance framework augmented with private liquidity (see Midrigan and Philippon (2010) for instance), or with money in the utility function. I choose the later for simplicity. The flow utility is now $u\left(C_t, M_t\right) = \frac{\left(C_t M_t^{\nu}\right)^{1-\rho}}{1-\rho}$. The budget constraint becomes $S_{t+1} + C_t + \psi_m M_t \leq \left(1 + r_t\right) S_t$, where ψ_m is the price of liquidity services, and S are total savings. The Euler equation $u_C\left(t\right) = \beta \mathbb{E}_t\left[\left(1 + r_{t+1}\right) u_C\left(t+1\right)\right]$ becomes

$$M_t^{\nu(1-\rho)} C_{0,t}^{-\rho} = \beta \mathbb{E}_t\left[\left(1 + r_{t+1}\right) M_{t+1}^{\nu(1-\rho)} C_{0,t+1}^{-\rho}\right]$$

The liquidity demand equation $u_M\left(t\right) = \psi_m u_C\left(t\right)$ is simply

$$\frac{M_t}{C_{0,t}} = \frac{\nu}{\psi_m}$$

[8] Several reasons motivate this choice. First, the simplest OLG model with two periods is not appealing because households do not actually borrow: the young ones save, and the old ones eat their savings. Second, bequests are of first order importance empirically. The simplest way to capture all these ideas is the mixed model. The interpretation is that the long-lived household has perfect bequest motives, so it is equivalent to an infinitely lived agent

On the BGP, M grows at the same rate as C. The Euler equation becomes $1 = \beta \mathbb{E}_t \left[(1 + r_{t+1}) \left(\frac{C_{t+1}}{C_t} \right)^{\nu(1-\rho)-\rho} \right]$, so the equilibrium interest rate solves

$$\beta (1 + r) = (1 + \gamma)^{\theta}$$

where $\theta \equiv \rho - \nu (1 - \rho)$. The capital demand equation is the same as before: $(1 - \alpha) \frac{y_t}{k_t} = r_t + \delta + \psi_k$. For simplicity we focus here on the case of homogenous corporate borrowers. Capital is still given by $(1 - \alpha) k^{-\alpha} = r + \delta + \psi_k$, and the capital-output ratio: $\frac{k}{y} = \frac{1-\alpha}{r+\delta+\psi_k}$.

Household Credit

The other households leave for two periods. The young (index 1) have a labor endowment η_1 and the old (index 2) have a labor endowment η_2. We normalize the labor supply to one: $\eta_1 + \eta_2 = 1$. The life-time utility of a young household is $u (C_{1,t}, M_{1,t}) + \beta u (C_{2,t+1}, M_{2,t+1})$. I consider the case where they want to borrow when they are young (i.e., η_1 is small enough). In the first period, its budget constraint is $C_{1t} + \psi_m M_{1t} = \eta_1 W_{1t} + (1 - \psi_c) B_t$. The screening costs of lending to households is ψ_c. In the second period, it consumes $C_{2t+1} + \psi_m M_{2t+1} = \eta_2 W_{t+1} - (1 + r_{t+1}) B_t$.

Households in the model do not lend directly to one another. Savers lend to intermediaries. These intermediaries lend to firms and to households who need to borrow. The detrended Euler equation for short lived households is:

$$\mathbb{E}_t \left[\beta (1 + r_{t+1}) (1 + \gamma_{t+1})^{-\theta} \left(\frac{c_{2t+1}}{c_{1t}} \right)^{-\theta} \right] = 1 - \psi_c.$$

On the Balanced Growth Path, the interest rate is pinned down by the long horizon savers $\beta (1 + r) = (1 + \gamma)^{\theta}$. The Euler equation of short lived households becomes simply

$$c_1 = (1 - \psi_c)^{\frac{1}{\theta}} c_2$$

In addition $\psi_m m = \nu c$ for each cohort, so the budget constraints are m$(1 + \nu) c_1 = \eta_1 w + (1 - \psi_c) b$ and $(1 + \nu) c_2 = \eta_2 w - \frac{1+r}{1+\gamma} b$. Using $w = \alpha y$, we find that borrowing by young households relative to GDP is

$$\frac{b}{y} = \frac{(1 - \psi_c)^{\frac{1}{\theta}} \eta_2 - \eta_1}{(1 - \psi_c) + (1 - \psi_c)^{\frac{1}{\theta}} \frac{1+r}{1+\gamma}} \alpha$$

If ψ_c is 0, we get $b = \frac{\eta_2 - \eta_1}{1 + \frac{1+r}{1+\gamma}} w$. If ψ_c is too high, no borrowing takes place. Broadly speaking, from the perspective of current consumption, credit costs act as a tax on future labor income.

Equilibrium

Finally we get the consumption of the long lived savers (c_0) from the resource constraint. Since $\psi_m m_i = \nu c_i$ for all i, we have $y = (1+\nu)(c_0 + c_1 + c_2) + \psi_c b + (\gamma + \delta + \psi_k) k$. Since $\eta_1 + \eta_2 = 1$, and $w = \alpha y$, we get

$$(1+\nu) c_0 = (r-\gamma)\left(k + \frac{b}{1+\gamma}\right).$$

Total expenditure of long lived households is equal to their capital income from loans to coporates and to short lived households.

The GDP share of finance is

$$\phi = \psi_m \frac{m}{y} + \psi_c \frac{b}{y} + \psi_k \frac{k}{y}$$

We summarize our results in the following Proposition

Proposition 2. ***Equilibrium Household Finance***. *The income share of finance is constant on the Balanced Growth Path. Consumer borrowing over GDP ($\frac{b}{y}$) decreases with intermediation costs ψ_c and increases with the slope of cycle earnings profiles. There is no permanent crowding out of corporate investment by household borrowing. Liquidity demand $\frac{m}{y}$ decreases with ψ_m and ψ_k. Changes in ψ_m have no impact on the GDP share of finance, while changes in ψ_c have an inverse U-shape impact.*

The no-crowding-out result is only true on the balanced growth path. It relies on a constant real rate (portfolio adjustment by long lived agents) and constant returns to scale in intermediation. The bigger the gap $\eta_2 - \eta_1$ the larger the borrowing. For instance, increased schooling creates more borrowing.

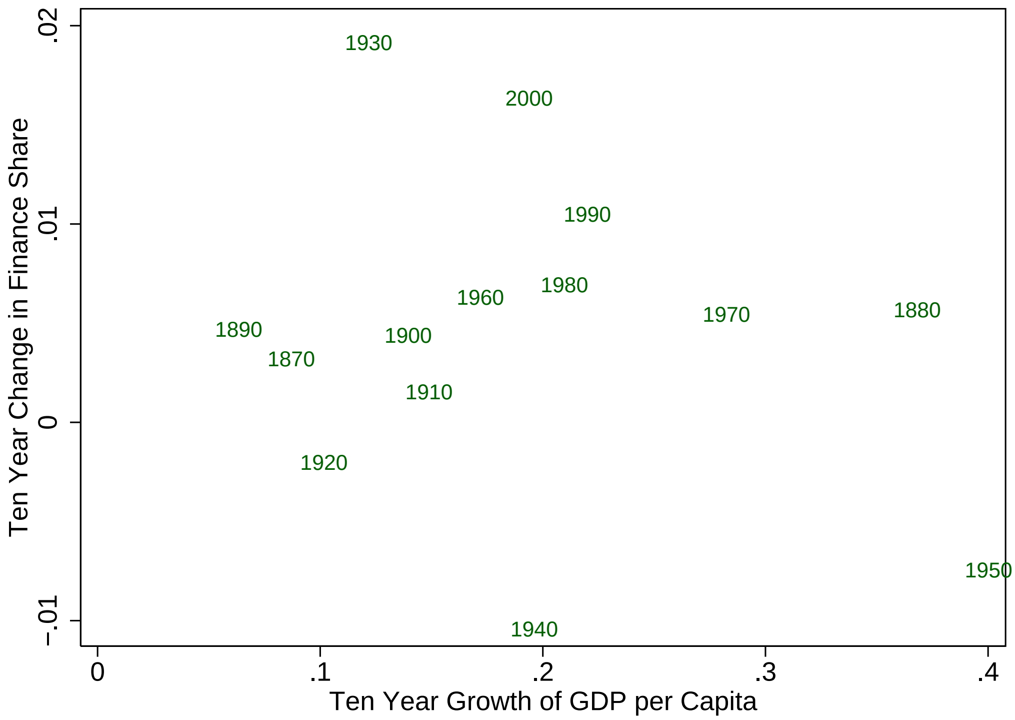
Improvements in corporate finance increase liquidity demand (by long lived household) because they increase the consumption output ratio. When ψ_k goes down, k/y goes up while b/y is unchanged, therefore $\nu c_0/y$ goes up.

One important point is that the model does not predict an income effect, i.e., just because a country becomes richer does not mean that it should spend a higher fraction of its income on financial services. Of course, income per capita is not a stationary variable, while the share of finance is bounded by definition. We can nonetheless look at long run changes in income and ask whether the share of finance tends to increase more when income growth is faster. Figure 4 shows that there is no mechanical relationship between the growth of income per capita and the share of finance. This rules out any theory that predicts that the finance share should mechanically increase with income.

3 Measuring the Production of Financial Intermediation

The previous section has made it clear that we need to carefully consider the production of assets. In this section I construct empirical proxies for $\frac{m}{y}$; $\frac{b}{y}$; $\frac{k}{y}$.

Figure 4: Finance and Income

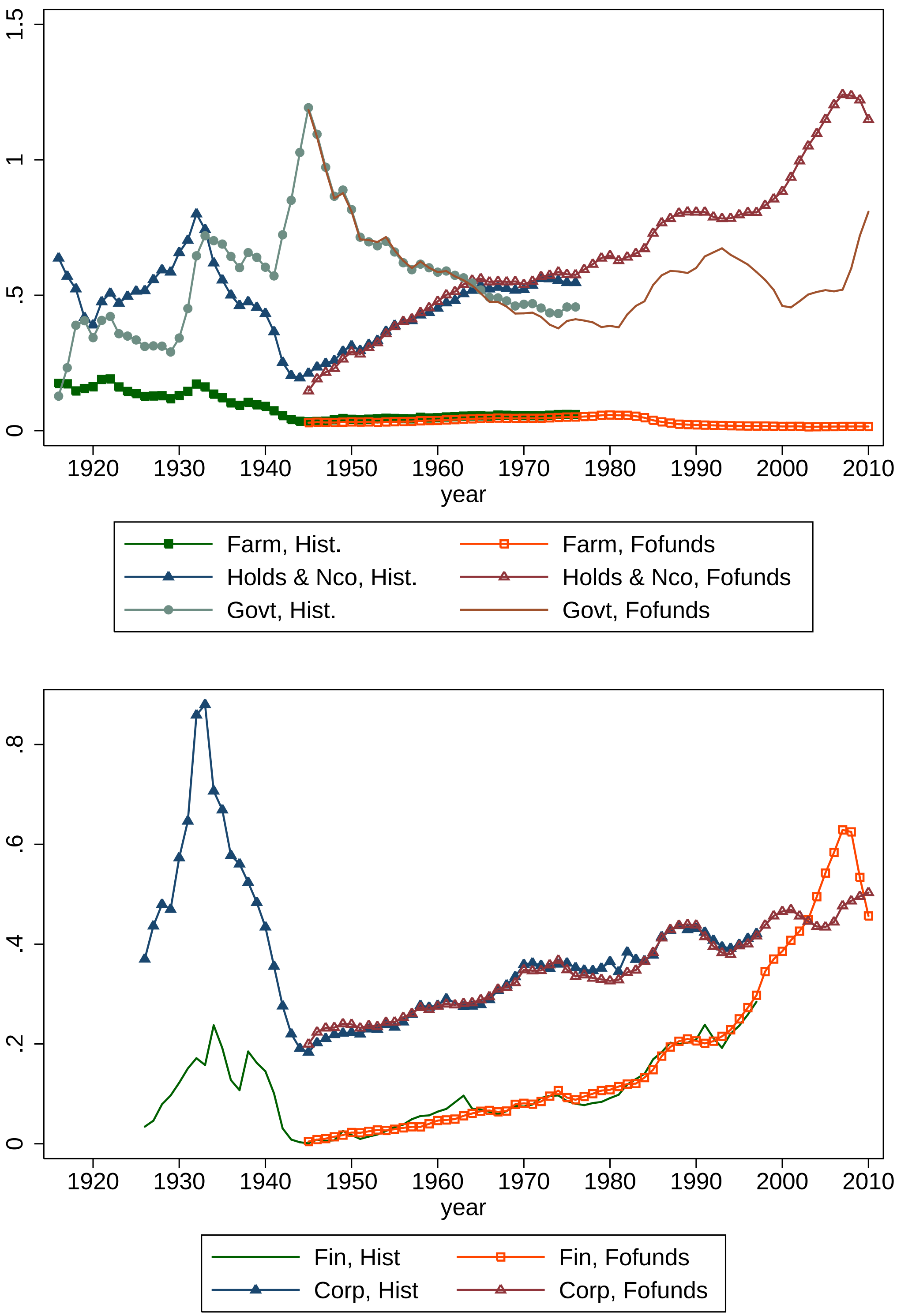


Notes: See notes to Figure 1 for definition of Income Share of Finance.

3.1 Credit Markets

Figure 5 presents credit liabilities of farms, households and the government. The first point to take away is the good match between the various sources. As with the income share above, this allows us to extend the series in the past. The main features of the long run series in Figure 5 are the impact of WWII on government debt, and the growth of household debt in the post-war era. The bottom panel of Figure 5 presents credit liabilities of financial and non-financial corporates. Two features stand out. First the non-financial corporate credit market is not as deep even today as it was in the 1920s. Second, financial firms have become a major player in the credit markets. Banks used to fund themselves with deposits and equity, and not much long term debt. Today they issue a lot of long term debt.

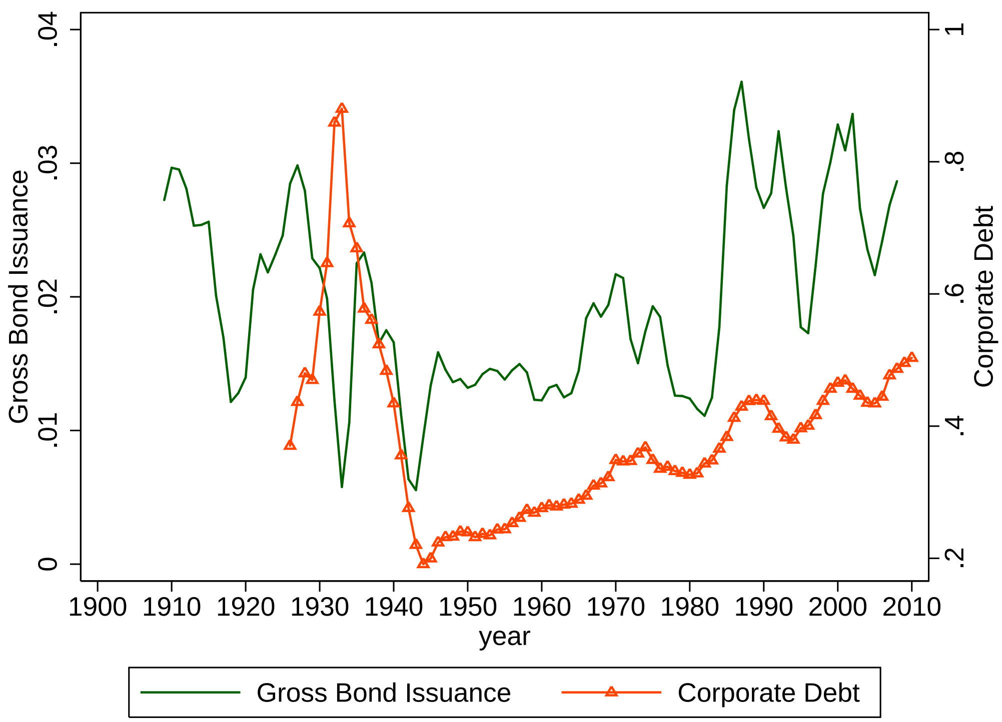
Figure 5: Debt over GDP: Farms, Households, Corporate, and Government



Notes: Farm is simply the farm sector, Holds & Nco include households and non-corporate, govt is government. Fin is finance and real estate, corp is non-financial corporate. Fofunds is flow of funds, Hist is Historical Statistics of the United States.

In the theory outlined earlier, there is no distinction between outstanding credit and issuances. In the data the two are different. For the non-financial corporate sector it is also useful to consider issuances of bonds. Figure 6 shows the issuance of (non-financial) corporate bonds and the ratio of oustanding (non-financial) corporate debt over GDP. There is a clear and obvious post-war correlation, but also a significant difference in the pre-war sample. The debt to GDP ratio peaks in the 1930s in part because of deflation, while bond issuance collapses.

Figure 6: Corporate Debt and Borrowing over GDP



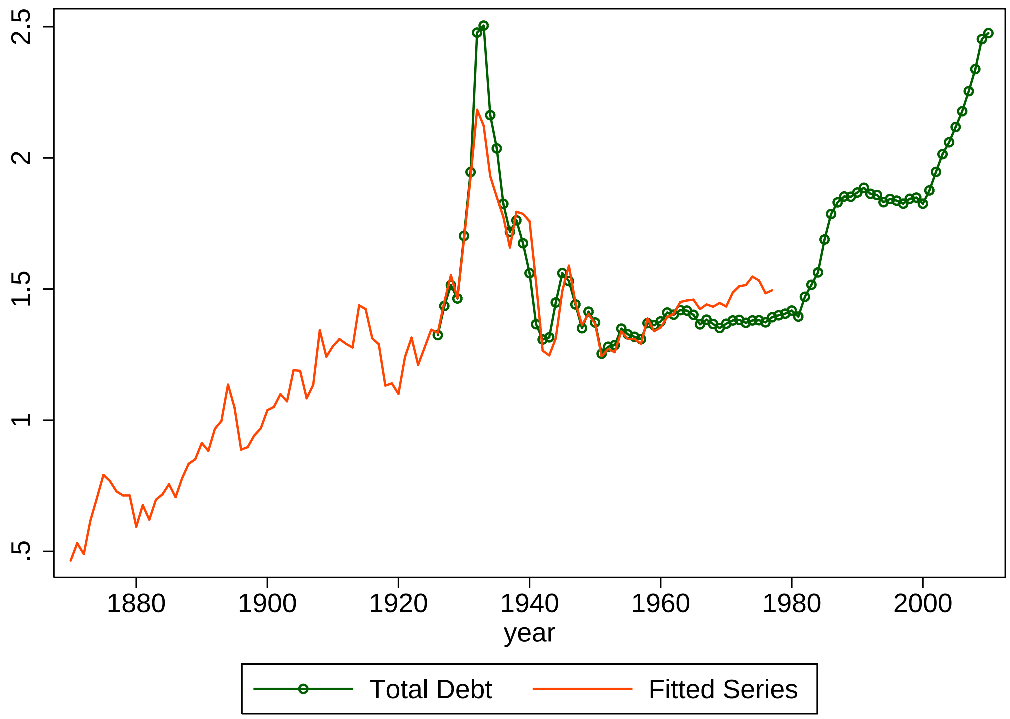
Notes: "Gross Issuance" is a three-year centered moving average of gross bond issuance by non-financial firms. Sources are Historical Statistics of the United States and Baker and Wurgler (2000).

To extend the credit series before 1920, I use the balance sheets of financial firms. I measure assets on the balance sheets of commercial banks, mutual banks, savings and loans, federal reserve banks, brokers, and life insurance companies. I define total assets as the sum of assets of all these financial firms over GDP. I use this series to extend the total non-financial debt series (households & non corporates, farms, corporates, government). I regress total credit on total assets and use the predicted value to extend the credit series. The fit and the extended series are presented on Figure 7.

3.2 Equity Market

The equity market is difficult to deal with because of valuation effects. Stocks, unlike bonds, are recorded at market value. The ratio of the market value of equity to GDP fluctuates without any intermediation services (i.e., without any issuance of equity). Another problem is that net issuances can be negative. However, the fact that net issuances are negative does not imply that no intermediation services are produced. To deal with these problems I use three measures of equity production: total market value over GDP, IPO proceeds over GDP, and gross (non-financial)

Figure 7: Total Debt/GDP (extended)



Notes: Fitted Series uses assets on balance sheets of financial firms to predict total debt. Sources are Historical Statistics of the United States and Flow of Funds.

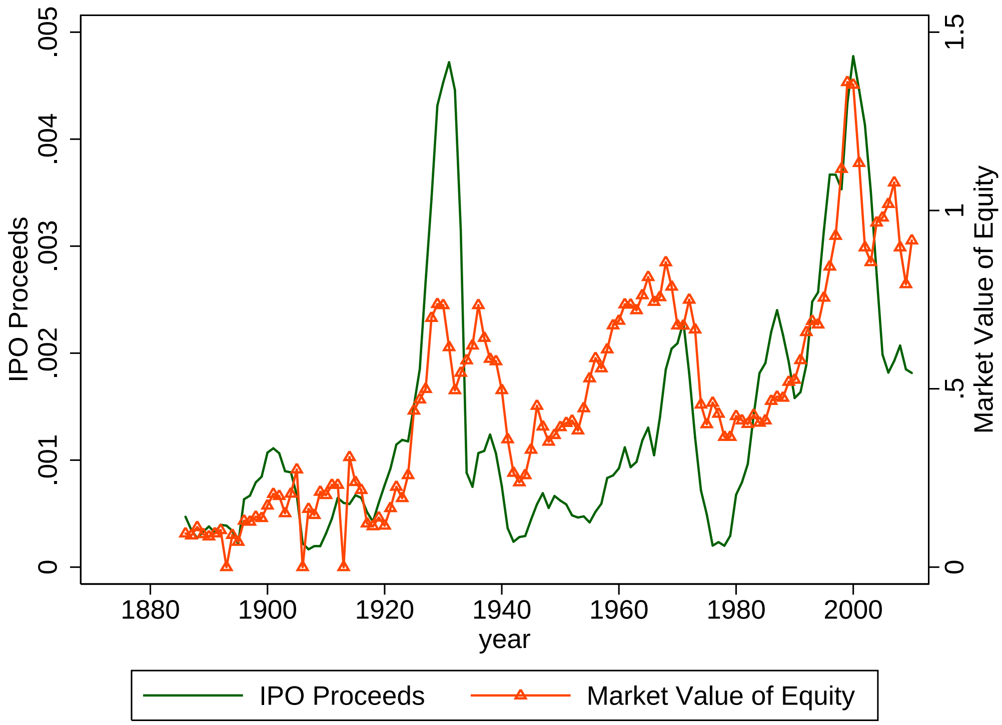
equity offerings over GDP. Figures 8 shows the IPO and market value measures. As argued by Jovanovic and Rousseau (2001) and Jovanovic and Rousseau (2005), the IPO market of the 1920s was remarkably active, even compared to the one of the 1990s: the IPO firms are of similar ages, and the proceeds are comparable. By contrast, the market value of GDP has an upward trend, in part due to increases in price earnings ratios, and in part due to an increase in the stock market listing.

Figure 9 shows the evolution of the market value of equity and of gross issuances of stock. The gross issuance series is dominated by the large spike in the late 1920s, but even without this spike, the level of stock offerings appears remarkably stationary. Thus, the increase in market value does not mean that equity funding has become more important.

3.3 Money and Liquidity

In addition to credit (on the asset side of banks), households benefit from payment and liquidity services (on the liability side of banks and money market funds). I use the total currency and deposits, including money market fund shares, held by households and nonprofit organizations. Figure 10 shows the evolution of this variable.

Figure 8: Equity and IPO Proceeds over GDP



Notes: Market Value of non-financial corporate firms from the Flow of Funds and from CRSP. IPO is a three-year centered moving average of IPO proceeds over GDP. Sources are Jovanovic and Rousseau (2001) and Ritter (2011).

3.4 Financial Intermediation Cost

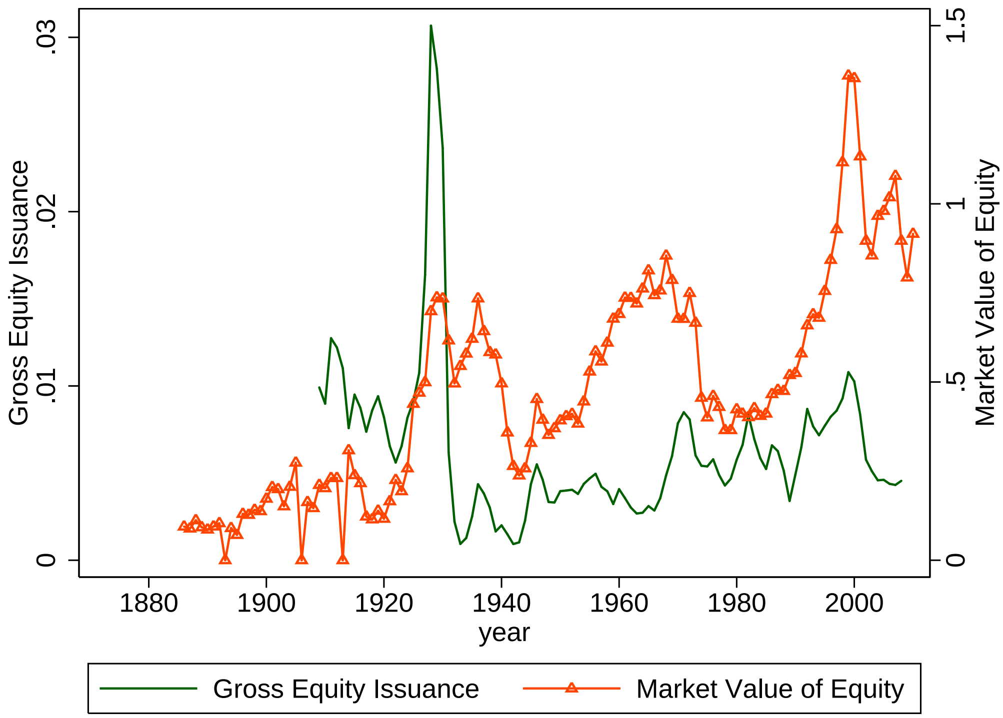
The models presented in Section 2 predict the following relationship between the GDP share of finance and the production of financial assets and services:

$$\phi = \psi_k \frac{b_k}{y} + \psi_e \frac{e}{y} + \psi_c \frac{b_c}{y} + \psi_m \frac{m}{y} + \psi_g \frac{b_g}{y},$$

where b_k is corporate borrowing, e is corporate equity issuance, b_c is household borrowing, m are deposits, and b_g is government debt. An important issue is that I cannot measure the GDP share linked to these assets separately, so I cannot directly estimate the parameters ψ's. I will therefore assume that the relatives ψ's are constant, and I allow the average ψ so move over time.

For lack of better information, I will assume that $\psi_k = \psi_c$ so that it is equally difficult to extend credit to firms or to households. I will also assume $\psi_m = \psi_c$ (but the results are not very sensitive because deposits are relatively stable after 1920). Altinkilic and Hansen (2000) report underwritter feeds of 4% for equity and about 1% for bonds. I assume $\psi_e = 4\psi_k$. Finally there is the issue of the debt of the government. On the one hand, it is risk-free and liquid. On the other hand, there is some duration risk, and it needs to be traded. For bonds, underwritting fees are about 1%, while the cheaper money funds charge about 25 basis points for corporate and government debt.

Figure 9: Equity and Gross Issuances over GDP

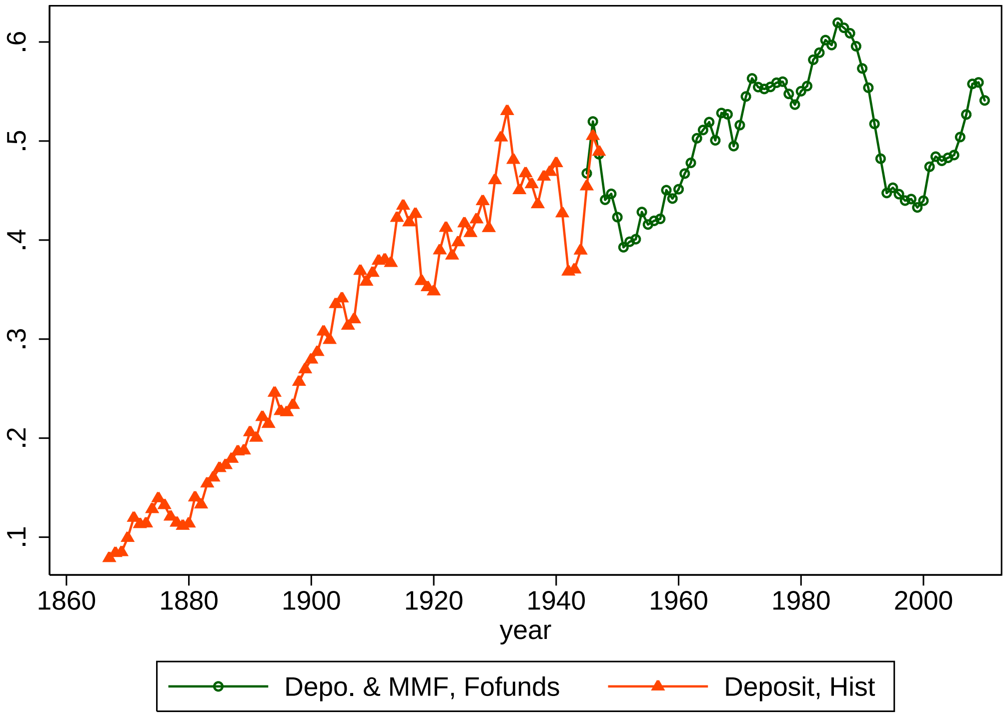


Notes: Market Value of non-financial corporate firms from the Flow of Funds and from CRSP. Gross issuance is a three-year centered moving averages. Sources are Historical Statistics of the United States and Baker & Wurgler (2001).

So, if the only cost of intermediation for government securities is 20bps and for corporates it is 1.2%, I assume $\frac{\psi_g}{\psi_k} = \frac{0.25}{1.25} = 0.2$.

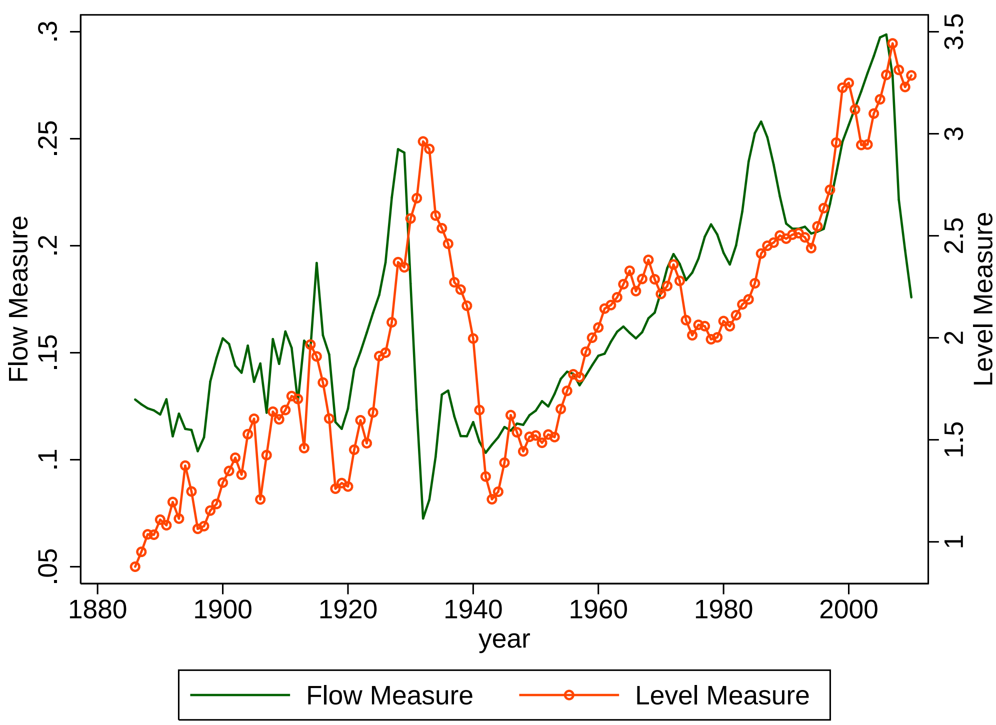
I construct two output series for the finance industry. One using the flows (gross issuances over GDP) and one using the levels (debt and equity over GDP). Note that both are relevant in theory. Screening models apply to the flow of new issuances, while monitoring models apply to the stocks. Trading applies to both. The two series are displayed in Figure 11. The production of financial services increases steadily until WWI, and rapidly after 1919 until 1929. It collapses during the great depression and WWII. It increases steadily until 1975 and more randomly afterwards. The flow and level measures share the same long term trends, but there are clear differences at medium frequencies. The flow variable is more stationary before WWI, suggesting a steady buildup of financial assets. The flow variable collapses much faster during the great depression and the great recession. The level variable peaks in 1933 because of deflation and the need to restructure balance sheets and deal with rising default rates.

Figure 10: Deposits



Notes: Sources are Historical Statistics of the United States and Flow of Funds.

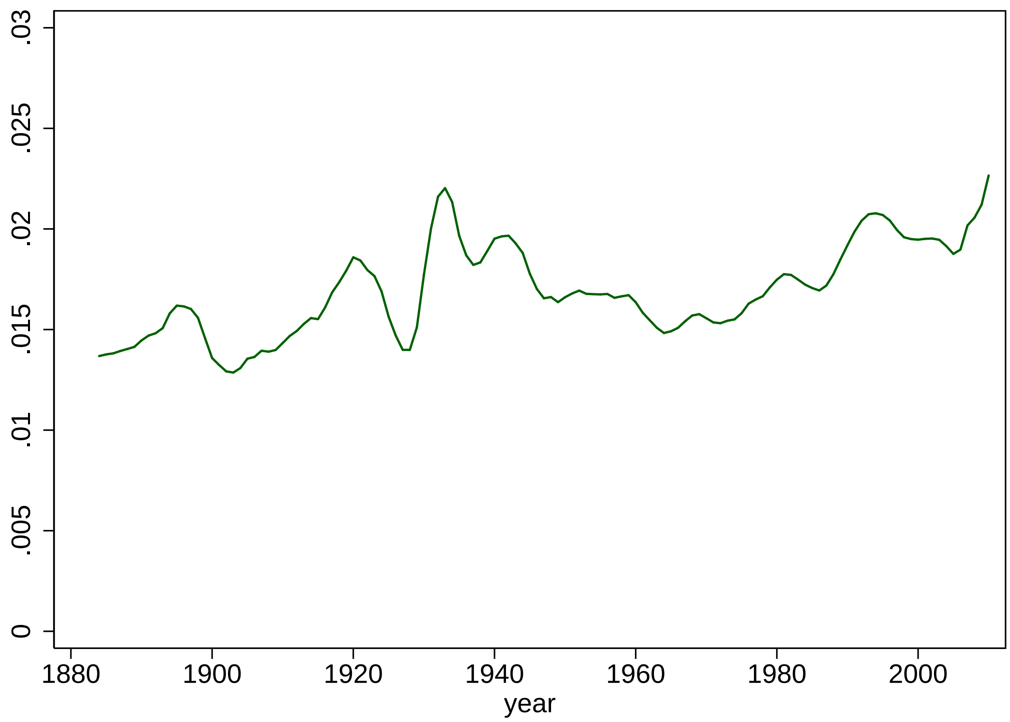
Figure 11: Financial Intermediation Output



Notes: Production of credit assets, equity and deposits divided by total intermediation costs.

Figure 12 estimates the cost of financial intermediation, defined as the value added share divided by output series. For output, I use a linear combination of the two series in figure 11: the average of the stock and 20 times the flow. The factor 20 gives approximately the same mean to the two components (flows are about 5% of stocks). Changing the weight changes the short run behavior of the cost, but not its long run behavior.

Figure 12: Financial Intermediation Cost Index



Notes: Production of credit assets, equity and deposits divided by total intermediation costs.

Figure 12 is the main contribution of the paper. It brings together the theory of Section 2 and the historical/empirical work of Section 3. There are two main points. The first, and most important, is that the ratio is remarkably stable. Recall that we started from a series in Figure 1 that fluctuates by a factor of 5 (9% relative to less than 2%). All the debt, deposit and equity series also vary a lot over time. But their ratio, properly scaled, seems quite stable. On Figure 12 it stays between 1.3% and 2.3% over 130 years. Also note that over this period, interest rates, inflation rates, and real growth rates also vary a lot. Thus, however stylized the model might be, it seems to capture something of first order relevance.

The second main point is that the finance cost index has been trending upward, especially since the 1970s. This is counter-intuitive. If anything, the technological development of the past 40 years (IT in particular) should have disproportinately increased efficiency in the finance industry. How is it possible for today's finance industry not to be significantly more efficient that the finance industry of John Pierpont Morgan? I conclude from Figure 12 that there is a puzzle.[9]

[9]Changes to the assumptions made along the way do not change the basic conclusion that the finance industry has become less

4 Discussion

4.1 Information Technology

An obvious driving force in financial intermediation is information technology. One often hears the argument that improvement in IT explains the increase in the share of finance. This argument, however, is either incomplete, or misleading. One reason it is incomplete is simply that the GDP share of finance was high in the 1920s, a long time before the IT revolution. One could argue that there were improvements in IT at that time (phones, cables, etc.). These technologies, however, did not disappear in the 1930s and only improved during WWII. Finance, on the other hand, never recovered its size until the late 1980s. Hence, the argument is incomplete.[10]

What makes the IT argument misleading, however, is that it is far from clear why IT should increase the share of finance. The models of Section 2 predict that, in most cases, technological improvement should lower the share of GDP spent on financial intermediation. In particular, this prediction is unambiguous for intermediation services used by all firms. The reason is that for these basic services there is no extensive margin effect where better finance could gives access to firms that were previously priced out. This seems like a fair description of some retail finance intermediation. Essentially, the physical transaction costs of buying and holding financial assets must have decreased because of IT. This effect should have lowered the amount spent on intermediation. An apt analogy is with retail and wholesale trade. As Blanchard (2003) explains in his discussion of Basu, Fernald, Oulton, and Srinivasan (2003) "fully one-third of the increase in TFP growth from the first to the second half of the 1990s in the United States came from the retail trade sector. For this reason, the general merchandising segment, which represents 20% of sales in the sector, was one of the sectors examined in a McKinsey study (McKinsey Global Institute, 2001) aimed at understanding the factors behind U.S. TFP growth in the 1990s."

Figure 13 shows the evolution of GDP shares and IT investment in wholesale trade, retail trade, and finance. The contrast is striking. It seems logical to conclude that for all financial services that resemble wholesale and retail trade, IT should have made finance smaller, not larger.

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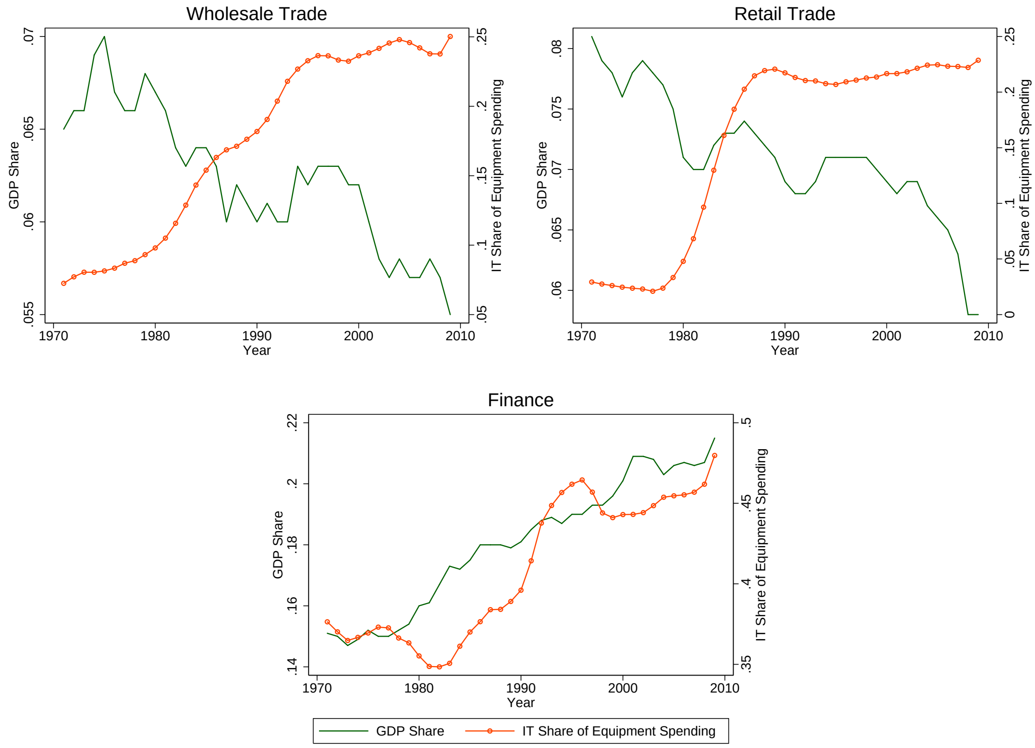
efficient over time. In fact, most changes only lend further support to the hypothesis that the finance industry has become less efficient over time.

[10] One could argue for a temporary impact of IT, but this would take us too far from our main discussion.

Figure 13: IT and GDP Shares in Trade and Finance



Notes: Data from BEA.

4.2 Price Informativeness and Risk Sharing

Using the GDP share of finance to measure the costs of financial intermediation is fairly straightforward. It ignores hidden costs of systemic risk, but it captures all fees and spreads. The output measure developed above, however, only captures the production of financial assets (equity, bonds, money, etc.). Two important functions of financial markets are not captured: the production of price information, and the provision of insurance.

Going back to the models of Section 2, it is important to ask the following question: If improvements in financial intermediation lead to more informative prices or better risk sharing, where would these improvements be seen in equilibrium?

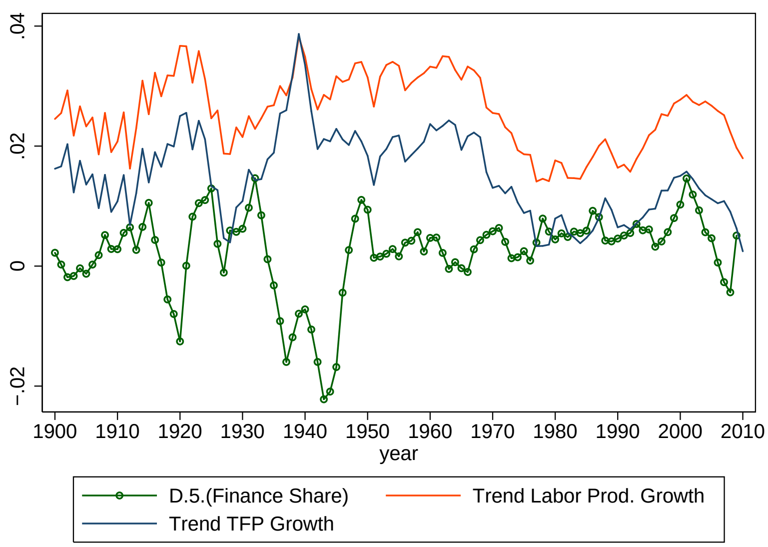
Informativeness of Prices

The second way to test the hypothesis that prices have become more informative is to directly test the signal-to-noise ratio of asset prices. One can, for instance, look at the forecasting quality of equity prices. Preliminary evidence by Bai, Philippon, and Savov (2011) does not suggest that equity or bond prices have become more informative. Among commodity prices, there is no evidence of better forecasting. In fact, practitioners seem to argue that commodity prices have become less informative, as argued by Hadas (2011) for instance. See also Tang and Xiong (2011).

Total Factor Productivity

In a model where managers learn from prices, better prices should lead to better capital allocation and higher productivity. One indirect way to test this idea is to look at the growth rate of productivity in the non-financial sector. Figure 14 presents the 5-year change in the finance income share ($\phi_t - \phi_{t-5}$) and the trend growth rates of labor productivity and total factor productivity. The trends are 10-year centered moving averages. The mean growth rates are 2.5% and 1.5% respectively, and the correlation between the two producivity series is 91.6%. Over the whole sample (1900-2009), the correlation of the change in the finance share is -27% with labor productivity and -45% with TFP. Over the post-war sample (1945-2009), the correlations are -48% and -56%, but they weaken and become insignificant in the post 1970 sample.

Figure 14: Finance and TFP



Notes: Fin Share Change is the 5-year change in the finance GDP share. Trend growth rates are the 10-year centered moving average of growth rates. Data from BLS and Historical Statistics of the United States.

Of course, the fact that the correlation between finance and productivity is negative does not mean that finance has a negative impact on productivity. The most likely interpretation is that a common factor is responsible for the correlation. For instance, the TFP slowdown of the 1970s is associated with increased credit risk for "fallen angels," and the resulting development of the junk bond markets. But at the very least the data reject the idea that the dominating force behind historical changes in productivity growth is improvement in finance leading to more finance and more productivity.

Risk Sharing & Consumption Smoothing

Another benefit of financial intermediation is risk sharing. Risk sharing can affect firms and households.

At the firm level, risk sharing is commonly called risk management. Better risk management would, in equilibrium, mostly translate into lower cost of fund, more issuances and more investment. This first effect would be captured by our measures of debt and equity issuances. Better risk management could also increase TFP if high productivity projects are also riskier. I am not aware, however, of any evidence suggesting improvements in risk management. The most obvious index, that of precautionary savings by businesses, suggest even the opposite: corporate cash holdings have increased over the past 30 years. There is also no direct evidence of credit derivatives leading to better risk management, and it is commonly believed that hedging represents a small fraction of all trades in the CDS market.

At the household level, better risk sharing should lead to less consumption risk. Income inequality has increased dramatically in the US over the past 30 years. If financial markets have improved risk sharing, however, one would expect consumption inequality to have increased by less than income inequality. This is a controversial issue, but Aguiar and Bils (2011) find that consumption inequality has closely tracked income inequality over the period 1980-2007. It seems difficult to argue that risk sharing among households has improved significantly over time. It is also difficult to point to a financial innovation in the past 30 years that would have directly improved risk sharing opportunities among households.

There is evidence of improved consumption smoothing in the housing market. Gerardi, Rosen, and Willen (2010) find that the purchase price of a household's home predicts its future income. The link is stronger after 1985, which coincides with important innovations in the mortgage market. The increase in the relationship is more pronounced for households more likely to be credit constrained. This type of smoothing is captured by the model because I measure all mortgage borrowing. So unlike pure insurance, consumption smoothing over the life cycle does not create a bias in my estimation.

Derivatives: should they be counted at face value?

The market for financial derivatives is extremely large. Since these contracts are in zero net supply, however, they do not enter directly the calculation of output for the finance industry. How should we account for these contracts?

One thing is clear: it would no make sense to count derivatives at face value. For instance, consider the following example. Without derivatives, corporation A borrows from bank B and pays fee ψ. Bank B retains the credit and duration risk on its books. With derivatives, bank B buys insurance against credit risk from fund C (in the CDS market). The sum of B and C holds exactly the same risk and receives the same fee. The two models are exactly equivalent, unless the CDS allows the total fee ψ to go down, and bank B to originate more loans. But this would be fully captured by the model.

In terms of economic theory, derivatives can add real value in one of two ways: (i) risk sharing; (ii) price discovery. Therefore, the correct way to measure their value added is to measure directly the informativeness of prices, or the welfare gains from risk sharing. There is no evidence that I am aware of that points toward better risk sharing. One difficult issue is that better risk sharing could lead to more risk taking and higher productivity. This could bias my results, but I do not know how to fix this potential bias.

4.3 Excess Trading

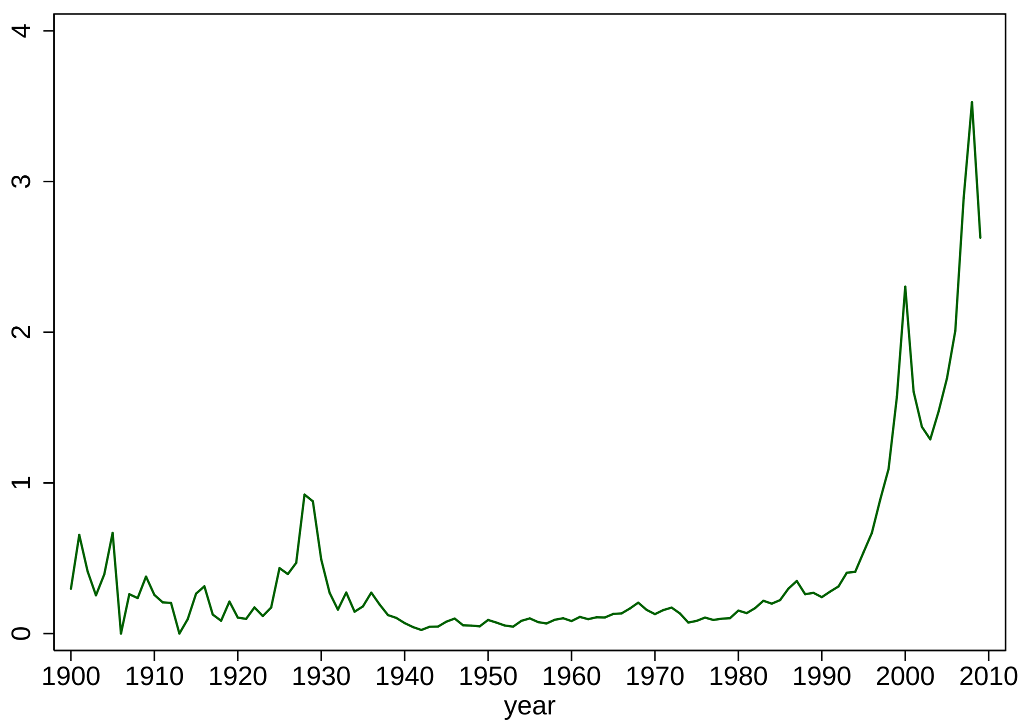
At this point, we are left with a puzzle. Finance has obviously benefited from the IT revolution and this has certainly lowered the cost of retail finance. Yet, even accounting for all the financial assets created in the US, the cost of intermediation appears to have increased. So why is the non-financial sector transferreing so much income to the financial sector?

Mechanically, the reason is an enormous increase in trading. Figure 15 shows the dollar volume of equity trading over GDP in the US. The difference with the other series is striking. Figures 5 to 9 suggest that asset production is roughly stationary. The finance industry of 1900 was just as able as the finance industry of 2000 to produce bonds and stocks, and it was certainly doing it more cheaply. But the recent levels of trading activities are three times larger than at any time in previous history.

Trading costs have decreased (Hasbrouck (2009)), but the costs of active fund management are large. French (2008) estimates that investors spend 0.67% of asset value trying (in vain, by definition) to beat the market. French's calculation are only for the equity market. In Figure 12, the intermediation cost index increases by 25%, from 150 basis points to 200 basis points. With finance at 8% of GDP, this suggests that about 2% of GDP, or about $280 billions annually, are either wasted or at least difficult to account for.

Why do people trade so much? The most obvious explanation is overconfidence, as in Odean (1998). See also Bolton, Santos, and Scheinkman (2011) for a rational reason why some type of informed trading might be excessive.

Figure 15: Equity Trading Volume / GDP



Notes: Dollar Volume of Equity Transactions. Data from NYSE and SEC.

5 Conclusions

The finance industry's share of GDP is about 2 percentage points higher than the neo-classical growth model would suggest, based on historical evidence. More research is needed to provide evidence on whether financial prices have become more informative, or whether risk management and risk sharing have improved. Otherwise, this would represent an annual misallocation of about $280 billions, which appears to come from the large trading volume that investors perform.

A Neo-Classical Growth Model

Households

There is a representative individual who makes all the inter-temporal decisions. She owns the capital stock K_t and maximizes her expected lifetime utility

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t u(C_t) \right],$$

subject to the budget constraint $K_{t+1} + C_t \leq (1 + r_t) K_t + W_t n_t$. From this program we obtain the well-known Euler equation $u_C(t) = \beta \mathbb{E}_t [(1 + r_{t+1}) u_C(t+1)]$. We assume constant returns to scale in production, CRRA preferences $u(C) = \frac{C^{1-\rho}-1}{1-\rho}$, and inelastic labor suply $n = 1$. The Euler equation written with scaled quantitites is then

$$\beta \mathbb{E}_t \left[(1 + r_{t+1}) (1 + \gamma_{t+1})^{-\rho} \left(\frac{c_{t+1}}{c_t} \right)^{-\rho} \right] = 1. \tag{7}$$

Production

Firms maximize profits period by period: $\{n_t, K_t\} = \arg\max_{n,k} F(K, A_t n) - (r_t + \delta) K - W_t n$, and for simplicity I use a Cobb-Douglass production function, where output Y is $F(K, N) = K^{1-\alpha} N^{\alpha}$. The two first order conditions are $F_K(t) = r_t + \delta$, and $F_N(t) = \frac{W_t}{A_t}$. Using $n = 1$, we obtain the capital demand equation

$$(1 - \alpha) k_t^{-\alpha} = r_t + \delta \tag{8}$$

The marginal product of capital must be equal to the rental rate plus the depreciation rate. Finally, detrended output is simply $y_t = k_t^{1-\alpha}$.

Equilibirum

The resource constraint leads to the capital accumulation equation $K_{t+1} = Y_t - C_t + (1 - \delta) K_t$, that can be written with the scaled variables:

$$(1 + \gamma_{t+1}) k_{t+1} = y_t + (1 - \delta) k_t - c_t. \tag{9}$$

The equilibrium involves the state variables $\{A_t, k_t\}$, the three unknowns endogenous variables $\{k_t, c_t, r_t\}$, and the three equilibrium conditions (7), (8), (9).

Two Sectors

The neo-classical growth model can easily be extended to accomodate two industrial sectors. I argue, however, that the tradional multisector model is not useful to analyze financial intermediation. With two industrial sectors, the typical approach is to write final output as a CES aggregate of the output of the two sectors:

$Y_t = \left(\omega \left(y_{1t}\right)^{\frac{\sigma-1}{\sigma}} + (1-\omega)\left(y_{2t}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$. The prediction of such a model are well known. The relative output of sector 1 is given by $\frac{y_1}{y_2} = \left(\frac{\omega}{1-\omega}\left(\frac{A_1}{A_2}\right)^{\alpha}\right)^{\sigma}$ in real terms, and by $\frac{p_1 y_1}{p_2 y_2} = \left(\frac{\omega}{1-\omega}\right)^{\sigma}\left(\frac{A_1}{A_2}\right)^{\alpha(\sigma-1)}$ in nominal terms. So the nominal GDP share of sector i increases with relative technological progress in sector i if and only if the elasticity of substitution is less than one. With goods and services that enter directly into the utility function, we can think of σ as a structural parameter. But this approach cannot shed light on financial intermediation because it is not the reduced form of any sensible model of financial intermediation. This will become evident in the next two section. Section 2.1 introduces the simplest model of intermediation services to firms. In this model, σ is not a structural parameter. It depends both on the shape of the distribution of borrowers and on the efficiency of the supply of financial services. In other words, even in the simplest corporate finance model, σ would depend on A_1/A_2. Section 2.2 introduces financial services to households, and shows again that the standard multi-sector model is not useful to understand the finance industry. To summarize, it is wrong to think of some stable, demand-determined value for σ.

B Household Credit

Capital market clearing requires

$$S_t = K_{t+1} + B_t$$

Adding up the budget constraints we have

$$W_t + (1+r_t) S_{t-1} + (1-\psi_c) B_t - (1+r_t) B_{t-1} = C_{st} + C_{1t} + C_{2t} + S_t$$

The two sides of GDP are

$$\begin{aligned} Y_t &= W_t + (r_t + \delta + \psi_k) K_t \\ Y_t &= K_{t+1} + C_{st} + C_{1t} + C_{2t} - (1-\delta-\psi_k) K_t + \psi_c B_t \end{aligned}$$

Combining them we get

$$K_{t+1} + C_{st} + C_{1t} + C_{2t} = W_t + (1+r_t) K_t - \psi_c B_t$$

Combining with the budget constraints we get

$$(1-\psi_c) B_t - B_t = -\psi_c B_t$$

which is simply the zero profit condition for consumer credit intermediaries.

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