The FinTech Opportunity

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Abstract

This paper assesses the potential impact of FinTech on the finance industry, focusing on financial stability and access to services. I document first that financial services remain surprisingly expensive, which explains the emergence of new entrants. I then argue that the current regulatory approach is subject to significant political economy and coordination costs, and therefore unlikely to deliver much structural change. FinTech, on the other hand, can bring deep changes but is likely to create significant regulatory challenges.

JEL: E2, G2, N2

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This paper studies the FinTech movement in the context of the long run evolution of the finance industry and its regulations. The 2007/2009 financial crisis has triggered new regulatory initiatives and has accelerated existing ones. I argue that the current framework has been useful but that it has run its course and is unlikely to deliver significant structural changes in the future. If regulators want to go further, they will need to consider alternative approaches that are likely to involve FinTech.

FinTech covers digital innovations and technology-enabled business model innovations in the financial sector. Such innovations can disrupt existing industry structures and blur industry boundaries, facilitate strategic disintermediation, revolutionize how existing firms create and deliver products and services, provide new gateways for entrepreneurship, democratize access to financial services, but also create significant privacy, regulatory and law-enforcement challenges. Examples of innovations that are central to FinTech today include cryptocurrencies and the blockchain, new digital advisory and trading systems, artificial intelligence and machine learning, peer-to-peer lending, equity crowdfunding and mobile payment systems.

The starting point of my analysis, developed in Section 1, is that the current financial system is rather inefficient. To show this, I update the work of Philippon (2015) with post-crisis U.S. data. I find that the unit cost of financial intermediation has declined only marginally since the crisis. The evidence outside the U.S. is remarkably similar, as shown in Bazot (2013). Recent research also suggests that many advanced economies have reached a point where "more finance" is not helpful.[1] Significant welfare gains from improvement in financial services are technologically feasible but unlikely to happen without entry of new firms.

I then propose an analysis of financial regulation based on the dichotomy between a top-down regulation of incumbents and a bottom-up regulation of entrants. I argue that current regulations fall in the first category, and I explain how an alternative approach would look like in the context of the FinTech movement.

Section 2 reviews recent regulatory efforts and challenges. The financial regulations enacted after 2009 are not as far reaching as the ones implemented after the Great Depression, but the evidence suggests that these efforts have made the financial sector safer.[2] A defining feature of the current approach, however, is that it focuses almost exclusively on incumbents. I argue that this approach makes it difficult to implement deep structural changes because of ubiquitous ratchet effects in leverage, size and interconnectedness, preferential tax treatments, and oligopoly rents. These distortions are embedded in the current financial system to such an extent that the political and coordination costs of removing them have become prohibitive.

An alternative approach to financial regulation is to encourage entry and shape the development of new systems in order to reach one's policy goals. This approach seeks to contain incumbents, consolidate existing efforts and prevent future regulatory arbitrage, but it does not seek not to impose top-down structural changes. The alternative approach can be complementary to the ongoing development of FinTech firms. One can achieve bottom-up structural

[1] See Favara (2009), Cecchetti and Kharroubi (2012), Shin (2012) among others.

[2] For instance, capital requirements are significantly higher, but funding costs have not increased (Cecchetti, 2014). Of course, higher capital ratios could be desirable (Admati et al., 2013).

change, for instance, by encouraging firms that provide transaction services without leverage, and trading systems that are cheap, transparent and open-access. This alternative approach creates specific regulatory challenges that are discussed in Section 3.

1 Inefficiency of the Existing System

The main finding in Philippon (2015) is that the unit cost of financial intermediation in the U.S. has remained around 2% for the past 130 years. Bazot (2013) finds similar unit costs in other major countries (Germany, U.K., France). Improvements in information technologies have not been passed through to the end users of financial services. This section offers an update of this work, with two goals in mind. First, measurement is difficult, and statistical agencies have recently made some significant data revisions to financial accounts. One needs to know if these revisions affect the main insights of the original paper. The second reason for updating the series is that the data in Philippon (2015) predates the financial crisis and one would like to know how the unit cost of intermediation has evolved since then. I then discuss recent trend in labor compensation and employment. Finally, I discuss the evidence on the link between finance and growth.

1.1 Financial Expenses and Intermediated Assets

To organize the discussion I use a simple model economy consisting of households, a non-financial business sector, and a financial intermediation sector. The details of the model are in the Appendix. The income share of finance, shown in Figure 1, is defined as[3]

$$\frac{y_t^f}{y_t} = \frac{\text{Value Added of Finance Industry}}{\text{GDP}}.$$

The model assumes that financial services are produced under constant returns to scale. The income of the finance industry y_t^f is then given by

$$y_t^f = \psi_{c,t} b_{c,t} + \psi_{m,t} m_t + \psi_{k,t} k_t, \tag{1}$$

where $b_{c,t}$ is consumer credit, m_t are assets providing liquidity services, and k_t is the value of intermediated corporate assets. The parameters $\psi_{i,t}$'s are the unit cost of intermediation, pinned down by the intermediation technology. The model therefore says that the income of the finance industry is proportional to the quantity of intermediated assets, properly defined. The model predicts no income effect, i.e., no tendency for the finance income share to grow

[3]Philippon (2015) discusses various issues of measurement. Conceptually, the best measure is value added, which is the sum of profits and wages. Whenever possible, I therefore use the GDP share of the finance industry, i.e., the nominal value added of the finance industry divided by the nominal GDP of the U.S. economy. One issue, however, is that before 1945 profits are not always properly measured and value added is not available. As an alternative measure I then use the labor compensation share of the finance industry, i.e., the compensation of all employees of the finance industry divided by the compensation of all employees in the U.S. economy. Philippon (2015) also explains the robustness of the main findings to large changes in government spending (because of wars), the rise of services (finance as a share of services displays a similar pattern to the one presented here), globalization (netting out imports and exports of financial services).

with per-capita GDP. This does not mean that the finance income share should be constant, since the ratio of assets to GDP can change. But it says that the income share does not grow mechanically with total factor productivity. This is consistent with the historical evidence.[4]

Measuring intermediated assets is complicated because these assets are heterogenous. As far as corporate finance is concerned, the model is fundamentally a user cost model. Improvements in corporate finance (a decrease in ψ_k) lower the user cost of capital and increase the capital stock, which, from a theoretical perspective, should include all intangible investments and should be measured at market value. A significant part of the growth of the finance industry over the past 30 years is linked to household credit. The model provides a simple way to model household finance. The model also incorporates liquidity services provided by specific liabilities (deposits, checking accounts, some form of repurchase agreements) issued by financial intermediaries. One can always write the RHS of (1) as $\psi_{c,t}\left(b_{c,t}+\frac{\psi_{m,t}}{\psi_{c,t}}m_t+\frac{\psi_{k,t}}{\psi_{c,t}}k_t\right)$. Philippon (2015) finds that the ratios $\frac{\psi_{m,t}}{\psi_{c,t}}$ and $\frac{\psi_{k,t}}{\psi_{c,t}}$ are close to one.[5] As a result one can define intermediated assets as

$$q_t \equiv b_{c,t}+m_t+k_t. \tag{2}$$

The principle is to measure the instruments on the balance sheets of non-financial users, households and non-financial firms. This is the correct way to do the accounting, rather than looking at the balance sheet of financial intermediaries. After aggregating the various types of credit, equity issuances and liquid assets into one measure, I obtain the quantity of financial assets intermediated by the financial sector for the non-financial sector, displayed in Figure 1.

1.2 Unit Cost and Quality Adjustments

I can then divide the income of the finance industry by the quantity of intermediated assets to obtain a measure of the unit cost

$$\psi_t \equiv \frac{y_t^f}{q_t}. \tag{3}$$

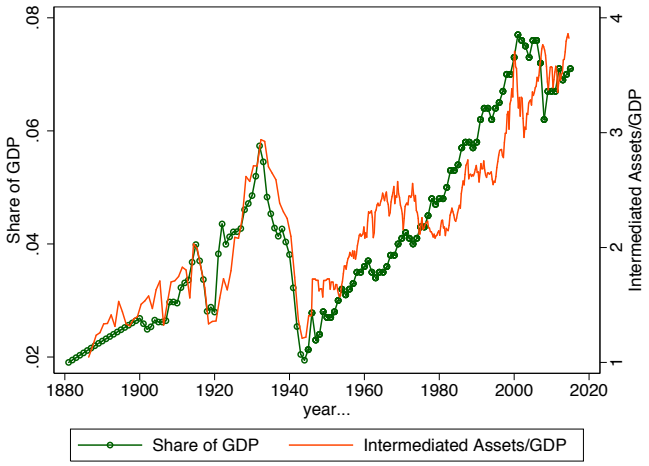
Figure 2 shows that this unit cost is around 2% and relatively stable over time. In other words, I estimate that it costs two cents per year to create and maintain one dollar of intermediated financial asset. Equivalently, the annual rate of return of savers is on average 2 percentage points below the funding cost of borrowers. The updated series are similar to the ones in the original paper. The unit costs for other countries are estimated by Bazot (2013) who finds convergence to US levels.

The raw measure of Figure 2, however, does not take into account changes in the characteristics of borrowers.

[4]The fact that the finance share of GDP is the same in 1925 and in 1980 makes is already clear that there is no mechanical relationship between GDP per capita and the finance income share. Similarly, Bickenbach et al. (2009) show that the income share of finance has remained remarkably constant in Germany over the past 30 years. More precisely, using KLEMS for Europe (see O'Mahony and Timmer (2009)) one can see that the finance share in Germany was 4.3% in 1980, 4.68% in 1990, 4.19% in 2000, and 4.47% in 2006.

[5]This is true most of the time, but not when quality adjustments are too large. Philippon (2015) provides calibrated quality adjustments for the U.S. financial system.

Figure 1: Finance Income and Intermediated Assets



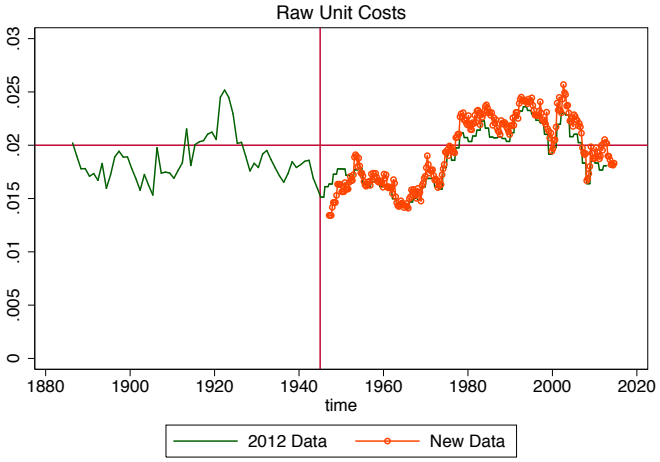
Notes: Both series are expressed as a share of GDP. Finance Income is the domestic income of the finance and insurance industries, i.e., aggregate income minus net exports. Intermediated Assets include debt and equity issued by non financial firms, household debt, and various assets providing liquidity services. Data range for Intermediated Assets is 1886 - 2012. See Philippon (2015) for historical sources and details about the underlying data.

These changes require quality adjustments to the raw measure of intermediated assets. For instance, corporate finance involves issuing commercial paper for blue chip companies as well as raising equity for high-technology start-ups. The monitoring requirements per dollar intermediated are clearly different in these two activities. Similarly, with household finance, it is more expensive to lend to poor households than to wealthy ones, and relatively poor households have gained access to credit in recent years.[6] Measurement problems arise when the mix of high- and low-quality borrowers changes over time.

Following Philippon (2015), I then perform a quality adjustment to the intermediated assets series. Figure 3 shows the quality adjusted unit cost series. It is lower than the unadjusted series by construction since quality adjusted assets are (weakly) larger than raw intermediated assets. The gap between the two series grows when there is entry of new firms, and/or when there is credit expansion at the extensive margin (i.e., new borrowers). Even with the adjusted series, however, we do not see a significant decrease in the unit cost of intermediation over time.

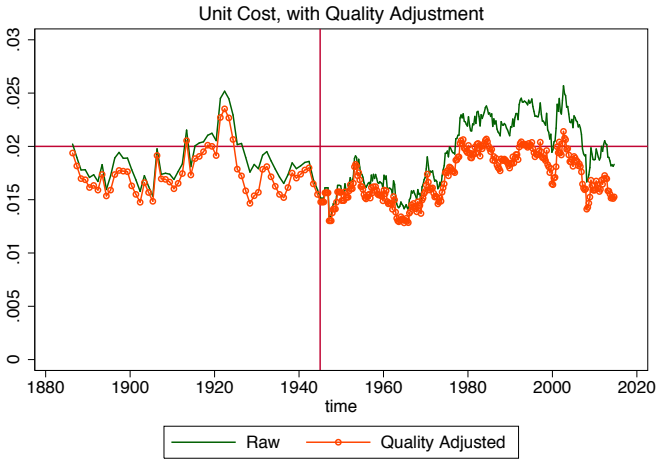
[6] Using the Survey of Consumer Finances, Moore and Palumbo (2010) document that between 1989 and 2007 the fraction of households with positive debt balances increases from 72% to 77%. This increase is concentrated at the bottom of the income distribution. For households in the 0-40 percentiles of income, the fraction with some debt outstanding goes from 53% to 61% between 1989 and 2007. In the mortgage market, Mayer and Pence (2008) show that subprime originations account for 15% to 20% of all HMDA originations in 2005.

Figure 2: Unit Cost of Financial Intermediation



Notes: The raw measure is the ratio of finance income to intermediated assets, displayed in Figure 1. The 2012 data is from Philippon (2015), while the new data was accessed in May 2016. Data range is 1886 - 2015.

Figure 3: Unit Cost and Quality Adjustment



Notes: The quality adjusted measure takes into account changes in firms' and households' characteristics. Data range is 1886 - 2015.

Finance has benefited more than other industries from improvements in information technologies. But, unlike in retail trade for instance, these improvements have not been passed on as lower costs to the end users of financial services. Asset management services are still expensive. Banks generate large spreads on deposits (see Figure 1 in Drechsler et al. (2014)). Finance could and should be much cheaper. In that respect, the puzzle is not that FinTech is happening now. The puzzle is why it did not happen earlier.

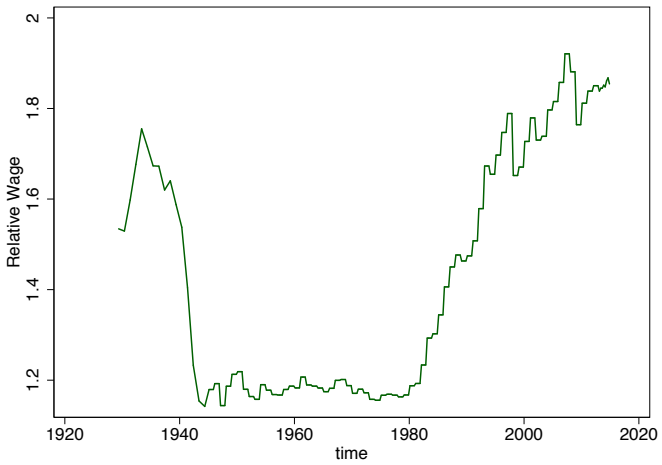
1.3 Wages and Employment

Philippon and Reshef (2012) document the evolution of the relative wage in the finance industry defined as

$$relw = \frac{\bar{w}_t^{fin}}{\bar{w}_t^{all}}$$

where $\bar{w}$ is the average wage (total compensation divided by total number of employees). This measure does not control for changes in the composition of the labor force within a sector (see Philippon and Reshef (2012) for micro evidence on this issue). Figure 4 updates their findings. One can clearly see the high wages of the 1920s, the drop following the Great Depression and WWII, and then a period a remarkably stability, from 1945 to 1980. After 1980 the relative wage starts increasing again, in part because low skill jobs are automated (ATMs) and in part because the finance industry hires more brains.

Figure 4: Relative Wage

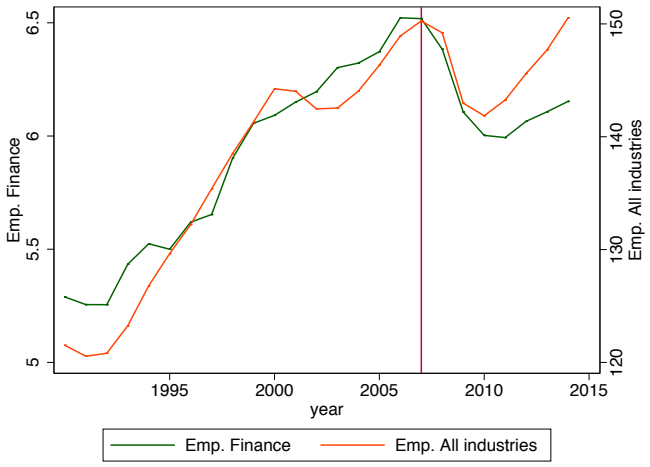


Notes: Wage in Finance divided by Average Wage in All Industries.

We can see some relative wage moderation following the 2007/2009 crisis but it is clearly limited. The labor share in finance has increased a bit relative to the rest of the private sector (i.e., the profit share has fallen a bit more in finance), suggesting that some more moderation in the future, but the changes are not large.

Figure 5 compares the employment dynamics in finance and other industries over the past 25 years. It is quite striking to see that the financial crisis did not initially hit the finance industry more than the rest of the economy. The main difference is the weaker recovery of employment in finance from 2010 onward. Overall finance has shrunk somewhat after the crisis but nowhere near as much as after the Great Depression.

Figure 5: Employment

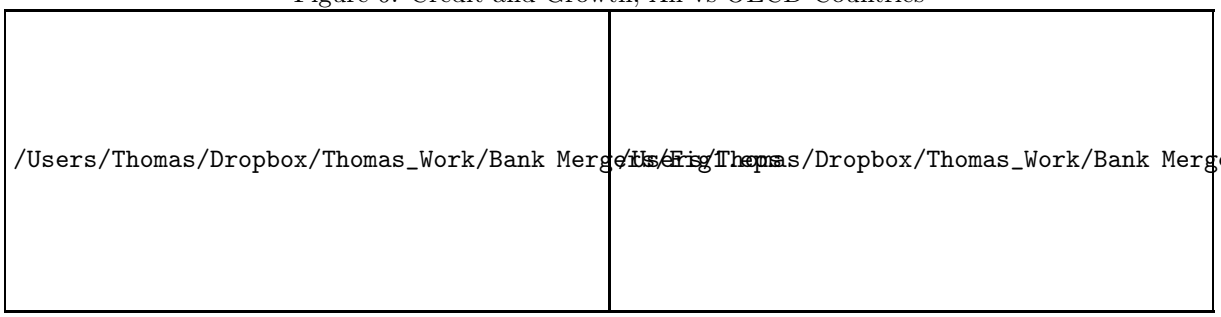


Notes: Millions of Jobs.

1.4 Finance and Growth

There is a large literature studying the links between finance and growth. Levine (2005) provides an authoritative survey, and Levine (2015) a recent discussion. One main finding is displayed in the left panel of Figure 6. Countries with deeper credit markets in 1960 (measured as credit outstanding over GDP) have grown faster between 1960 and 1995.

Figure 6: Credit and Growth, All vs OECD Countries



Notes: Dataset "Financial_Intermediation_and_Growth_dataset" available on Ross Levine's website. See Beck et al. (2011)

It is also important to emphasize that the link between finance and (long term) growth is not a mechanical consequence of credit expansion. As Levine (2005) emphasizes, the primary driver of the finance–growth nexus is the allocation of capital. Better financial systems provide a better allocation of capital, not necessarily more overall credit. This is consistent with the findings in Favara (2009) and Cecchetti and Kharroubi (2012) who argue that the relation between credit and growth is not monotonic.[7] One way to quickly see this is to take the same data, but focus only on OECD countries. Among OECD countries the link between credit and growth is not significant,

[7]It is also related to the issue of credit booms. Schularick and Taylor (2012) document the risk involved in rapid credit expansions. This is not to say that all credit booms are bad. Dell'Ariccia et al. (2016) find only 1/3 of credit booms end in a financial crisis, while many booms are associated with financial reform and economic growth.

as can be see in the right panel of Figure 6.

1.5 Summary

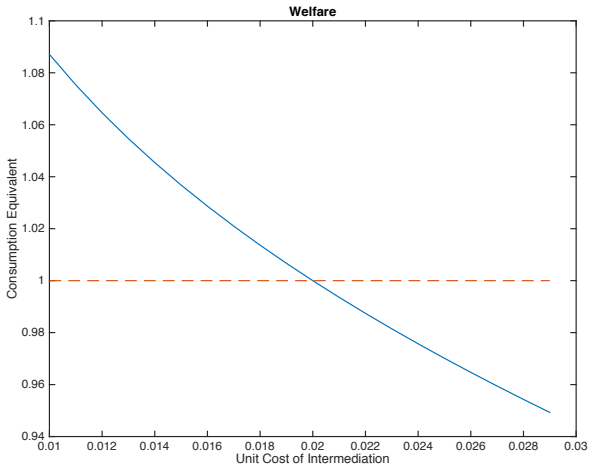
Finance is important for growth, in particular for the allocation of capital, but much of the recent growth of the finance industry has little to do with efficient capital allocation. Financial services remain expensive and financial innovations have not delivered significant benefits to consumers. The point is not that finance does not innovate. It does. But these innovations have not improved the overall efficiency of the system. This is not a great theoretical puzzle: we know that innovations can be motivated by rent seeking and business stealing, in which case the private and social returns to innovation are fundamentally different. The race for speed is an obvious example: there is a large difference between foreknowledge and discovery in terms of *social* welfare, even though the two activities can generate the same *private* returns (Hirshleifer, 1971). This tension between private and social returns exists in most industries, but economists tend to think that entry and competition limit the severity of the resulting inefficiencies.

Lack of entry and competition, however, has been an endemic problem in finance in recent decades. Berger et al. (1999) review the evidence on consolidation during the 1990s. The number of US banks and banking organizations fell by almost 30% between 1988 and 1997, and the share of total nationwide assets held by the largest eight banking organizations rose from 22.3% to 35.5%. Several hundred M&As occurred each year, including mega-mergers between institutions with assets over $1 billion.[8] The main motivations for consolidation were market power and diversification. Berger et al. (1999) do not find much evidence of cost efficiency improvement, which is consistent with Figure 2 and 3. DeYoung et al. (2009) show that consolidation continued during the 2000s. They argue that there is growing evidence that consolidation is partly motivated by the desire to obtain TBTF status, and that M&As have a negative impact certain types of borrowers, depositors, and other external stakeholders.

It is also important to keep in mind that the welfare implications are significant. Figure 7 plots the welfare of agents in the economy as a function of the unit cost of intermediation. Welfare is measured in equivalent consumption units and normalized to one in the benchmark case of a unit cost of 2%. Agents in the economy would be willing to pay 8.7% of consumption to bring the unit cost of intermediation down to 1%.

[8] Banking M&As were part of a large wave. "Nine of the ten largest M&As in US history in any industry occurred during 1998, and four of these – Citicorp-Travelers, BankAmerica-NationsBank, Banc One-First Chicago and Norwest-Wells Fargo – occurred in banking." (Moore and Siems, 1998)

Figure 7: Welfare and The Unit Cost of Intermediation



If one steps back, it is difficult not to see finance as an industry with excessive rents and poor overall efficiency. The puzzle is why this has persisted for so long. There are several plausible explanations for this: zero-sum games in trading activities, inefficient regulations, barriers to entry, increasing returns to size, etc.[9] I will not attempt to disentangle all these explanations. The important point for my argument is simpler: there is (much) room for improvement. In the next section, I will argue that the current regulatory approach is unlikely to bring these improvements.

2 A Perspective on Current Regulations

I will not provide a comprehensive overview of recent financial regulations since the major regulatory bodies publish annual reports that summarize ongoing regulations. The goal of this section is instead to make the case that the focus on incumbents inherent in current regulations increases political economy and coordination costs.

2.1 Recent Achievements

The logic of the current regulatory effort is well summarized in Ingves (2015). Regulators have drawn the lessons from the 2008 disaster and tried to fix the existing system. For instance, before the crisis, banking regulation was mostly based on RWA ratios that were set quite low. Today's regulation is actually quite different:

[9]Greenwood and Scharfstein (2013) provide an illuminating study of the growth of modern finance in the U.S. They show that two activities account for most of this growth over the past 30 years: asset management and the provision of household credit. For asset management, they uncover an important stylized fact: individual fees have typically declined but the allocation of assets has shifted towards high fee managers in such a way that the average fee per dollar of assets under management has remained roughly constant. In Glode et al. (2010), an "arms' race" can occur as agents try to protect themselves from opportunistic behavior by (over)-investing in financial expertise. In Bolton et al. (2011), cream skimming in one market lowers assets quality in the other market and allows financial firms to extract excessive rents. In Pagnotta and Philippon (2011) there can be excessive investment in trading speed because speed allows trading venues to differentiate and charge higher prices. Gennaioli et al. (2014) propose an alternative interpretation for the relatively high cost of financial intermediation. In their model, trusted intermediaries increase the risk tolerance of investors, allowing them to earn higher returns. Because trust is a scarce resource, improvements in information technology do not necessarily lead to a lower unit cost.

- RWA ratios are significantly higher;
- there are multiple metrics, including simple leverage, liquidity ratios, and counter-cyclical buffers;
- there are surcharges for SIFIs, and systemic risk regulation extends beyond banking;
- regulators run rigorous stress tests and banks are required to write living wills.

These regulations are a work in progress, and the path has not always been straightforward. For example, European stress tests were poorly designed in 2009, and became credible only in 2014. The new regulations are costly and sometimes complex, and policy makers are likely to consolidate some of them and streamline the reporting process. But, by and large, these regulations are here to stay, and some of the complexity is by design. As Ingves (2015) argues, multiple metrics make it harder for banks to game the system. Using several measures of risk is also useful because different measures have different advantages and drawbacks. For instance, RWA is better than simple leverage if we think about arbitrage across asset classes at a point in time. On the other hand, simple leverage is more counter-cyclical, as shown by Brei and Gambacorta (2016).

The regulatory tightening, although not as ambitious as after the Great Depression, has achieved several important goals. Capital requirements have increased without adverse effects on funding costs (Cecchetti and Schoenholtz, 2014). For instance, EBA (2015) reports that the CET1 ratio of EU banks increased by 1.7% between December 2013 and June 2015, with a 1.9% increase in capital and about 0.1% increase in RWA. The banking industry has become less risky, at least in developed economies (see for instance the real time value of the Systemic Risk Measure of Acharya et al. (2009) at http://vlab.stern.nyu.edu). Some important goals, however, remain elusive.

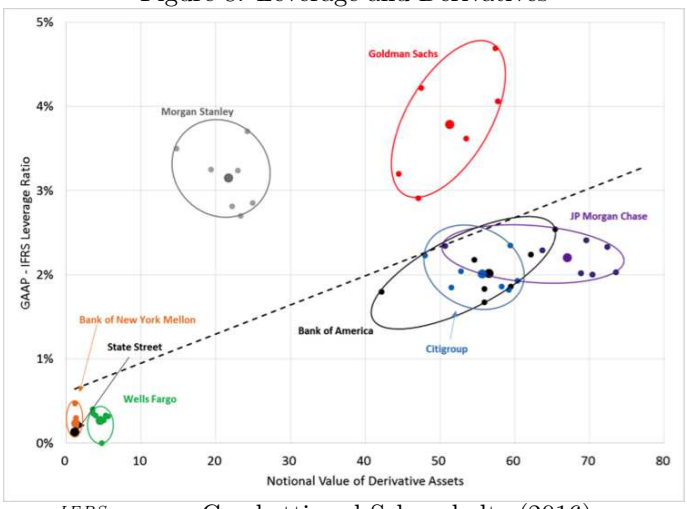
2.2 The Leverage Controversy

The most important regulatory debate following the 2007/2009 crisis revolves around the appropriate level of capital requirement for banks. An influential paper by Admati et al. (2013) argues for high capital ratios and debunked several misleading claims about the supposed cost of such requirements. In the end, capital ratios have been raised significantly, but not to the extent advocated by these authors. The bank leverage debate illustrates an important pitfall of the current approach to financial regulation. Almost everyone agrees that bank leverage was too high before the crisis, but agreeing on a new target capital ratio is more difficult. Countries have conflicting objectives, lobbies are powerful, and, perhaps most importantly, we do not know what the 'right' ratio is because there are several tradeoffs to consider. If the world had only commercial banks and one global regulator, we would be able to estimate an optimal capital ratio, and it would probably be rather high, for the reasons explained in Admati and Hellwig (2013). But this is not our world. Regulators do not always cooperate, jurisdictions compete and undermine each other, and we worry about pushing activities away from the regulated banking sector. Regulatory arbitrage is omnipresent and regulators are highly uncertain about when and how it could happen. Finding the second-best (or third-best) optimal ratio becomes a daunting task. The information and coordination requirements of the current

regulatory approach are prohibitive. I will argue in the last section of the paper that another approach might be feasible.

Leverage is Difficult to Measure. Regulating leverage is also particularly difficult because there are many ways for banks to take risks without increasing their "measured" leverage. One example is the use of derivatives. Figure 8, from Cecchetti and Schoenholtz (2016), shows the impact of netting on the size of balances sheets under two accounting standards. GAAP allows more netting than IFRS. As a result, the equity-to-assets ratio appears larger under GAAP than under IFRS. The difference between the two measures is large for banks that are active in derivatives. This has a material impact on financial regulation, but it is difficult to figure out the true riskiness of these positions.

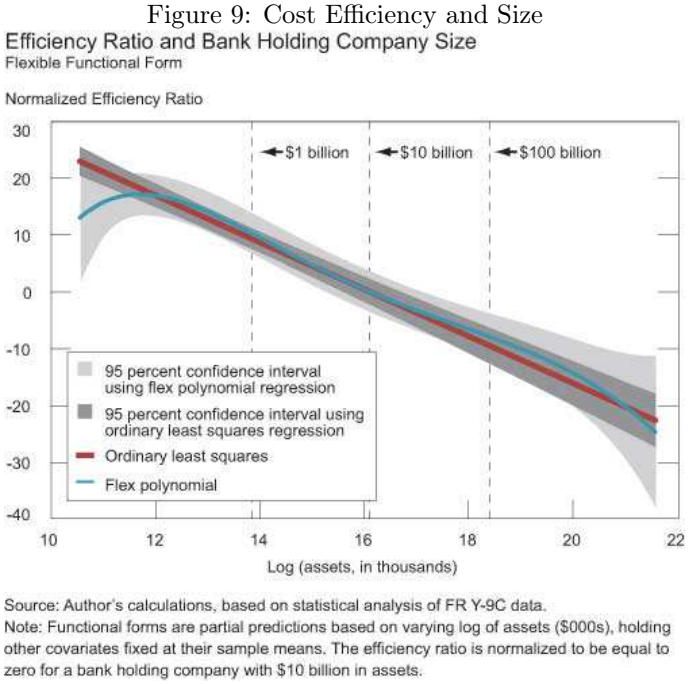
Figure 8: Leverage and Derivatives



Notes: Vertical axis is $E/A^{GAAP} - E/A^{IFRS}$. Source: Cecchetti and Schoenholtz (2016), http://www.moneyandbanking.com

Banks Want to Be Large and Opaque. Banks may want to be large for many reasons. A legitimate reason is to achieve better cost efficiency, as documented in Kovner et al. (2014) and presented in Figure 9. Other reasons involve market power, political influence and implicit guarantees. Consistent with the TBTF idea, Santos (2014) finds that the funding advantage enjoyed by the largest banks is significantly larger than that of the largest non-banks and non-financial corporations. As banks grow, they take on more leverage and they become more opaque. Cetorelli et al. (2014) consider the implications of increasing complexity for supervision and resolution. Finally, implicit guarantees are not only a function of a bank's individual size. Kelly et al. (2016) find evidence of collective government guarantees for the financial sector.

Figure 9: Cost Efficiency and Size



Source: Author's calculations, based on statistical analysis of FR Y-9C data.
Note: Functional forms are partial predictions based on varying log of assets ($000s), holding other covariates fixed at their sample means. The efficiency ratio is normalized to be equal to zero for a bank holding company with $10 billion in assets.

Notes: Efficiency Ratio is non-interest expense over (net interest income + non-interest income). Source: http://libertystreeteconomics.newyorkfed.org/ based on Kovner et al. (2014).

2.3 G-SIFIs versus Narrow Banks

A formidable challenge in financial regulation is to provide credible resolution mechanisms for G-SIFIs. There are two fundamental difficulties. One difficulty comes from the sheer size and complexity of these organizations and the impossibility to forecast what would happen during a crisis. The other issue is that there is little scope for learning and testing various mechanisms because G-SIFIs do not usually fail for idiosyncratic reasons. Living wills, TLAC requirements, are necessary, but in all likelihood they will not be properly battle-tested before a crisis actually happens.

This issue, among others, has led several observers to argue for some form of narrow banking. As Pennacchi (2012) explains, a narrow bank is a financial firm that "issues demandable liabilities and invests in assets with little or no nominal risk". Depending on how restrictive one's definition is, narrow banking can range from money market funds investing exclusively in Treasury Bills to Commercial Banks that are restricted to back all their deposits with money market instruments but can hold many other assets.[10] Pennacchi (2012) notes that "recommendations for narrow banking appear most frequently following major financial crises". The crisis of 2008 is no exception. Chamley et al. (2012) explain how "limited-purpose banking could work, and Cochrane (2014) propose reforms to make the financial system "run-proof".

These are certainly powerful arguments in favor of narrow banking, but there are also several issues. The

[10]Narrow banking has deep historical roots. The evidence suggests that, prior to the 20th century, British and American banks lent mostly short term. Early american banks did not offer long term loans. According to Bodenhorn (2000), banks made short-term loans that early manufacturing firms used to finance inventories and pay rents and wages. According to Summers (1975), "the practice of guaranteeing future credit availability has existed since the beginning of banking in the United States", but "it has only been since the mid-1960's that the topic of commercial bank loan commitment policies has become an explicit issue in banking circles."

theoretical case is not as clear-cut as some proponents argue. Wallace (1996) shows that narrow banking negates liquidity risk sharing, in the sense that, in a Diamond and Dybvig (1983) setup, any allocation under narrow banking can be achieved under autarky. Another critique of the narrow banking proposal is that the joint provision of demand deposits and loan commitments allows banks to diversify the use of liquidity (Kashyap et al., 2002). Pennacchi (2012), however, argues that this synergy might in fact be a consequence of FDIC- provided insurance.

Another major issue is that narrow banking would require powerful regulators to implement a radical transformation of existing firms, and would create incentives to move maturity transformation outside the regulated system. Of course, the fact that an idea would be difficult to implement should not prevent us from studying its merits. As Zingales (2015) argues, "when we engage in policy work we try to be relevant", and this can be a problem because it is easy to discredit good ideas by labelling them politically unrealistic. It is, however, a reason to think about different ways to reach the same goal, as I argue below.

2.4 Why a New Strategy is Needed

There is an apparent contradiction between a fairly shared diagnostic of some issues and significant disagreements about how to address them. Essentially everyone agrees that leverage (especially short term leverage), opacity and complexity were significant contributors to the financial crisis of 2007/2009. It seems also clear that many large financial firms enjoy TBTF subsidies and oligopolistic rents. Yet, as I have argued earlier, our tools and our understanding of how to use them are limited. In other words, the problem is not so much that we do not know where we would like to go, the problem is that we do not know which path to follow.

Two reasons explain these difficulties. The first is the complexity and depth of the distortions embedded in the current system: the tax treatment of interest expenses, too-big-to-fail subsidies, oligopoly rents, and much of the plumbing of the global financial system. These distortions are protected by powerful incumbents who benefit directly and indirectly from them, as argued in Rajan and Zingales (2003) and Admati and Hellwig (2013). The bottom line is that transforming incumbent financial firms into safe and efficient providers of financial services is an uphill battle. At best, it will be long and costly. At worst, it will simply not happen.

The second reason is that it is genuinely difficult to design good regulations. When we think about systemic risk, for instance, there is always a tension between regulating by entity and regulating by function. Regulating by function is intellectually appealing, but it is technically challenging and requires cooperation among many parties. On the other hand, regulating by entity is simpler but designating non-bank SIFIs creates legal challenges, as seen recently in the case of MetLife. Tightening regulations is not only difficult, it can also be counter-productive. The most obvious risk is that of shifting activities outside the regulated banking system. Another risk is to make compliance costs prohibitive for would-be entrants. Finally, and most importantly, no one knows how a safe and efficient financial system should look like. All we know is that the current one is expensive, risky, and dominated by too-big-to-fail companies. Many proposals for wide-ranging structural change would require unrealistic amounts

of foresight by regulators.

The current regulatory approach, then, has reached its limits because of political economy and coordination costs. If we could design the rules from scratch, we would write them quite differently from what they are today. We do not have this luxury for the legacy systems, but we could do it for the new ones. My point is that it is a lot easier to create and maintain a simple and transparent system, than it is to transform a complex and opaque system into a simple and transparent one.

3 The FinTech Opportunity

The previous section has argued that the current approach to financial regulation is to impose changes on existing firms. This section asks if the same regulatory goals can be achieved via a different approach, focused on new financial firms and systems. This alternative approach creates new challenges but I argue that it is likely to benefit from the FinTech movement. This section is therefore not a survey of current trends in FinTech. Instead, I highlight instances where there is a tension between private incentives to innovate and broad regulatory objectives.

3.1 Some Specific Features of FinTech

The FinTech movement shares some features with all other movements of disruptive innovations, but it also has some features that are specific to the finance industry.

Like in other industries, FinTech startups propose disruptive innovations for the provision of specific services. The key advantage of incumbents is their customer base, their ability to forecast the evolution of the industry, and their knowledge of existing regulations. The key advantage of startups is that they are not held back by existing systems and are willing to make risky choices. In banking, for instance, successive mergers have left many large banks with layers of legacy technologies that are at best partly integrated, as discussed in Kumar (2016). FinTech startups, on the other hand, have the chance to build the right systems from the start. Moreover they share a culture of efficient operational design that many incumbents do not have.

A feature that is more specific to the finance industry is the degree to which incumbents rely on leverage. As argued earlier, leverage is embedded in many financial contracts and subsidized by several current regulations. This gives the illusion that leverage is everywhere needed to operate an efficient financial system. Conceptually, one can think of leverage today as partly a feature and partly a bug. It is a feature, for instance, when it is needed to provide incentives, as in Diamond and Rajan (2001). It is a bug when it comes from bad design or regulatory arbitrage (as in fixed face value money market funds), or when it corresponds to an old feature that could be replaced by better technology (as in some payment systems discussed below). The issue, of course, is that it is difficult to distinguish the leverage-bug from the leverage-feature. FinTech startups can therefore help for two reasons. First, they will show how far technology can go in providing low-leverage solutions. Second, they are themselves funded with much

more equity than existing firms.

3.2 An Alternative Approach to Financial Regulation

Financial stability and access to financial services are often stated as two important goals of financial regulation. This section asks if an alternative approach to regulation can make progress towards these goals, specifically in the context of the FinTech movement. FinTech innovations are happening and are likely to have an impact in many areas of finance, as discussed by Yermack (2015) in the case of corporate governance. There is no reason to think, however, that these innovations will automatically enhance stability or even access of services. If regulators want FinTech to reduce the risks created by TBTF firms and high leverage, for instance, they need to adapt the regulatory framework. This section discusses the challenges they are likely to face.

Challenge 1: Entry and level-playing-field FinTech offers an opportunity but its interests are not naturally aligned with regulators' long term goals. FinTech firms will enter where they think they can make a profit, but there are many regions of the financial system where incumbents are entrenched and entry is difficult. An example of a highly concentrated market is custody and securities settlement. In theory, the blockchain technology could improve the efficiency of the market, but if there is no entry, this could simply increase the rents of incumbents. A restricted blockchain could in fact be used by incumbents to deter entry and stifle innovation. As successful firms grow large, they seek to alter the political system to their advantage and increase the cost of entry. The beneficiaries of an open, competitive system often work to close the system and stifle competition, as argued in Rajan and Zingales (2003).

This highlights the complex issue of biases in the competition between entrants and incumbents. Ensuring a level playing field is a traditional goal of regulation. Darolles (2016) discusses this idea in the context of FinTech and argues, from a microeconomic perspective, that regulators should indeed ensure a level playing field. This line of argument, however, does not readily apply to many of the distortions that plague the finance industry. For instance, what does a level playing field mean when incumbents are too-big-to-fail? Or when they rely excessively on short term leverage? The level playing field argument applies when entrants are supposed to do the same things as incumbents, only better and/or cheaper. But if the goal is to change some structural features of the industry, then a strict application of the level-playing-field principle could be a hindrance.

The level-playing-field argument also sheds new light on some old debates, such as capital requirements. Over the years incumbents have optimized their use of implicit and explicit public subsidies and barriers to entry, and it is costly to undo these distortions one by one.[11] Regulators can, however, prevent an erosion of the standards agreed upon after the crisis, and given the various subsidies and advantages of debt, one can see capital requirements as a way to reduce barriers to entry and foster a level-playing-field. The substantial increase in bank capital that

[11] In addition, as Baker and Wurgler (2015) argue, leverage can be rewarded by institutional investors who would like to lever up, but are precluded by charter or regulation.

has occurred since the crisis does not appear to have shifted activity from banks to shadow banks, as argued by Cecchetti and Schoenholtz (2014).

Challenge 2: Leverage and history-dependence Payment systems have been an early target of FinTech firms. Rysman and Schuh (2016) review the literature on consumer payments and discuss three recent innovations: mobile payments, real-time payments, and digital currencies. Mobile payments are already popular in Asia and parts of Africa and faster systems are often encouraged by central banks. These innovations are likely to improve retail transactions, but they are unlikely to fundamentally change the payment system. In particular, they are unlikely to decrease its reliance on short term, runnable claims.

We are used to thinking that many financial services (payment among others) require accounts with fixed nominal values. The best examples are retail deposits and checking accounts. This has been true for over 300 years of banking history. But today's technologies open new possibilities. We can assess the value of many financial assets in real time, and we can settle payments (almost) instantly. Many transactions could therefore be cleared using floating value accounts.[12] Suppose buyer B and seller S agree on a price p in units of currency. B and S can both verify with their smartphones the value v of a financial security (say a bond index fund). B can transfer p/v units of the security to S to settle the transaction. S does not need to keep the proceeds in the bond fund. S could immediately turn them into currency or shares of a treasury bill fund. The point here is that new systems would not need to rely on (fixed nominal value) deposits like the old system did. Deposit-like contracts create liquidity risk and macro-financial stability would be enhanced if more transactions could be settled without them. This was not technologically feasible a few years ago, but today it is. As Cochrane (2014) argues, however, there are non-technological impediments, most notably with accounting and taxes, since these transactions would generate capital gains. If regulators want to decrease the systemic reliance on short term leverage, they will need to identify issues that often lay beyond their traditional regulatory horizon.

The other important point here is history dependence. Regulations are likely to be more effective if they are put in place early, when the industry is young. A counter-factual history of the money market mutual fund industry can be used to motivate this idea. Suppose that regulators had decided in the 1970s that, as a matter of principle, all mutual funds should use a floating NAV. Such regulation would have been relatively straightforward to implement when the industry was small, and it would have guided its evolution and encouraged innovations consistent with the basic principle. It is significantly more difficult today when the industry has several trillion of dollars under management. A challenge for regulators is then to be forward-looking when dealing with FinTech. Effective regulation requires them to identify some basic features they would like FinTech to have in thirty years, and mandate them now.

[12] This possibility was recognized by Samuelson (1947) "in a world involving no transaction friction and no uncertainty ... securities themselves would circulate as money and be acceptable in transactions..." (page 123), and discussed in Tobin (1958). I thank Kim Schoenholtz for these references.

Challenge 3: Consumer Protection FinTech is likely to create new issues of consumer protection. An example is robo-advisors for portfolio management. An important issue for the industry is when and how investors will "trust" robots, as discussed by Dhar (2016). Robo-advising will certainly create new legal and operational issues, and is likely to be a headache for consumer protection agencies.

But if the goal is to protect consumers, robo-advising does not need to be perfect. It only needs to be better than the current system. And it is important to keep in mind just how bad the track record of human advisors really is. First, at an aggregate level, fees have not declined because, as standard product became cheaper, customers were pushed into higher fee products (Greenwood and Scharfstein, 2013). Second, the conflicts of interest are pervasive in the industry. Bergstresser et al. (2009) find that broker-sold mutual funds deliver lower risk-adjusted returns, even before subtracting distribution costs. Chalmers and Reuter (2012) find that broker client portfolios earn significantly lower risk-adjusted returns than matched portfolios based on target-date funds but offer similar levels of risk. Broker clients allocate more dollars to higher fee funds and participants tend to perform *better* when they do not have access to brokers. Mullainathan et al. (2012) document that advisers fail to de-bias their clients and often reinforce biases that are in their interests. Advisers encourage returns-chasing behavior and push for actively managed funds that have higher fees, even if the client starts with a well-diversified, low-fee portfolio. Foà et al. (2015) find that banks are able to affect customers' mortgage choices not only by pricing but also through an advice channel. Egan et al. (2016) show that misconduct is concentrated in firms with retail customers and in counties with low education, elderly populations, and high incomes. They also document that the labor market penalties for misconduct are small.

So robo-advisors will have issues, but there is so much room for improvement that it should be easy for them to do better, on average, than human-advisors. One can also make the case that a software is easier to monitor than a human being. For instance, if the robo-advisor contains a line of code that says: "if age>70 & education<High School, then propose fund X", and X happens to be a high-fee actively managed fund, then the meaning of the advice is clear. Any equivalent advice a human advisor could give would certainly be much more ambiguous. Humans are good at maintaining plausible deniability, and in the case of financial advising, that is a serious problem.

If the goal of financial regulation is to foster stability and access to services, then regulators should consider policies that promote low-leverage technologies and the entry of new firms. This alternative approach can complement the current, incumbent-focused approach. It does not require regulators to forecast which technology will succeed or which services should be unbundled (i.e., what the "finance-Uber" or "finance-Airbnb" could look like). It also does not require regulators to force top-down structural changes onto powerful incumbents.

Appendix

A A Simple Model of Financial Intermediation Accounting

In this Appendix I sketch a model, based on Philippon (2015), that can be used for financial intermediation accounting. The model economy consists of households, a non-financial business sector, and a financial intermediation sector. Long term growth is driven by labor-augmenting technological progress $A_t = (1+\gamma) A_{t-1}$. In the benchmark model borrowers are homogenous, which allows a simple characterization of equilibrium intermediation.[13] I consider a setup with two types of households: some households are infinitely lived, the others belong to an overlapping generations structure.[14] Households in the model do not lend directly to one another. They lend to intermediaries, and intermediaries lend to firms and to other households.

A.1 Technology and Preferences

Long-Lived Households

Long-lived households (index l) are pure savers. They own the capital stock and have no labor endowment. Liquidity services are modeled as money in the utility function. The households choose consumption C and holdings of liquid assets M to maximize

$$\mathbb{E}\sum_{t\geq 0}\beta^t u\left(C_t, M_t\right).$$

I specify the utility function as $u\left(C_t, M_t\right) = \frac{\left(C_t M_t^{\nu}\right)^{1-\rho}-1}{1-\rho}$. As argued by Lucas (2000), these homothetic preferences are consistent with the absence of trend in the ratio of real balances to income in U.S. data, and the constant relative risk aversion form is consistent with balanced growth. Let r be the interest rate received by savers. The budget constraint becomes

$$S_t + C_t + \psi_{m,t} M_t \leq \left(1+r_t\right) S_{t-1},$$

where ψ_m is the price of liquidity services, and S are total savings. The Euler equation of long lived households $u_C\left(t\right) = \beta\mathbb{E}_t\left[\left(1+r_{t+1}\right) u_C\left(t+1\right)\right]$ can then be written as

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

The liquidity demand equation $u_M\left(t\right) = \psi_{m,t} u_C\left(t\right)$ is simply

$$\psi_{m,t} M_{l,t} = \nu C_{l,t}.$$

Overlapping Generations

The other households live for two periods and are part of on overlapping generation structure. 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 $u\left(C_{1,t}, M_{1,t}\right) + \beta u\left(C_{2,t+1}, M_{2,t+1}\right)$. 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 $C_{1,t} + \psi_{m,t} M_{1,t} = \eta_1 W_{1,t} + \left(1-\psi_{c,t}\right) B_t^c$. The screening and monitoring cost is $\psi_{c,t}$ per unit of borrowing. In the second period, the household consumes $C_{2,t+1} + \psi_{m,t+1} M_{2,t+1} = \eta_2 W_{t+1} - \left(1+r_{t+1}\right) B_t^c$. The Euler equation for OLG households is

$$\left(1-\psi_{c,t}\right) M_{1,t}^{\nu(1-\rho)} C_{1,t}^{-\rho} = \beta\mathbb{E}_t\left[\left(1+r_{t+1}\right) M_{2,t+1}^{\nu(1-\rho)} C_{2,t+1}^{-\rho}\right].$$

Their liquidity demand is identical to the one of long-lived households.

[13] Heterogeneity and quality adjustments are discussed in Philippon (2015).

[14] The pure infinite horizon model and the pure OLG model are both inadequate. The infinite horizon model misses the importance of life-cycle borrowing and lending. The OLG model ignores bequests, and in the simple two-periods version households do not actually borrow: the young ones save, and the old ones eat their savings. The simplest way to capture all these relevant features is the mixed model. The standard interpretation is that long-lived households have bequest motives, and are therefore equivalent to infinitely lived agents.

Non Financial Businesses

Non-financial output is produced under constant returns technology, and for simplicity I assume that the production function is Cobb-Douglass:[15]

$$F\left(A_t n_t, K_t\right) = \left(A_t n_t\right)^{\alpha} K_t^{1-\alpha}.$$

The capital stock K_t depreciates at rate δ, is owned by the households, and must be intermediated. Let $\psi_{k,t}$ be the unit price of corporate financial intermediation. Non financial firms therefore solve the following program: $\max_{n,K} F\left(A_t n, K\right) - \left(r_t + \delta + \psi_{k,t}\right) K - W_t n$. Capital demand equates the marginal product of capital to its user cost:

$$(1-\alpha)\left(\frac{A_t n_t}{K_t},\right)^{\alpha} = r_t + \delta + \psi_{k,t}. \tag{4}$$

Similarly, labor demand equates the marginal product of labor to the real wage:

$$\alpha\left(\frac{A_t n_t}{K_t},\right)^{\alpha-1} = \frac{W_t}{A_t}. \tag{5}$$

Financial Intermediation

Philippon (2012) discusses in details the implications of various production functions for financial services. When financial intermediaries explicitly hire capital and labor there is a feed-back from intermediation demand onto the real wage. This issue is not central here, and I therefore assume that financial services are produced from final goods with constant marginal costs. The income of financial intermediaries is then

$$Y_t^f = \psi_{c,t} B_{c,t} + \psi_{m,t} M_t + \psi_{k,t} K_t$$

where $B_{c,t}$, M_t and K_t have been described above.

A.2 Equilibrium Comparative Statics

An *equilibrium* in this economy is a sequence for the various prices and quantities listed above such that households choose optimal levels of credit and liquidity, financial and non financial firms maximize profits, and the labor and capital markets clear. This implies $n_t = 1$ and

$$S_t = K_{t+1} + B_t^c.$$

Let us now characterize an equilibrium with constant productivity growth in the non-financial sector (γ) and constant efficiency of intermediation (ψ). On the balanced growth path, M grows at the same rate as C. The Euler equation for long-lived households becomes $1 = \beta \mathbb{E}_t \left[\left(1 + r_{t+1}\right)\left(\frac{C_{t+1}}{C_t}\right)^{\nu(1-\rho)-\rho}\right]$, so the equilibrium interest rate is simply pinned down by

$$\beta\left(1+r\right) = \left(1+\gamma\right)^{\theta}. \tag{6}$$

where $\theta \equiv \rho - \nu\left(1-\rho\right)$. Let lower-case letters denote de-trended variables, i.e. variables scaled by the current level of technology: for capital $k \equiv \frac{K_t}{A_t}$, for consumption of agent i $c_i \equiv \frac{C_{i,t}}{A_t}$, and for the productivity adjusted wage $w \equiv W_t / A_t$. Since $n = 1$ in equilibrium, equation (4) becomes

$$k^{\alpha} = \frac{1-\alpha}{r + \delta + \psi_k}.$$

[15] Philippon (2012) discusses the consequences of assuming a different production function for the industrial sector. The key parameter is the elasticity of substitution between capital and labor, which is 1 under Cobb-Douglass technology. Qualitatively different results only happen for elasticity values above 6, which is far above the range of empirical estimates. Thus assuming a Cobb-Douglass technology does not entail much loss of generality.

Non financial GDP is $y = k^{1-\alpha}$, and the real wage is

$$w = \alpha k^{1-\alpha} = \alpha y.$$

Given the interest rate in (6), the Euler equation of short lived households is simply

$$c_1 = (1-\psi_c)^{\frac{1}{\theta}} c_2. \tag{7}$$

If ψ_c is 0, we have perfect consumption smoothing: $c_1 = c_2$ (remember these are de-trended consumptions). In addition, all agents have the same money demand $\psi_m m_i = \nu c_i$. The budget constraints are therefore $(1+\nu) c_1 = \eta_1 w + (1-\psi_c) b$ and $(1+\nu) c_2 = \eta_2 w - \frac{1+r}{1+\gamma} b$. We can then use the Euler equations and budget constraints to compute the borrowing of young households

$$\frac{b_c}{w} = \frac{(1-\psi_c)^{\frac{1}{\theta}} \eta_2 - \eta_1}{1-\psi_c + (1-\psi_c)^{\frac{1}{\theta}} \frac{1+r}{1+\gamma}}. \tag{8}$$

Borrowing costs act as a tax on future labor income. If ψ_c is too high, no borrowing takes place and the consumer credit market collapses. Household borrowing increases with the difference between current and future income, captured by $\eta_2 - \eta_1$. Liquidity demand is

$$m = \frac{\nu c}{\psi_m}.$$

and aggregate consumption is

$$c = \frac{1}{1+\nu} \left(w - \psi_c b_c + (r-\gamma) k \right). \tag{9}$$

The comparative statics are straightforward. The ratios are constant along a balanced growth path with constant intermediation technology, constant demographics, and constant firms' characteristics. Improvements in corporate finance increase y, w, k/y, c/y and m/y, but leave b^c/y constant. Improvements in household finance increase b^c/y, c/y and m/y, but do not affect k. Increases in the demand for intermediation increase the finance income share ϕ while supply shifts have an ambiguous impact.

The utility flow at time t is $u(c,m) = \frac{(cm^\nu)^{1-\rho}}{1-\rho}$ and since $m = \frac{\nu c}{\psi_m}$, we have

$$u(c,m) = \frac{\left(\frac{\nu}{\psi_m}\right)^{\nu(1-\rho)} c^{(1+\nu)(1-\rho)} - 1}{1-\rho}$$

Imagine $A = 1$ for simplicity. Then welfare for a particular generation is

$$\begin{aligned} W &= u(c_1, m_1) + \beta u(c_2, m_2) + \frac{\omega}{1-\beta} u(c_l, m_l) \\ &= \frac{\left(\frac{\nu}{\psi_m}\right)^{\nu(1-\rho)}}{1-\rho} \left(c_1^{1-\theta} + \beta c_2^{1-\theta} + \omega \frac{c_l^{1-\theta}}{1-\beta} \right) - \frac{1}{1-\rho} \end{aligned}$$

where ω is the Pareto weight on the long lived agents.

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