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The FinTech Opportunity

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The FinTech Opportunity

Abstract

This chapter assesses potential impacts of FinTech on the finance industry. First we show that financial services remain surprisingly expensive in the U.S., which helps explain the emergence of new entrants. We then argue that the current regulatory approach is subject to significant political economy and coordination costs, and therefore it is unlikely to deliver much structural change. FinTech can improve both financial stability and access to services, but this will require important changes in the focus of regulations.

Keywords

robo-advice, financial advice, innovation, financial services market, disruption, costs

Disciplines

Behavioral Economics | Finance | Other Economics

Comments

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The Disruptive Impact of FinTech on Retirement Systems

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Chapter 11

The FinTech Opportunity

Thomas Philippon

This chapter studies the FinTech movement in the context of the long run evolution of the finance industry and its regulations. The 2007–09 financial crisis triggered new regulatory initiatives and accelerated existing ones. I argue that the current framework has been useful, but it has run its course and is unlikely to deliver significant welfare gains in the future. If regulators want to go further, they will need to consider alternative approaches 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 is that the current financial system is rather inefficient. To show this, I update Philippon (2015) with post-crisis US data and I show that the unit cost of financial intermediation has declined only marginally since the crisis. The evidence outside the US is remarkably similar (Bazot 2017). 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.

Next I review 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. This approach is

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unlikely to deliver much further improvement 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 based on the idea that encouraging entry and shaping the development of new systems might be the best way to solve the remaining challenges in financial regulation. With respect to incumbents, this alternative approach would be a form of containment: its goal would be to consolidate existing efforts, and prevent future regulatory arbitrage, but not to impose top-down structural changes. The new approach would focus on entrants and take advantage of the ongoing development of FinTech firms. The main idea is to achieve bottom-up structural change by encouraging, for instance, firms that provide transaction services without leverage, and trading systems that are cheap, transparent and open-access. I conclude by sketching out some guiding principles for this new approach.

Inefficiency of the Existing System

The unit cost of financial intermediation in the US has stayed at around 2 percent for the past 130 years (Philippon 2015); Bazot (2017) finds similar unit costs in other major countries (Germany, UK, 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. We need to know if these revisions affect the main insights of the original paper. A second reason for updating the series is that the data in Philippon (2015) predate the financial crisis, so it is of interest 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.

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 11.1, is defined as³

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

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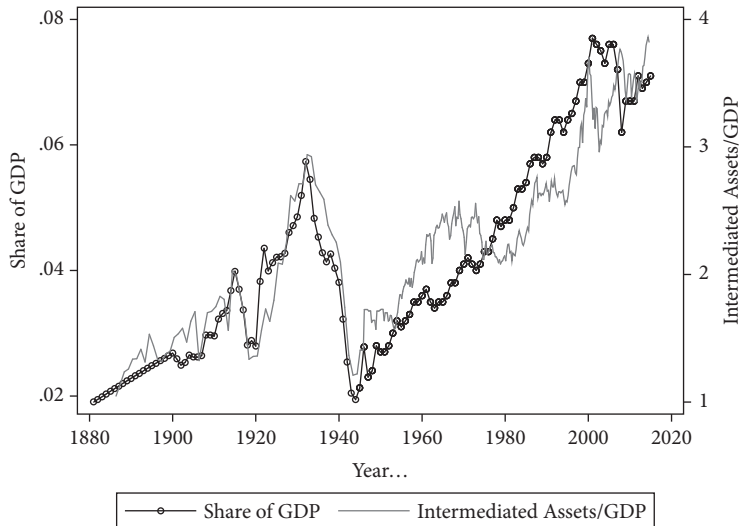


Figure 11.1 Finance income and intermediated assets

Note: 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.

Source: Philippon (2015).

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

$$y_t^f = \psi_{c,t} b_{c,t} + \psi_{m,t} m_t + \psi_{k,t} k_t, \quad (11.1)$$

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 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 heterogeneous. 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

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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 (11.1) as $\psi_{c,t}(b_{c,t} + \frac{\psi_{m,t}}{\psi_{c,t}} m_t + \frac{\psi_{k,t}}{\psi_{c,t}} k_t)$. 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:

$$q_t \equiv b_{c,t} + m_t + k_t \quad (11.2)$$

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 11.1.

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:

$$\psi_t \equiv \frac{y_t^f}{q_t} \quad (11.3)$$

Figure 11.2 shows that this unit cost is around 2 percent 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 two 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 (2017) who finds convergence to US levels.

The raw measure of Figure 11.2, however, does not take into account changes in the characteristics of borrowers. 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.

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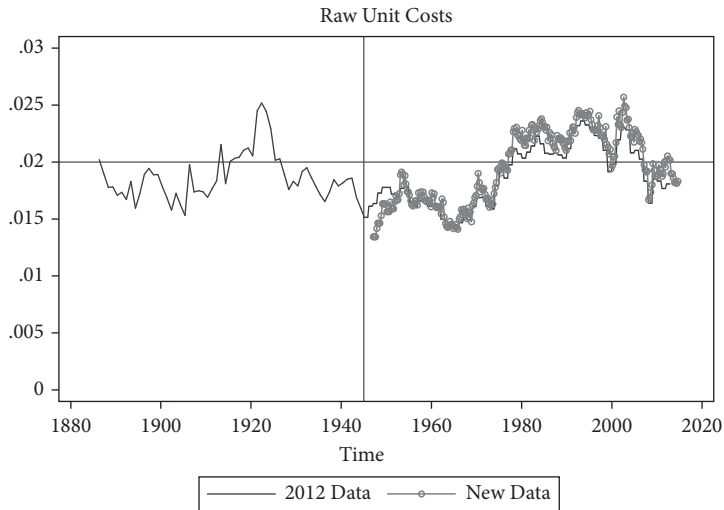


Figure 11.2 Unit cost of financial intermediation

Notes: The raw measure is the ratio of finance income to intermediated assets, displayed in Figure 11.1. The 2012 data are from Philippon (2015), while the new data were accessed May 2016. Data range is 1886–2015.

Source: Philippon (2015) with updated data.

I then perform a quality adjustment to the intermediated assets series, following Philippon (2015). Figure 11.3 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 see no significant decrease in the unit cost of intermediation over time.

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 (Drechsler et al. 2017). 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.

Wages and employment. The relative wage in the finance industry is defined as

$$relw = \frac{\bar{w}_t^{fin}}{\bar{w}_t^{all}} \tag{11.4}$$

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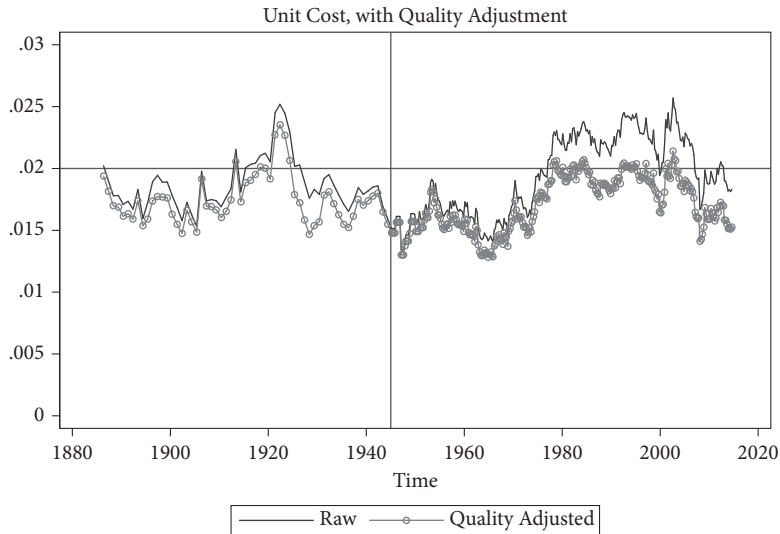


Figure 11.3 Unit cost and quality adjustment

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

Source: Philippon (2015).

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 11.4 updates previous findings. One can clearly see the high wages of the 1920s, the drop following the Great Depression and WWII, and then a period of 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.

There was some relative wage moderation following the 2007/2009 crisis, but it was 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 some moderation in the future, but the changes are not large.

Figure 11.5 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.

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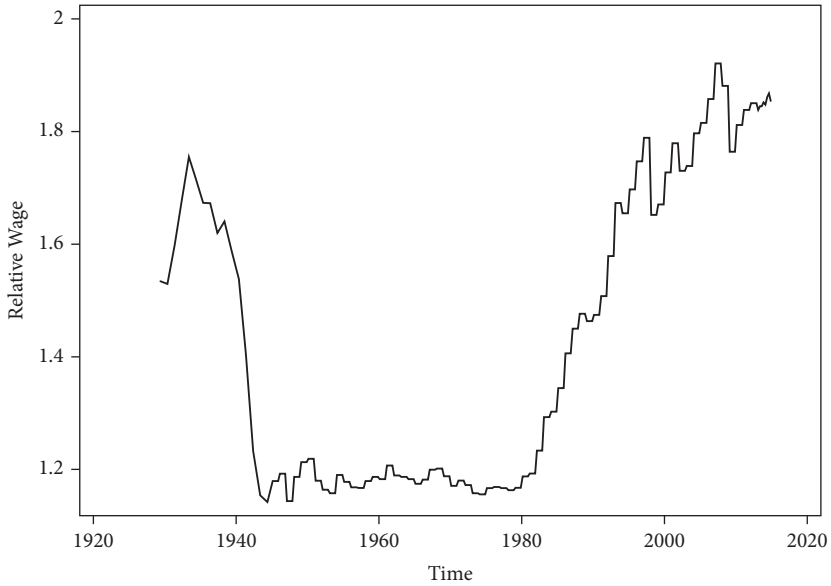


Figure 11.4 Evolution of relative wage in finance vs. all industries

Notes: Wage in finance divided by average wage in all industries.

Source: Philippon and Reshef (2012), updated.

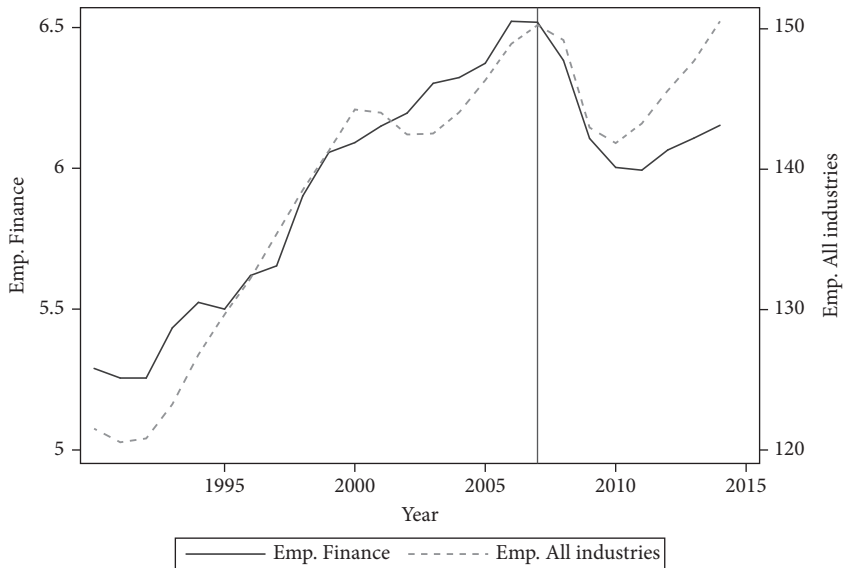


Figure 11.5 Employment in finance vs. all industries

Notes: Employment is measured in millions of jobs.

Source: Philippon and Reshef (2012), updated.

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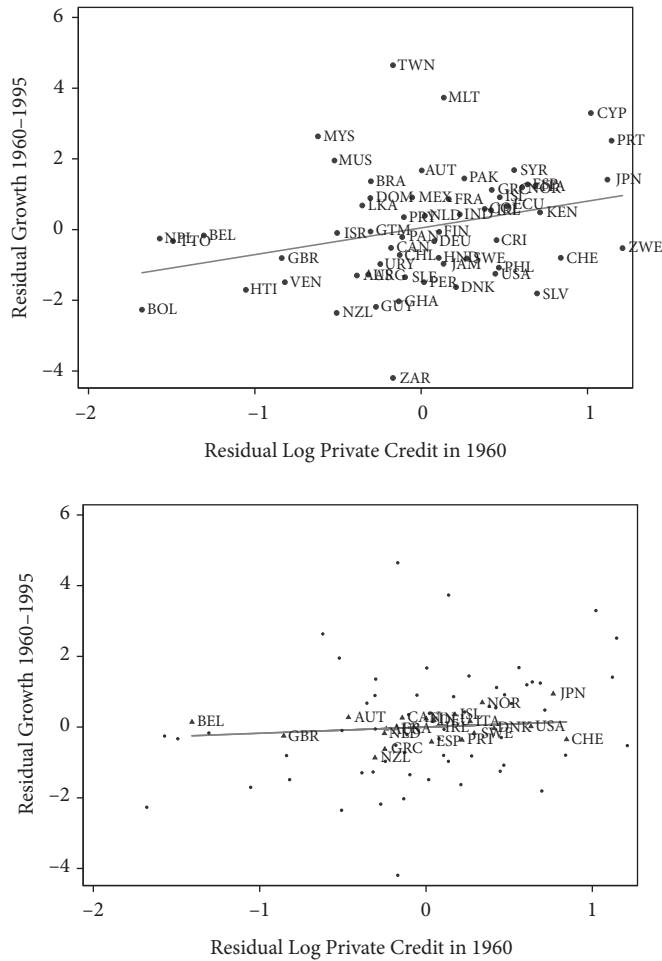


Figure 11.6 Credit and growth, all vs. OECD countries

Source: Beck et al. (2011) dataset. Available at <http://www.worldbank.org/en/publication/gfdr/data/financial-structure-database> (accessed March 25, 2019).

Finance and growth. There is a large literature studying the links between finance and growth. Levine (2005) provides an authoritative survey, and Levine (2014) a recent discussion. One main finding is displayed in the left panel of Figure 11.6. Countries with deeper credit markets in 1960 (measured as credit outstanding over GDP) grew faster between 1960 and 1995.

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) emphasized, the primary driver of the finance–growth

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nexus is the allocation of capital. Better financial systems provide a better allocation of capital, not necessarily more overall credit, as noted by Favara (2009) and Cechetti and Kharroubi (2012), who argued that the relation between credit and growth is not monotonic.⁷ One way to quickly see this is to examine the same data for only the OECD countries. Among OECD countries the link between credit and growth is not significant, as can be seen in the right panel of Figure 11.6.

Summary. Finance is important for growth, in particular for the allocation of capital, but much of the recent growth of the finance industry had 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, yet 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 percent between 1988 and 1997, and the share of total nationwide assets held by the largest eight banking organizations rose from 22.3 percent to 35.5 percent. Several hundred mergers and acquisitions (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) found little evidence of cost efficiency improvement, which is consistent with Figure 11.5 and 11.3. De Young et al. (2009) showed that consolidation continued during the 2000s. They argued that there was growing evidence that consolidation is partly motivated by the desire to obtain too-big-to-fail status, and that M&As have a negative impact on certain types of borrowers, depositors, and other external stakeholders.

It is also important to keep in mind that the welfare implications of financial efficiency are significant. In order to calculate welfare, we use a simple model presented in the appendix. Figure 11.7 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

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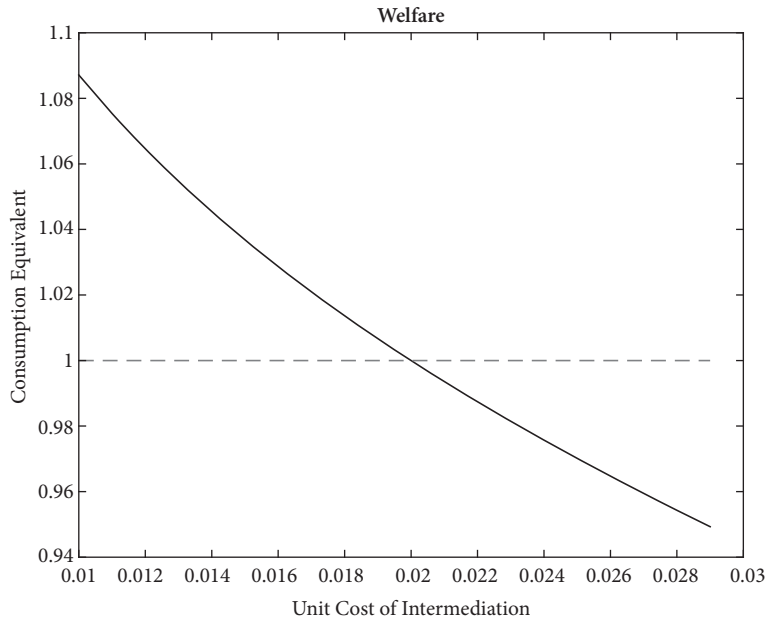


Figure 11.7 Welfare and the unit cost of intermediation

Notes: The welfare calculations are constructed using the model in the appendix. Welfare is calculated as the amount of consumption agents would be willing to give up to reduce the unit cost of intermediation.

one in the benchmark case of a unit cost of 2 percent. I have found that agents in the economy would be willing to pay 8.7 percent of consumption to bring the unit cost of intermediation down to 1 percent.

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.

A Perspective on Current Regulations

Rather than providing a comprehensive overview of recent financial regulations, instead I make the case that the focus on incumbents inherent in current regulations increases political economy and coordination costs.

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Recent achievements. Regulators have drawn several lessons from the 2008 disaster and tried to fix the existing system, as is well summarized in Ingves (2015). For instance, before the crisis, banking regulation was mostly based on risk-weighted assets (RWA) ratios that were set quite low.

Today's regulation is actually quite different:

- (1) RWA ratios are significantly higher;
- (2) There are multiple metrics, including simple leverage, liquidity ratios, and counter-cyclical buffers;
- (3) There are surcharges for Systemically important financial institutions (SIFIs), and systemic risk regulation extends beyond banking; and
- (4) 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 to sometimes complex, and it will be desirable to consolidate some of the measures and to 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).

This 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 'common equity tier 1' (CET1) ratio of banks in the European Union increased by 1.7 percent between December 2013 and June 2015, with a 1.9 percent increase in capital and about 0.1 percent increase in RWA. The banking industry has become less risky, at least in developed economies.¹⁰ Nevertheless, some important goals remain elusive.

The leverage controversy. The most important regulatory debate following the 2007–09 crisis revolves around the appropriate level of capital requirement for banks. Admati et al. (2011) argued 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

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crisis, but agreeing on a new target capital ratio has proved 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 then becomes a daunting task. The information and coordination requirements of the current regulatory approach are prohibitive. I will argue in the final section of the chapter that another approach might be preferred.

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 11.8, from Cecchetti and Schoenholtz (2016), shows the impact of

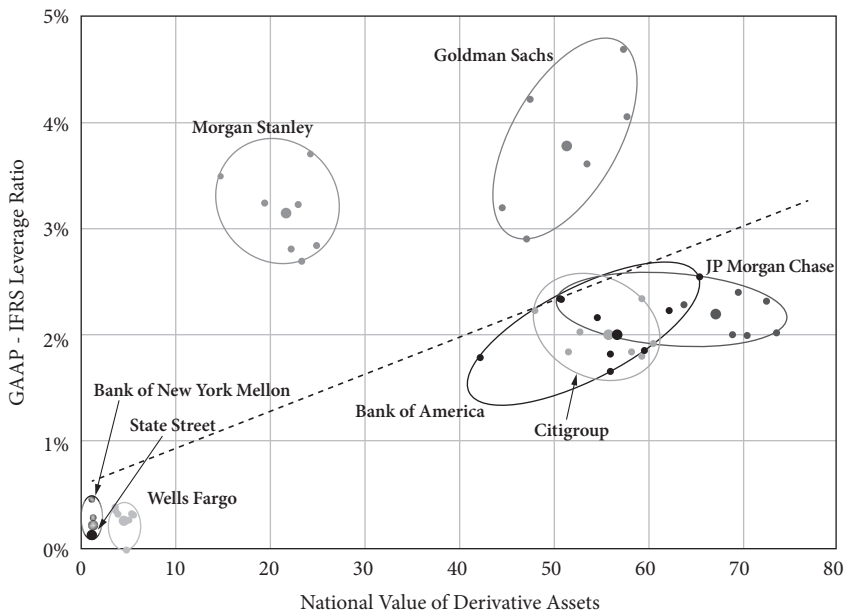


Figure 11.8 Differences in leverage accounting and derivatives

Notes: Vertical axis is leverage (equity divided by assets) as measured by the GAAS minus leverage as measured by the IFRS.

Source: Cecchetti and Schoenholtz (2016), *Leverage and Risk*: <http://www.moneyandbanking.com> (accessed March 3, 2019).

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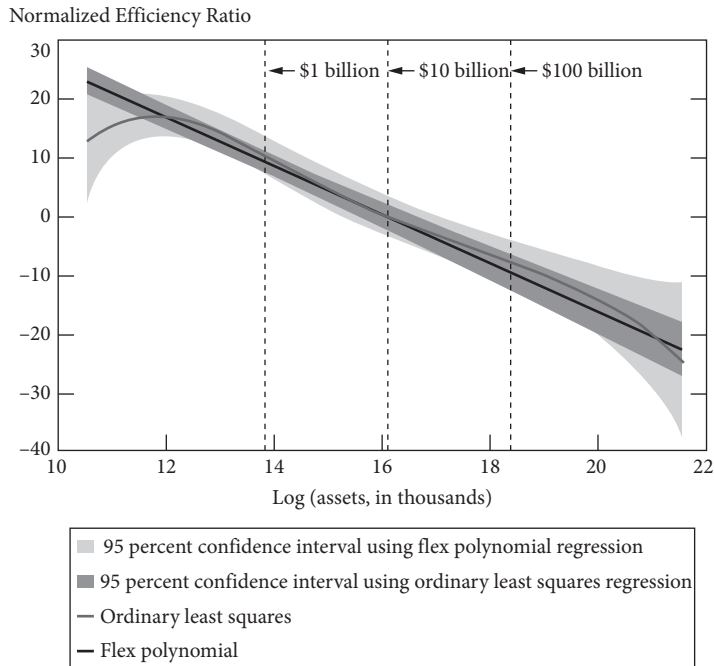


Figure 11.9 Cost efficiency and size

Notes: Efficiency ratio is non-interest expense over (net interest income + non-interest income).

Source: Kovner et al. (2014).

netting on the size of balances sheets under two accounting standards. GAAP allows more netting than IFRS. As a result, the equity 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.

Banks want to be large and opaque. There are several reasons that banks may want to be large. One reason is to achieve better cost efficiency, as documented in Kovner et al. (2014) and presented in Figure 11.9. Other reasons involve market power, political influence, and implicit guarantees. Consistent with the TBTF idea, Santos (2014) found that the funding advantage enjoyed by the largest banks was 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) considered the implications of increasing complexity for supervision and resolution. Finally, implicit guarantees are not only a function of a

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bank's individual size. Kelly et al. (2016) found evidence of collective government guarantees for the financial sector.

G-SIFIs versus narrow banks. A formidable challenge for financial regulation is to provide credible resolution mechanisms for global systemically important financial institutions (G-SIFIs). There are two fundamental difficulties. One comes from the sheer size and complexity of these organizations and the impossibility to forecast what would happen during a crisis. A second 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, total loss-absorbing capacity (TLAC) requirements, are necessary, but in all likelihood they will not be properly battle-tested before a crisis actually happens.

This has led several observers to argue for some form of 'narrow banking.' As Pennacchi (2012) explained, a narrow bank is a financial firm that invests in assets with little nominal risk and issues demandable liabilities. Depending on how restrictive one's definition is, narrow banking can range from money market funds investing exclusively in Treasury Bills to commercial banks which are restricted to back all their deposits with money market instruments but can hold many other assets.¹¹ Pennacchi (2012: 8) also noted that 'recommendations for narrow banking appear most frequently following major financial crises.' The crisis of 2008 was no exception. Chamley et al. (2012) explained how limited-purpose banking could work, and Cochrane (2014) proposed reforms to make the financial system 'run-proof.'

These are certainly powerful arguments in favor of narrow banking, but there are also several counterarguments. The theoretical case is not as clear-cut as some proponents argue. Wallace (1996) showed 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, argued that this synergy might in fact be a consequence of the insurance provided by the Federal Deposit Insurance Corporation (FDIC).

Another major issue is that narrow banking would require powerful regulators to implement a radical transformation of existing firms, and it would also 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: 1355) argued, '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. Nevertheless, it does prompt reason to thinking about different ways to reach the same goal.

Why a new strategy is needed. There is an apparent contradiction between the widely shared diagnostic of the problems and the disagreements about

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how to address them. Essentially everyone agrees that leverage (especially short-term leverage), opacity, and complexity were significant contributors to the financial crisis of 2007–09. It seems also clear that many large financial firms still enjoy too big to fail (TBTF) subsidies and oligopolistic rents. Yet, as I have argued earlier, our tools and our understanding of how to use them are limited; the problem is not so much that we do not know where we would like to go, but that we do not know which path to follow.

Two factors are at the source of 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 (Rajan and Zingales 2003; 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, and worst, it will simply not happen.

The second concern 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. By contrast, regulating by entity is simpler but designating non-bank G-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 what 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 surely could 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.

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Above I argued that the current approach to financial regulation mostly impose changes on existing firms. This section asks if the same regulatory

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goals could be achieved via a different approach, focused on new financial firms and systems. The 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.

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. As in other industries, FinTech startups propose disruptive innovations for the provision of specific services. The key advantages of incumbents are 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 (Kumar 2016). FinTech startups, by contrast, have a chance to build the right systems from the start. Moreover, they share a culture of efficient operational design that many incumbents lack.

A feature more specific to the finance industry is the degree to which incumbents rely on financial 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 financial sector firms.

An alternative approach to financial regulation. Financial stability and access to financial services are often stated as two important goals of financial regulation. My goal is to explore whether an alternative approach to regulation can make progress toward these goals, specifically 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 to services. If regulators want FinTech to reduce the risks created by TBTF firms and high leverage,

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they must adapt the regulatory framework. This section discusses the challenges they are likely to face.

Challenge 1: Entry and level-playing field. FinTech's interests are not naturally aligned with regulators' long term goals. That is, 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 market efficiency, but if there is no entry, this could simply increase incumbents' rents. For instance, a restricted blockchain could be used by incumbents to 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 are open, competitive system often work to close the system and stifle competition (Rajan and Zingales 2003).

This highlights the complex issue of biased competition between entrants and incumbents. Ensuring a level playing field is a traditional goal of regulation Darrolles (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 over capital requirements. In the past, 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.¹² 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 has occurred since the crisis does not appear to have shifted activity from banks to shadow banks (Cecchetti and Schoenholtz 2014).

Challenge 2: Leverage and history-dependence. Payment systems have been an early target of FinTech firms, as noted by Rysman and Schuh (2016) who 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

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the payment system. In particular, they are unlikely to decrease its reliance on short-term claims that are subject to runs.

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.¹³ 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, although there are non-technological impediments, most notably with accounting and taxes. Interestingly, in the field of credit, we see that innovative players such as Square propose loan contracts with repayments indexed on sales, instead of fixed coupons.

Another 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 Net Asset Value. Such regulation would have been relatively straightforward to implement when the industry was small, and it would have guided market evolution and encouraged innovations consistent with the basic principle. Now it is significantly more difficult to change regulation 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 30 years, and mandate them now.

Challenge 3: Consumer protection. FinTech is likely to create new issues of consumer protection, illustrated by example with robo-advisors for portfolio management. An important issue for the industry is when and how investors will 'trust' robots (Dhar 2016). Robo-advising will certainly create new legal and operational issues, and it is likely to be a headache for consumer protection agencies, as discussed in Baker and Dellaert (2019).

Yet 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. As well, it is

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important to keep in mind just how bad the track record of human advisors has been. 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, conflicts of interest have been pervasive in the industry. For instance, Bergstresser et al. (2009) found that broker-sold mutual funds delivered lower risk-adjusted returns, even before subtracting distribution costs. Chalmers and Reuter (2012) showed that broker client portfolios earned significantly lower risk-adjusted returns that matched portfolios based on target-date funds, but they offered similar levels of risk. Broker clients allocated more dollars to higher fee funds and participants tended to perform *better* when they did not have access to brokers. Mullainathan et al. (2012) documented that advisers failed to de-bias their clients and often reinforced biases that were not their interest. Advisers encouraged returns-chasing behavior and pushed for actively managed funds with higher fees, even if a client started with a well-diversified, low-fee portfolio. Foà et al. (2015) found that banks were able to affect customers' mortgage choices not only by pricing but also through an advice channel. Egan et al. (2016) showed that misconduct was concentrated in firms with retail customers and in counties with low education, elderly populations, and high incomes. They also documented that the labor market penalties for misconduct were 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 than human advisors, on average. One can also make the case that a software program should be easier to monitor than a human being. For instance, if the robo-advisor contained 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's a serious problem.

Conclusion

The goal of financial regulation is to foster stability and access to services. Accordingly, regulators should consider policies that promote low-leverage technologies and the entry of new firms. This approach applied to FinTech, 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' would look like). It also does not require regulators to force top-down structural changes onto powerful incumbents.

Appendix: 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.

I consider a setup with two types of households: some households are infinitely lived, the others belong to an overlapping generations structure. Households in the model do not lend directly to one another. They lend to intermediaries, and intermediaries lend to firms and to other households.

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:

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

I specify the utility function as $u(C_t, M_t) = \frac{(C_t M_t^\psi)^{1-\rho} - 1}{1-\rho}$. As argued by Lucas (2000), these homothetic preferences are consistent with the absence of trend in the ratio of real balances to income in US 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:

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

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

$$M_{l,t}^{v(1-\rho)} C_{l,t}^{-\rho} = \beta E_t[(1 + r_{t+1}) M_{l,t+1}^{v(1-\rho)} C_{l,t+1}^{-\rho}].$$

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

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

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

$$(1 - \psi_{c,t})M_{1,t}^{v(1-\rho)} C_{1,t}^{-\rho} = \beta E_t[(1 + r_{t+1})M_{2,t+1}^{v(1-\rho)} C_{2,t+1}^{-\rho}].$$

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

Non-financial business. Non-financial output is produced under constant returns technology, and for simplicity I assume that the production function is Cobb-Douglas:¹⁰

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

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: $\max_{n,K} F(A_t n, K) - (r_t + \delta + \psi_{k,t})K - W_t n$. Capital demand equates the marginal product of capital to its user cost:

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

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

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

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 feedback 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.

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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 $1 = \beta E_t[(1 + r_{t+1})(\frac{C_{t+1}}{C_t})^{\nu(1-\rho)-\rho}]$, so the equilibrium interest rate is simply pinned down by:

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

where $\theta \equiv \rho - \nu(1 - \rho)$. 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 $i c_i \equiv \frac{C_{i,t}}{A_t}$, and for the productivity adjusted wage $w \equiv W_t/A_t$. Since $n = 1$ in equilibrium, Equation (11.2) becomes:

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

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

$$w = a k^{1-a} = a y.$$

Given the interest rate in (11.4), the Euler equation of short-lived households is simply:

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

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 $(1 + v)c_1 = n_1 w + (1 - \psi_c)b$ and $(1 + v)c_2 = n_2 w - \frac{1+r}{1+\gamma} b$. We can then use the Euler equations and budget constraints to compute the borrowing of young households:

$$\frac{b_c}{w} = \frac{(1 - \psi_c)^{\frac{1}{\nu}} n_2 - n_1}{1 - \psi_c + (1 - \psi_c)^{\frac{1}{\nu}} \frac{1+r}{1+\gamma}}.$$

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 $\eta_1 - \eta_2$. Liquidity demand is:

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

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and aggregate consumption is:

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

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 \varnothing while supply shifts have an ambiguous impact.

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

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

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

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

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

Notes

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 2015). Of course, higher capital ratios could be desirable (Admati et al. 2013).
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 US 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 US 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).

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4. The fact that the finance share of GDP is the same in 1925 and in 1980 makes it 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 percent in 1980, 4.68 percent in 1990, 4.19 percent in 2000, and 4.47 percent 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 US financial system.
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 percent to 77 percent. 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 percent to 61 percent between 1989 and 2007. In the mortgage market, Mayer and Pence (2008) show that subprime originations account for 15 percent to 20 percent of all HMDA originations in 2005.
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 one-third of credit booms end in a financial crisis, while many booms are associated with financial reform and economic growth.
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 (Moore and Siems 1998). Of these M&As, four occurred in banking (Citicorp-Travelers, BankAmerica-NationsBank, Banc One-First Chicago and Norwest-Wells Fargo).
9. Greenwood and Scharfstein (2013) provide an illuminating study of the growth of modern finance in the US. 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 toward 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. (2016), cream skimming in one market lowers assets quality in the other market and allows financial firms to extract excessive rents. In Pagnotta and Philippon (2018) 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.

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10. See for instance the real time value of the Systemic Risk Measure of Acharya et al. (2017) at <http://vlab.stern.nyu.edu> (accessed March 3, 2019).
11. Narrow banking has deep historical roots. The evidence suggests that, prior to the twentieth 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: 1), ‘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.’
12. In addition, as Barker and Wurgler (2015) argue, leverage can be rewarded by institutional investors who like to lever up but who are precluded by charter or regulation.
13. This possibility was recognized by Samuelson (1947: 123) ‘in a world involving no transaction friction and no uncertainty... securities themselves would circulate as money and be acceptable in transactions...’ and discussed in Tobin (1958). I thank Kim Schoenholtz for these references.

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