Economic Growth and Bank Innovation+

Gary Gorton, Yale and NBER

Ping He, Tsinghua University

September 23, 2021

Abstract

Based on archival and survey data we show that the maturity of U.S. business loans has been continuously increasing since the mid-1930s when banks invented the term loan. Concurrently, bank innovation first involved the invention of credit analysis and covenant design. Later, bank innovation included the advent of loan sales, increased loan syndications, the opening of the leveraged loan market, and the securitization of loans in collateralized loan obligations. We estimate and calibrate a model of bank innovation to determine the quantitative contribution of bank innovation to economic growth.

JEL Codes: O1, O11, O30, O43, E02

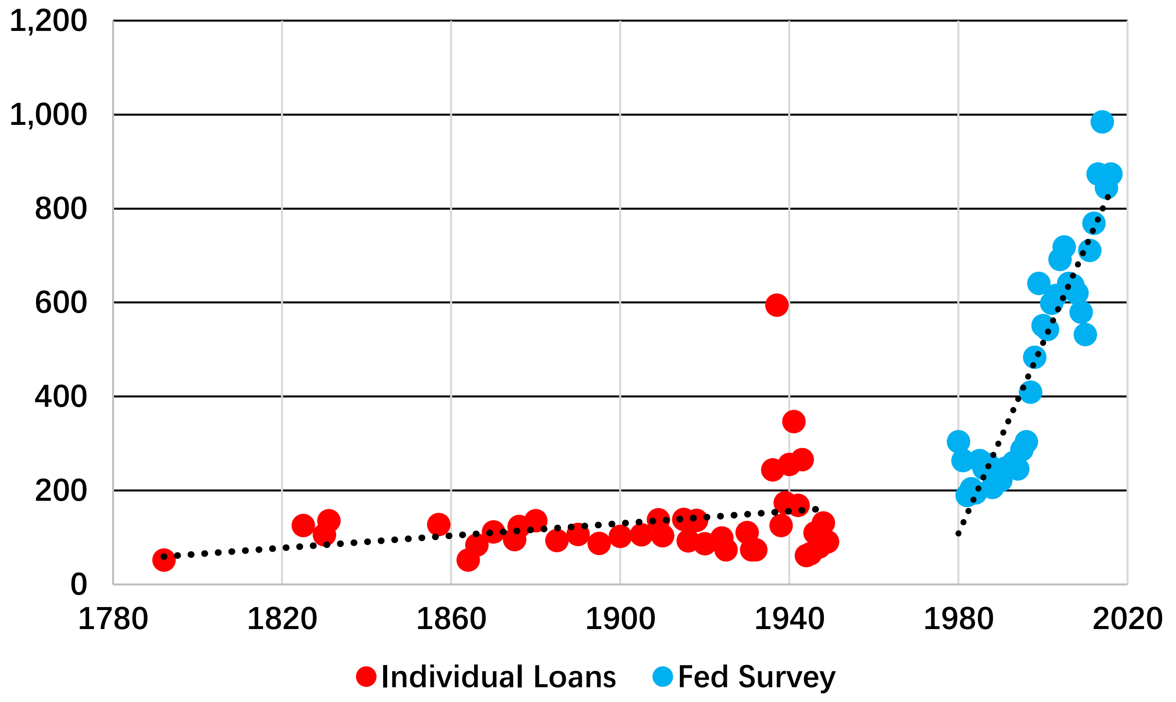
Key words: bank innovation, economics growth

+ For comments and suggestions, we thank Mike Bordo, Marc Flandeau, Gary Richardson, Jonathan Rose, Chris Cotter, Stephen Quinn, and Warren Weber. Thanks to the following archivists, at various archives, for assistance: Margaret Baille, Lucas Clawson, Susan Cohen, Betty Coykendall, Yvonne Deligato, Anne Difabio, Elizabeth Fox, Ken Frew, Amy McCoy Glover, Colleen Hailey, Linda Hocking, Cary Hutto, Melissa Josefiak, Tara Kelley, Adam Levine, Kelly Marino, Bob Mohr, Rachel Moskowitz, Melissa Murphy, Chelsea Ordner, Mark Procknik, Raechel Rivera, Bill Robinson, Tom Ruller, Mel Smith, Matthew Straus, David Thomson, Erin Weinman. Also, for assistance with data we thank Jeremy Atack, Nathan Balke, Stanley Engerman, Price Fishback, and Robert J. Gordon. Special thanks to Arwin Zeissler for research assistance. Also, thanks to Sang Kim, Michelle Tong, and Runyu (Steve) Zhang for research assistance.

1. Introduction

Banks intermediate between household savers and borrowing firms. Banks borrow short and lend long. "Short" means on demand (demand deposits) or overnight (repos). But how long is "long"? Figure 1 shows the average maturity of business loans granted by banks in the United States (in days). Evidently, "long" has been getting longer and longer.

Figure 1: Weighted Average Original Maturity (Days)



In Figure 1 the data points to left are weighted average maturities of business loans from bank archives, as discussed in Appendix A.[1] The points on the right are from the Federal Reserve's Survey of the Terms of Lending, which was discontinued in May 2017.[2]

The figure suggests two important changes in U.S. financial intermediation. First, it is evident that prior to 1933 the maturity of business loans was around 100 days. In fact, 90 days was

[1] We could not fill in the missing dates from 1945 to 1980. The Federal Reserve's Survey of Terms of Business Lending started in 1980. We found no available bank archives covering the missing period.

[2] The Federal reserve did not breakout loan maturity be whether the loan was collateralized or not but did ask for percentage of loans that were collateralized. That time series is essentially flat except for the last two years, where there is an increase. See https://fred.stlouisfed.org/series/ESANQ

standard.[3] But after the mid-1930s business loan maturity rises. This corresponds to the invention of the term loan.[4] This change was very significant and was noted by the National Bureau of Economic Research (NBER), which commissioned several volumes and surveys to study this phenomenon. In the NBER Introduction to Jacoby and Saulnier (1941), a book on term loans, the (unnamed) NBER author introducing the book, writes "In 1934 term loans were insignificant as bank assets; by 1940 they had increased in major proportions. By 1942 term loans were playing an important part in the financing of war production" (p. 2).[5]

Regarding the later period, since 1987 the maturity of business loans has been continuously increasing. This corresponds to some momentous changes in loan markets: the loan sales market opened, growing to significant amounts, syndicated lending increased, the leveraged loan market opened, and loans are now securitized into collateralized loan obligations.[6] Pavel and Phillis (1987) noted that "In 1984, commercial banks sold roughly $148 billion of loans. By 1985, loan sales by commercial banks jumped nearly 75 percent to $258 billion" (p. 3). Drucker and Puri (2009) report that the mean maturity of loans sold was 62.21 months while loans that were not sold had a mean maturity of 24 months (a statistically significant difference).

[3] These short-term loans are consistent with the Real Bills Doctrine, the view that bankers should only lend against collateral of 90 days or less commercial paper or bills of exchange representing claims on real goods in the process of production. See Mints (1945).

[4] According to Jacoby and Saulnier (1941), "A 'term loan' is a loan to a business enterprise that is repayable, according to agreement between borrower and lender, after the lapse of more than one year. Such loans fall within the 'medium-term' credit market, which is defined for purposes of this study to include credits that run for more than one but not more than fifteen years" (p. 1).

[5] Jacoby and Saulnier (1941) surveyed 99 commercial banks, all large institutions. As of March 31, 1941, the more loans had terms of five years than other number of years. About 30 percent of the number and 49 percent of the value had maturities exceeding five years (p. 4).

[6] Loan syndications are different from loan sales. A syndicated loan is one in which each bank in the syndicate has a direct lending relationship with the borrower, and the lead bank acts as a managing agent for the group. "Leveraged loans" refer to loans to below investment-grade firms.

The opening of the loan sales market was very significant because bank loans were not supposed to be saleable due to moral hazard and lemons problems.[7] According to the FDIC *Call Reports*, in the second quarter of 1983 loan sales were $26.7 billion, but by the end of the third quarter of 1989, loan sales were $290.9 billion. The market had expanded beyond traditional correspondent networks, and increasingly involved nonbank buyers. See Gorton and Pennacchi (1995). This expansion has continued. Nini (2017) reports that "Since the early 1990s, few innovations have changed the practice of corporate finance more than the development of large corporate loans financed by nonbank institutional investors" (p. 1). The nonbank institutional investors buy loans or buy tranches (bonds ranked by seniority) of collateralized loan obligations.[8]

Meanwhile, the syndicated loan market volume was skyrocketing. Dennis and Mullineaux (2000) noted that over the 1990s the syndicated loan market grew "at well over a 20% rate annually . . . which totaled over $1 trillion in 1997" (p. 404). They also report that "The mean maturity of the syndicated loans is almost 50% larger than the average for nonsyndicated loans and the median is twice as large" (p. 415). Their empirical estimates show that a longer loan maturity makes a loan more likely to be syndicated.

"Leveraged loans" is not an official *Call Report* category of loans. These are loans to below investment-grade firms (below BBB-) and that have an interest margin over LIBOR of 150-175 basis points.[9] Foley-Fisher, Gorton, and Verani (2021) find that in 2020 the mean maturity of leveraged loans was 4.5 years (the median was 4.8 years) compared to 2.8 years for the business loans in Figure 1. And Berg, Saunders, and Steffen (2021) report that the maturities of leveraged loans are, on average, two years longer compared to investment-grade loans.

---

[7] Loan sales involve a single bank that makes the loan and subsequently sells portions of it to other banks. Loan sales usually involve a "participation" contract which grants the buyer a claim on the loans cash flows. The loan buyer then has an indirect relationship with the borrowers.

[8] Collateralized loan obligations (CLOs) are managed special-purpose vehicles that buy leveraged loans. The liabilities the CLOs issue are purchased by institutional investors.

[9] But definitions differ depending on the source. For example, Loan Pricing Corporation defines "leveraged loans" as loans with BB, BB/B, and B or lower, bank loan ratings. Bloomberg says they are loans with a spread over LIBOR of 250 basis points or more.

Leveraged loans are competitors of junk bonds. Indeed, the two markets have essentially merged. de Fontenay (2014): ”That bonds and loans are now virtually interchangeable is nothing short of remarkable” (p. 727). Part of this success is no doubt due to securitization vehicles called collateralized loan obligations, that now hold around 60 percent of the leveraged loan market.

These changes resulted in a reallocation of risks in the economy: risk of loss due to a firm defaulting and interest rate risk (which may come back to the banks in the form of swaps). Our focus is on quantifying the effects of these innovations on economic growth, but it is worth noting that the increases in business loan maturity occur in contexts where the risks of longer maturity loans are to some extent borne elsewhere. Deposit insurance was part of the 1933 Bank Act and meant that the risk of a bank panic was significantly reduced, perhaps making it safer to increase loan maturity (shifting risk to the Federal Deposit Insurance Corporation). White (2003) argues that “New Deal regulations pushed [banks] into offering much longer-term credit than they would have otherwise” (p. 68). The Glass-Steagall Act of 1932 also played a role, according to White. Glass-Steagall separated commercial banking from investment banking. White argues that business customers did not find it easy or cheap to turn to purely investment banks for assistance in raising capital. Jacoby and Saulnier (1941) suggest numerous reasons for the invention of the term loan, including the increased cost of issuing securities publicly because of the new Securities Exchange Act of 1934 which created the Securities and Exchange Commission.

The changes in the 1980s and 1990s involve the opening of new markets or the significant growth in an existing market in the case of syndicated lending. The maturity of business loans remaining on bank balance sheets was considerably shorter, so the increase in maturity did not greatly affect their duration mismatch. The later innovations transfer firm risk to banks, but banks then off-load the loans to nonbanks, spreading the risk out of the banking system.

The trend towards a longer bank loan maturity seems to be a global trend. Chen, Sophia, Paola Ganum, Lucy Liu, Leonardo Martinez, and Soledad Martinez Peria (2018) show that recently debt maturity generally has lengthened. “Across all countries, the maturity of loans lengthened before the GFC and declined during the episode" (p.25). The decline in U.S. loan maturity during the financial crisis was likely due to the reduced issuance in the markets for bank loans. In Figure 1 the financial crisis can be seen, the dots below trend. As will be seen, this will appear in the model as dis-innovation, as banks revert to previous practices.

We present a model of bank innovation in Section 3. The model parameterizes bank innovation with one parameter, which can be interpreted broadly. The innovation by banks includes many areas, as we discuss below, such as credit analysis, covenant design, better pricing, developing and opening new markets and so on. The model incorporates these innovations as reducing the risk of borrowers to the bank, which implicitly includes off-loading loans.

There is a very large literature on financial intermediation and economic growth. Classic papers by King and Levine (1993) and Rajan and Zingales (1998) argue that financial development causes economic growth. Levine (2005) surveys this literature. Somewhat closer to our paper are quantitative models involving financial intermediation in some way and the connections with economic growth.

Jeong and Townsend (2008) study two different models, one where occupational choice is the key and the other where participation in the financial sector is the important choice. In both cases, there are fixed costs of entering a more productive sector and investment is limited to self-financing. Over time, the economy-wide wealth shifts to the right and more households choose the productive sector or gain access to financial intermediaries, which in turn affects economic growth and income inequality dynamics. In the estimation and calibration of the models, the authors do not use the aggregate dynamics of growth and inequality or the shape of the income distribution. Rather, these data are saved in order to compare the models' macro dynamics predictions with those in the data.

Buera, Kaboski, and Shin (2011) study quantitative models with financial frictions. As in Jeong and Townsend (2008), there are two sectors that differ in productivity and in the fixed costs to enter. Individuals differ in talent and there are endogenous collateral constraints. They show that financial frictions can account for a lot of the cross-country differences in productivity measures. Greenwood, Sanchez, and Wang (2013) incorporate Townsend's (1979) costly state-verification into a quantitative growth model. They calibrate the model to match facts about the U.S. economy for 1974 and 2004 and then study international data. Comparing the U.S. calibration for 1974 to 2004 shows that financial intermediation accounts for 29 percent of U.S. growth. Other quantitative models include Giné and Townsend (2004), Townsend (2010), and Amaral and Quintin (2010). We differ from this literature in that we focus specifically on the effects of bank *innovation* on economic growth considering its interactions with other factors, including TFP, capital and labor. Like Jeong and Townsend (2008) we withhold macro time series from the estimation and calibration so that we can ask how well the model can match those time series.

In our model, financial innovations, which cannot be observed directly, contribute to economic growth indirectly by allowing banks to offer longer maturity loans to the real sector with higher productivity. Because of the complexity of the model, some of the parameters cannot be matched to the relevant moments of the data in analytical form as in, for example, Buera, Kaboski and Shin (2011). Moreover, the contribution of financial innovation is intertwined with TFP growth in the real sector. These complications impose great challenges to our calibration strategy, which needs to open a black box with unknown parameters, latent factors and interactive contributions. As will be seen, the calibration strategy would apply to more general setups beyond the existing literature.

In our calibration strategy, we calibrate the latent factor and some parameters together to have a best fit between the data and the model. In calibrating the contribution of financial innovations, as we cannot explicitly separate the contribution of financial innovation with the available data as in Jeong and Townsend (2007), we calculate the contribution of each factor pointwise using first-order approximations of output growth, which is a complex function of factors without analytical form. And then we calculate the average contribution of each factor over time. A similar approach was adopted by Friedman (1956) in calculating factor contributions to money growth.

The paper proceeds as follows. In section 2 we provide more details about the innovations in the two periods. Section 3 contains the model of bank innovation. Characterizations of the model are provided in Section 4 and in Section 5 we develop the growth accounting stemming from the model. In Section 6 we discuss the estimation and calibration strategy. Calibration results are in Section 7 and a final discussion is in Section 8.

2. The Financial Innovations

In general, the innovations that allowed banks to extend the maturity of business loans involved undertaking more extensive credit risk analysis than in the later period, redesigning covenants, and using more extensive data sets for credit analysis and pricing and opening new markets.

a. 1929-1941: Credit Analysis and Covenants

The first period we study is 1929-1941. This dating comes from Field (2011, 2003) who describes this period as the most technologically progressive in U.S. history.[10] Prior to the invention of the term loan, when a bank made a short-term loan to a firm, 30 days to 90 days, there was the implicit promise that the loan would be rolled over. See Jacoby and Saulnier (1941, p. 13). But the loan did not have to be rolled. At maturity the bank had the opportunity to assess the state of the firm and decide whether to roll the loan. Credit analysis, mostly based on the borrower's good name, could be done every 90 days. But during the Great Depression firms found that there were problems with loan rollovers. During that period, according to Moore (1959) "Often short-term loans could not, or would not, renew" (p. 209).

When the bank commits to a longer maturity, two issues arise. First, ex ante credit analysis becomes more important for the bank. See Jacoby and Saulnier (1941). Prochnow (1949) puts it this way: "In the extension of bank credit there are certain factors that require attention whether the loan is for a short period of three months, or whether for a longer term of three to five years. However, a long-term may require the consideration of factors that would have little or no significance if the loan ran for only 90 says" (p. 96). This was all new to banks.

[10] It also is business cycle peak-to-peak to make his analysis free of business cycle effects.

Foulke and Prochnow (1939), in a textbook, start by saying: "it is rather strange that there should be a dearth of practical literature on loan operations" (p. v).

And the second issue: loan covenants must be designed. Walter Schneckenburger, a banker, recommended in May 1939 that at a minimum loan contracts should have covenants that (1) require the maintenance of a minimum ratio of current assets to current liabilities; (2) the maintenance of a minimum amount of current assets in excess of current liabilities; (3) have a prohibition against the pledging of assets or the mortgaging of property during the life of the loan; (4) have a prohibition against a material change in the character or nature of the business without the consent of the lending bank; (5) include a restriction or limitation on dividends; and (6) have a limitation on the salaries of top management. The design of loan covenants is discussed by Jacoby and Saulnier (1941) in Chapter 5, called "Practices and Techniques of Term Lending" which discusses credit analysis, credit standards, covenant design."[11] Also see Foulke and Prochnow (1939) and Prochnow (1949).

b. 1987-2016: Loan Sales, Syndicated Lending, Leveraged Loans, and Collateralized Loan Obligations

Innovation in the later period of 1987-2016 resulted in new markets opening, which allowed loan maturity to increase further. As discussed in the Introduction, the maturities of the loans sold in the loan sales market, the syndicated lending market, and the leveraged loan market are longer than those retained on balance sheet. In addition, many leveraged loans are securitized by collateralized debt obligations (CLOs). For these markets to have opened, banks had to innovate because the loan buyers implicitly rely on banks that the loans being sold are of the quality described.

What were the innovations? Gadanecz (2004) says that banks "started applying more sophisticated risk pricing to syndicated lending . . . They also started to make wider use of covenants, triggers which linked pricing explicitly to corporate events such as changes in ratings and debt servicing. While banks became more sophisticated, more data became

[11] Beam (1947) shows the actual loan contract widely used in New York and Chicago at the time and discusses the loan covenants included.

available on the performance of loans, contributing to the development of a secondary market" (p.76-77). Griffin, Nini, and Smith (2019) show, over the past 20 years, that banks have redesigned covenants: "lenders have eased the restrictiveness of covenants in ways that greatly reduce the ratio of false positives relative to false negatives, including by switching to covenant packages with higher signal-to-noise ratios" (p. 1).

Collateralized loan obligations (CLO) also play an important role. A CLO is a special purpose vehicle, a legal entity, that buys loans from banks and finances them by issuing different layers of debt ordered by seniority in the capital market. Unlike standard securitizations, the CLO manager can subsequently buy and sell the loans. Fed Chair Jerome Powell (2019) observed that CLOs are about 62 percent of the leverage loan market, which itself is $1.1 trillion and is used by 70 percent of U.S. companies. Bord and Santos (2015) study a sample of CLOs over the period 2004-2008. Their empirical findings suggest that banks use more lax standards to underwrite the loans they sell to CLOs, but that investors understand this. Benmelech, Dlugosz, and Ivashina (2012) study a sample of CLOs over the period 1997-2007 and find no evidence of adverse selection.

Banks need access to these markets because the cost of funds is lower. Standard and Poor's argued that the reason for the leverage loan and syndicated loan markets grew was because: "Syndicated loans are less expensive and more efficient to administer than traditional bilateral – one company, one lender – credit lines."[12] Nadauld and Weisbach (2012) found that bank loans that are eligible to be securitized (i.e., be sold to a collateralized loan obligation) cost borrowers 17 basis points less than otherwise. Gorton and Metrick (2013) present a model of loan securitization and loan sales showing how benefits to the bank can arise. For example, selling loans allows banks to reduce their exposure to any one borrower and to reduce undesirable risk concentration. But these benefits only accrue if the bank has access to these markets, which requires maintaining relationships with loan buyers (see Gorton and Souleles (2007)).

[12] See S&P (no date), "Leveraged Commentary & Data (LCD): Leveraged Loan Primer," https://www.spglobal.com/marketintelligence/en/documents/lcd-primer-leveraged-loans_ltr_updated.pdf

Observers also point to several developments that contributed to the development of these markets. De Fontenay (2014) points to the change in U.S. capital requirements under Basel II, which motivated banks to maintain lending relationships, but minimize the regulatory cost by selling the loans. Thomas and Wang (2004) point to the adoption of Rule 144A in 1990 when the Securities' Act of 1933 was amended. The rule made it possible for loans in the secondary market to be trade in a lightly regulated way. Registration requirements under the Securities Act of 1933 were not required if the buyers were "qualified institutional buyers" (QIBs).

c. The Benefits of Longer Maturity Loans

Longer maturity loans shift risk from borrowers to banks, so the banks need to be able to manage these risks. In the period 1929-1941, banks innovated by developing methods of credit risk analysis and covenant design. During 1987-2016, as loan maturity continued to increase, banks innovated to shift the risk to nonbank, institutional, investors. The risk is spread through the economy.

In the period 1929-1941, the longer maturity of loans reduced the rollover risk of borrowers. That is, the money is locked in for a longer period. "Rollover risk" refers to situations when a firm's debt is close to maturity and the firm seeks to refinance the debt. The risk is that this refinancing will not be available, leading the firm to cut investment and employment. Because of bank relationships, it is not easy to quickly find replacement financing. Bernanke (1983) drew attention to this risk in his study of the negative effect of bank closures during the Great Depression on economic activity (although Bernanke never used the term "rollover risk"). Bank closures meant that firms could not refinance.[13] Bernanke's (1983) argument was detailed and buttressed by Benmelech, Frydman and Papanikolaou (2019) who focused on firms whose debt was maturing during the Depression. During the Depression the corporate bond market collapsed and so firms could not refinance their debt. The authors argue that these firms reduced their investment and employment because they would not easily obtain alternative financing. The effect on unemployment was significant.

[13] Because of bank relationships it was not easy to just switch banks. See Ongena and Smith (2000) for a review of this literature.

Rollover risk is important in the later period, 1987-2016, as well. Kalemli-Ozcan, Laeven, and Moreno (2018) studied the collapse of investment after the European Crisis (following the 2008 financial crisis). In the prior boom leading up to the crisis, the debt was mostly short-term. They distinguish between a weak credit supply channel and a rollover channel; the authors use sovereign risk exposure of banks as a measure of bank weakness. They found that firms that borrowed more short-term suffered more from rollover risk and decreased investment more.

Wang, Chiu, and Peña (2017) study publicly traded U.S. firms over the period 1986-2013. Their measure of rollover risk is the amount of the firm's long-term debt outstanding at the end of year $t - 1$, due for repayment in year t, weighted by total assets. Their main finding is that for a firm that depends on bank financing, an increase of one standard deviation in the rollover risk measure leads to a significant increase of 3.2% in its default probability within one year.[14]

In the period 1929-1941 risk was shifted from firms to banks. In 1987-2016 risk is further shifted from banks to nonbanks. We have no direct evidence of the size of this risk-shifting or its benefits, but the pattern of increasing maturity is characteristic of economic development generally. Demirgüç-Kunt and Maksimovic (1999) report systematic differences between developing and developed economies: “Firms in developing countries use less long-term debt as a proportion of total debt” (p. 298). And Peria and Schmukler (2017): “. . . the maturity of bank loans in advanced economies is significantly longer than in developing ones . . . . close to a third of bank loans in high-income economies have a maturity that exceeds five years, for developing economies the share of loans with maturity larger than 5 years averages 18 percent” (p. 9).[15]

---

[14] There is more empirical evidence, as well. Gopalan et al. (2014), for example, find that firms with greater exposure to rollover risk have poorer credit ratings. And Chen et al. (2012) found that a larger drop in the maturity of debt leads to larger increases in credit spreads during the 2007–2009 crisis.

[15] This is also true in country case studies, for example, Schiantarelli and Sembenelli (1996) on the United Kingdom and Italy; Jaramillo and Schiantarelli (1996) on Ecuador; Calomiris, Halouva, and Ospina (1996) on Colombia; and Schiantarelli and Srivastava (1996) on India. In general, these studies find that short-term debt has no effect on efficiency and growth.

There is some evidence of the real effects of longer maturities. Caprio and Demirgüç-Kunt (1998) report that "The conventional wisdom that more long-term debt may actually lead to productivity improvements was confirmed in Ecuador, Italy, and the United Kingdom" (p. 182). Kpodar and Gbenyo (2010) use panel data on countries in the West African Economic and Monetary Union over the period 1995-2006, and "find that while financial development does support growth in the region, long-term bank financing has a greater impact on economic growth than short-term financing because long-term projects have higher returns adjusted for risks" (abstract).

3. A Model of Bank Innovation

In this section we introduce a model of bank innovation.

a. The Model Environment

The economy is populated by a continuum of agents with measure *L* evolving over discrete time *t* = 0, 1, 2 . . . Each agent runs a firm. There are two kinds of production technologies: manufacturing and non-manufacturing. Manufacturing employs an innovative technology, where firm *i* earns a risky return in τ periods:

$$y_{it}^{M} = \begin{cases} f(k_{it})\ with\ prob.\ p_{it} \\ 0\ with\ prob.\ 1 - p_{it} \end{cases}$$

Non-manufacturing employs the regular technology, where firm *i* earns a safe return in each period $y_{it}^{N} = A^{N} k_{it}$. The probability of success for a manufacturing investment, p_{it}, is independent of the initial wealth level and is randomly drawn from a time-invariant *i.i.d.* distribution *H* (with pdf $h(.)$) over the interval $[\underline{p}, 1]$ with $0 < \underline{p} < 1$. Assume that p_{it} is a private information for firm *i*, and we can interpret p_{it} as the type of firm *i*. To simplify our analysis, assume every firm's type updates every τ periods.

b. Bank Innovation

Banks have a technology for information production using credit analysis and monitoring through loan covenants to screen out λ_t portion of the long-term manufacturing investment that would otherwise have project realizations in the left tail, while not making any mistakes on those with positive returns in the right tail. We will detail this below.

At time t, firm *i* with type p_{it} decides whether to take a long-term ($\bar{\tau}$-period) loan for manufacturing investment or a short-term ($\underline{\tau}$-period) loan for non-manufacturing investment. If firm *i* applies for a short-term loan (borrowing) k_{it}^N and roll over the loan for $\bar{\tau}/\underline{\tau}$ times, its $\bar{\tau}$-period payoff will be

$$\pi_{it}^N = (\bar{\tau}/\underline{\tau})[A^N k_{it}^N - ((1+r^N)^{\underline{\tau}} - 1)k_{it}^N].$$

If firm *i* applies for a long-term loan k_{it}^M, its $\bar{\tau}$-period payoff will be

$$\pi_{it}^M = p_{it}[f\left(k_{it}^M\right) - ((1+r^M)^{\bar{\tau}} - 1)k_{it}^M] + (1-p_{it})\lambda_t \pi_{it}^N \ .$$

Conditional on firm *i* passing the bank's screening, its default probability becomes

$$d_{it} = \frac{(1-p_{it})(1-\lambda_t)}{p_{it} + (1-p_{it})(1-\lambda_t)} \leq 1 - p_{it}$$

which is decreasing in λ_t. This is how the banks technology, as described by λ_t, works.

There is a cutoff type, p_t^*, above which a firm will apply for a long-term loan from a bank if $\pi_{it}^M \geq \pi_{it}^N$ (but might be screened out by the bank with some probability).

c. Discussion of the Model

The model of the bank's technology is very general. Innovation corresponds to improvements in λ_t. Nothing in the model means that innovation cannot reverse. During the period 1929-1941, bank innovation with credit analysis and covenant design is captured by increases in λ_t. During 1987-2016 banks made longer maturity loans and reduced their risk by selling loans, making the bank less likely to fail when longer maturity loans are made. The innovations associated with this are also captured by λ_t. Subsequently, in the calibration we will be able to recover a time series of λ_t.

4. Characterization of the Equilibrium

As the model does not involve intertemporal terms or an individual firm's type, we simplify the notation by dropping the subscripts *t* and *i* in the analysis below.

Assume that banks' cost of funds is *r*. In equilibrium, banks make zero profits, which implies $r^N = r$ and $((1+r^M)^{\bar{\tau}}(1-E[d|p \geq p^*]) = (1+r)^{\bar{\tau}}$.

In equilibrium, the total amount of investment aggregates manufacturing projects and non-manufacturing projects. For a firm choosing a manufacturing project, its borrowing k^M is the solution of the following optimization problem:

$$\max_{k^M}[f(k^M) - ((1+r^M)^{\bar{\tau}} - 1)k^M].$$

The first order condition implies

$$f'(k^M) = (1+r^M)^{\bar{\tau}} - 1.$$

Assume that, in *per capita* terms, $f(k) = A^M k^\alpha$. Then we have

$$k^M = \left(\frac{(1+r^M)^{\bar{\tau}} - 1}{\alpha A^M}\right)^{1/(\alpha-1)}$$

which is independent of a firm's type.[16]

The total amount of capital can be expressed as

$$K = K^M + K^N = k^M L \rho^M + k^N L \rho^N$$

with $\rho^M = \int_{p^*}^{1}[p + (1-p)(1-\lambda)]h(p)dp$ and $\rho^N = 1 - \rho^M$.

For the consumers' decision, to simplify our analysis, we assume consumers consume every $\bar{\tau}$ periods, that is, the consumption lasts for $\bar{\tau}$ periods.

---

[16] The total output can be written as $Y = Lf(k) = A^M k^\alpha L = A^M K^\alpha L^{1-\alpha}$, which is the linearly homogenous Cobb - Douglas production function.

As k^M is a function of r^M, or equivalently, p^*, we can also solve for k^N as a function of p^*. Lastly, let $\pi^M(p^*) = \pi^N$, and so we can solve for p^*.

Assuming the short-term project return is low such that a long-term project (with the optimal level of capita input) will yield a higher expected return than the short-term project, we can show that p^* always exists.

Proposition 1 (Existence): Assume the level of wealth, *W*, is not too large, the return to the regular technology is low relative to the innovative technology, and that the lower bound of firm quality, $\underline{p}$, is small enough, then there exists a cutoff firm type $p^* \in [\underline{p},1]$, with a type above which firms will choose to apply for a long-term loan and invest in innovative technology.

Proof: Given any $p^* \in [\underline{p},1]$, the payoff to a firm with type $\underline{p}$ is: $\pi^M\left(\underline{p}\right) = \underline{p}\, max_{k^M}[f(k^M) - ((1 + r^M)^{\bar{\tau}} - 1)k^M] + (1 - \underline{p})\lambda\pi^N$, and $\pi^M\left(\underline{p}\right) < \pi^N$ if $\underline{p}$ is close to zero; the payoff of a firm with type *p* = 1 is: $\pi^M(1) = max_{k^M}[f(k^M) - ((1 + r^M)^{\bar{\tau}} - 1)k^M]$, and when the level of social wealth, *W*, is not too large, and the return of to the regular technology is low relative to the innovative technology, we have $\pi^M(1) > \pi^N$. Therefore, there exists a $p = p^{*\prime} \in [\underline{p},1]$ such that $\pi^M(p^{*\prime}) = \pi^N$. The map from p^* to $p^{*\prime}$ is a continuous map from $[\underline{p},1]$ to $[\underline{p},1]$, and according to the Kakutani fixed point theorem, there exists some $p^* \in [\underline{p},1]$ such that $p^{*\prime} = p^*$. ∎

Remarks: For the purpose of simplifying our calibration, we assume a linear production function for the regular technology and a concave production function for the innovative technology. Under this assumption, if there is too much capital in the economy, a large amount of capital invested in the regular technology could make firms with the regular technology yield an infinitely large return and drive investment out of the innovative technology. This phenomenon of the “curse of scale” is ruled out by assuming the amount of capital is not too large. The regular technology likely has a decreasing return to scale though in reality.

5. Growth Accounting

The total output is

$$Y = Y^M + Y^N = f(k^M)(1 - E[d|p \geq p^*])L^M + \frac{\bar{\tau}}{\underline{\tau}} A^N k^N L^N$$
$$= f(k^M)(1 - E[d|p \geq p^*])L\rho^M + \frac{\bar{\tau}}{\underline{\tau}} A^N k^N L\rho^N$$

and

$$Y^M = f(k^M)(1 - E[d|p \geq p^*])L^M = A^M {K^M}^{\alpha} {L^M}^{1-\alpha}(1 - E[d|p \geq p^*])$$

Remarks:

(1) When a firm chooses a manufacturing project and survives bank screening, its default risk *d* is decreasing with the bank screening technology, and the long-term loan interest rate r^M, which is independent of firm type, is decreasing with the bank screening technology. Therefore, the cutoff type, p^*, is also decreasing with bank screening technology, which implies that there will be more firms applying for a long-term loan for manufacturing investment as bank screening technology advances.

(2) There is a crowding out effect, as more firms take the manufacturing project, less capital is invested in the non-manufacturing projects. This crowding out effect further reduces the output (as well as profits) from the non-manufacturing sector, which further lowers the cut off type, p^*.

(3) Both firms and banks make zero profits. In equilibrium, all the output is owned by agents (depositors).

(4) The growth of capital investment, *K*, is another source of output growth. However, without bank screening technology advancement, the extra capital supply will only flow into non-manufacturing, and we have $K^N = K - K^M$, with K^M being independent of *K*. This implies that the marginal return for capital supply is a constant, $\frac{\bar{\tau}}{\underline{\tau}} A^N$.

(5) Assuming that the technology advancement in the non-manufacturing sector is relatively slow, the capital investment in manufacturing will only be affected by the bank technology advancement relevant for manufacturing, while not being affected by the technology advancement in non-manufacturing. Therefore, the technology advancement in non-manufacturing will only affect the output in the non-manufacturing sector.

Therefore, the total output can be decomposed into two parts, manufacturing sector output and non-manufacturing sector output, which can be rewritten as follows

$$Y = Y^M(A^M, L, \lambda) + Y^N(A^N, K, L, \lambda).$$

The growth rate of total output can be written as

$$\Delta Y = \frac{\partial Y^M}{\partial A^M}\Delta A^M + \frac{\partial Y^N}{\partial A^N}\Delta A^N + \frac{\partial Y^N}{\partial K}\Delta K + \left(\frac{\partial Y^M}{\partial L} + \frac{\partial Y^N}{\partial L}\right)\Delta L + \left(\frac{\partial Y^M}{\partial \lambda} + \frac{\partial Y^N}{\partial \lambda}\right)\Delta \lambda$$

which implies (by a first order Taylor expansion)

$$\frac{\Delta Y}{Y} = \frac{\partial Y^M}{\partial A^M}\frac{A^M}{Y}\frac{\Delta A^M}{A^M} + \frac{\partial Y^N}{\partial A^N}\frac{A^N}{Y}\frac{\Delta A^N}{A^N} + \frac{\partial Y^N}{\partial K}\frac{K}{Y}\frac{\Delta K}{K} + \left(\frac{\partial Y^M}{\partial L} + \frac{\partial Y^N}{\partial L}\right)\frac{L}{Y}\frac{\Delta L}{L} + \left(\frac{\partial Y^M}{\partial \lambda} + \frac{\partial Y^N}{\partial \lambda}\right)\frac{\lambda}{Y}\frac{\Delta \lambda}{\lambda}.$$

6. Estimation and Calibration

a. Technological advances in the banking sector

The relationship between p^* and λ can be derived in the model when we know the distribution of *p* and other exogenous factors:

$$\rho^M = \int_{p^*}^1 [p + (1-p)(1-\lambda)]h(p)dp \qquad (6\text{-}1)$$

$$E[d|p \geq p^*] = \int_{p^*}^1 \frac{(1-p)(1-\lambda)}{p+(1-p)(1-\lambda)}\, h(p)dp \qquad (6\text{-}2)$$

In (6-1), ρ^M is portion of firms that borrow using long-term loans from banks and banks produce information about these firms. We use the superscript *M* for sectors that apply for long-term loans resulting in information production. For the functional form of $h(p)$, which describes the probability of success for a manufacturing firm, we assume *p* has a uniform distribution *i.i.d.* over time on the interval $[\underline{p}, 1]$. Set $\underline{p} > 0$ as the lower-bound of the uniform distribution. $\underline{p}$ is a constant that can be captured during the calibration, and thus (6-1) and (6-2) can be written as:

$$\rho^M = \left[(1-p^*) - \frac{1}{2}\lambda(1-p^*)^2\right] / (1-\underline{p}) \quad (6\text{-}3)$$

$$E[d|p \geq p^*] = (\frac{\lambda-1}{\lambda^2}(\log(\lambda p^* - \lambda + 1) - \lambda p^*) + \frac{(\lambda-1)}{\lambda})/(1-p^*) \quad (6\text{-}4)$$

We have two time periods and the overall economic structure (i.e., the mix of industries) for these two periods is different. For the older era (1929-1941), we assume only firms in manufacturing industries borrowed with long-term loans and banks were producing information about these firms. Jacoby and Saulnier (1941): "Manufacturing concerns have comprised the most important industrial category of borrower from all term lending institutions" (p. 39). Also, see their Table 6, p. 54.

For the later period (1987-2016), we assume all firms in manufacturing industries and the industries (at the level of two-digit NACIS code) in the service sector with higher profitability than the manufacturing sector borrow with long-term loans where banks were producing information. This division of industries through profitability threshold is a direct implication of the model.

The profitability (per capita income) of each industry (at the level of two-digit NACIS code) is calculated as $\pi = y - rk$, where *y* is per capital output, *k* is per capita capital, and *r* is the risk-free rate. The results show that mining, construction, information and real-estate have higher profitability than manufacturing. Finance and government are excluded.

For the purpose of calibration, we rewrite (6-3) and (6-4) with residual errors:

$$\rho_t^M = \frac{\left[(1-p_t^*) - \frac{1}{2}\lambda_t(1-p_t^*)^2\right]}{1-\underline{p}} + \varepsilon_{1t} \quad (6\text{-}5)$$

$$E[d|p \geq p^*]_t = \frac{\frac{\lambda_t - 1}{\lambda_t^2}(\log(\lambda_t p_t^* - \lambda_t + 1) - \lambda_t p_t^*) + \frac{(\lambda_t - 1)}{\lambda_t}}{1-p_t^*} + \varepsilon_{2t} \quad (6\text{-}6)$$

To calibrate the value of default risk in (6-6), we first calibrate the value of $\bar{\tau}$ with $\underline{\tau}$ set to one month, and, at time *t*, the average loan maturity $\hat{\tau}$ can be written as:[17]

$$\hat{\tau}_t = (\frac{K^M}{K})_t \bar{\tau} + (\frac{K^N}{K})_t \underline{\tau} + \varepsilon \qquad (6\text{-}7)$$

With data on $\hat{\tau}$ and capital of manufacturing and non-manufacturing sectors, we can estimate $\bar{\tau}$. The default risk $E[d|p \geq p^*]_t$ for the periods 1929-1941 and 1987-2016 are estimated using $((1+r^M)^{\bar{\tau}}(1-E[d|p \geq p^*]) = (1+r)^{\bar{\tau}}$.[18] For r^M, We use Moody's Seasoned Aaa Corporate Bond Yield. For *r*, we use Government's Long-term Bond Yield.

With the estimated value of default risk, $(p_1^*, p_2^*, \ldots, p_T^*)$, $(\lambda_1^*, \lambda_2^*, \ldots, \lambda_T^*)$ and $\underline{p}$ are calibrated by solving the following optimization problem:

$$\left(p_1^*, p_2^*, \ldots, p_T^*, \lambda_1^*, \lambda_2^*, \ldots, \lambda_T^*, \underline{p}\right) = argmin \sum_{t=0}^{T} \varepsilon_{1t}^2 + \varepsilon_{2t}^2 \qquad (6\text{-}8)$$

b. TFP growth of the sectors borrowing long-term from banks and of the traditional sectors

For TFP growth we will estimate a simple model. We use the regression without an intercept to estimate α:

$$lny_t^M - ln(1-d_t) = \alpha lnk^M + \varepsilon \qquad (6\text{-}9)$$

We have A^M and A^N calculated as $A_t^M = \frac{y_t^M}{(1-E[d_t|p \geq p_t^*]){k_t^M}^{\alpha}}$ and $A_t^N = \frac{y_t^N}{k_t^N}$.

c. Decomposition and contribution of λ to output growth

[17] This use of AAA data is consistent with the term loan experience at that time. "Early term loans were made to high quality borrowers, which over their life showed negligible losses and defaults" (see Jacoby and Saulnier (1941), p. 110). Banks were very conservative in the beginning of term lending.

[18] Alternatively, for this later period 1987-2016, we can use the bank delinquency rate from FRED directly, which gives pretty much the same results. See Appendix D for the results of later period using the bank delinquency rate.

The growth rate of total output can be decomposed as below:

$$\frac{\Delta Y}{Y} = \frac{\partial Y^M}{\partial A^M}\frac{A^M}{Y}\frac{\Delta A^M}{A^M} + \frac{\partial Y^N}{\partial A^N}\frac{A^N}{Y}\frac{\Delta A^N}{A^N} + \frac{\partial Y^N}{\partial K}\frac{K}{Y}\frac{\Delta K}{K} + \left(\frac{\partial Y^M}{\partial L} + \frac{\partial Y^N}{\partial L}\right)\frac{L}{Y}\frac{\Delta L}{L} + \left(\frac{\partial Y^M}{\partial \lambda} + \frac{\partial Y^N}{\partial \lambda}\right)\frac{\lambda}{Y}\frac{\Delta \lambda}{\lambda} \quad (6\text{-}10)$$

When calculating the contributions of factor growth to output growth, we have:

$$\frac{\partial Y^M}{\partial A^M} = f'(k^M)(1-d)L^M\frac{\partial k^M}{\partial A^M} + f(k^M)L^M\frac{\partial(1-d)}{\partial A^M} + f(k^M)(1-d)\frac{\partial L^M}{\partial A^M} \quad (6\text{-}11)$$

$$\frac{\partial Y^N}{\partial A^N} = \frac{\bar{\tau}}{\underline{\tau}}k^N L\rho^N = \frac{\bar{\tau}}{\underline{\tau}}K^N = \frac{Y}{A^N} \quad (6\text{-}12)$$

$$\frac{\partial Y^N}{\partial K} = \frac{\bar{\tau}}{\underline{\tau}}A^N = \frac{Y^N}{K^N} \quad (6\text{-}13)$$

$$\frac{\partial Y^M}{\partial L} + \frac{\partial Y^N}{\partial L} = f(k^M)(1-d)\rho^M + \frac{\bar{\tau}}{\underline{\tau}}A^N k^N \rho^N = \frac{Y^M}{L} + \frac{Y^N}{L} = \frac{Y}{L} \quad (6\text{-}14)$$

$$\frac{\partial Y^M}{\partial \lambda} + \frac{\partial Y^N}{\partial \lambda} = f'(k^M)(1-d)L^M\frac{\partial k^M}{\partial \lambda} - f(k^M)L^M\frac{\partial d}{\partial \lambda} + f(k^M)(1-d)\frac{\partial L^M}{\partial \lambda} + \frac{Y^N}{K^N}\frac{\partial K^N}{\partial \lambda} + \frac{Y^N}{L^N}\frac{\partial L^N}{\partial \lambda}$$

(6-15)

Note that we use $f(k^M) = A^M {k^M}^{\alpha}$ to calculate $f'(k^M)$, and for *d* we use the default risk derived from Moody's Seasoned Aaa Corporate Bond Yield described above. As for the differentials that cannot be directly derived from the model, we use Newton Interpolation to estimate them by assuming that over a short time period the macroeconomic structure of the economy does not change (See Appendix B for more details).

7. Calibration Results

The results are presented separately for the two periods: 1929-1941 and 1987-2016.

a. The Period 1929-1941

Using these parameters from the estimation, $\alpha = 0.893$ (estimated using (6-9)), and calibration, $\bar{\tau} =$ 2.14 years, and $\underline{p}$ = 42.62% (calibrated using (6-8)), Figures 1-1 and 1-2 show the calibrated paths for p_t^* and λ. Recall that p_t^*, is the cutoff above which a firm will apply for a long-term loan from a bank. During this period more and more firms were applying for long-term loans and banks were innovating over the period. Figure 1-3 shows the path of

TFP for the manufacturing sector. Consistent with Field (2011, 2003) it is rising during this period.

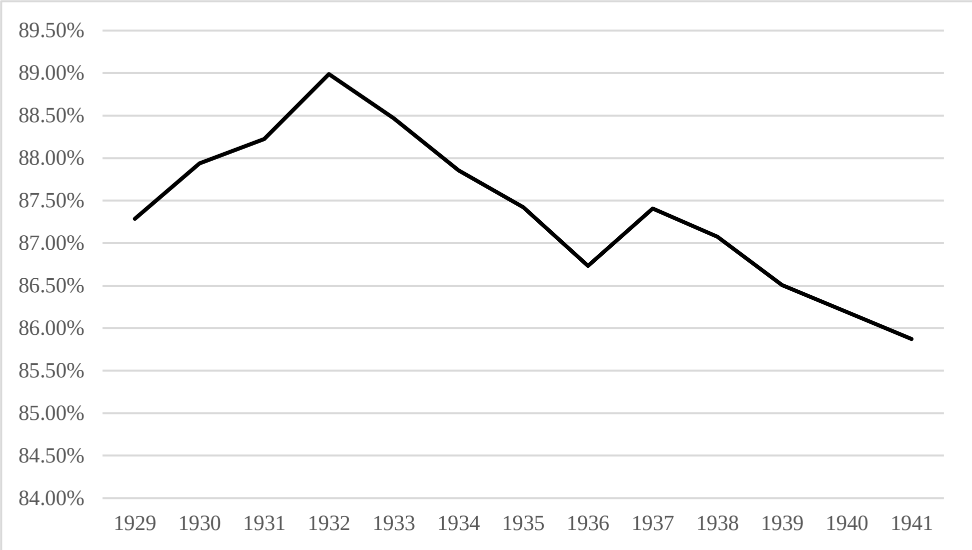


Figure 1-1 Overall Trend for p^* (1929-1941)

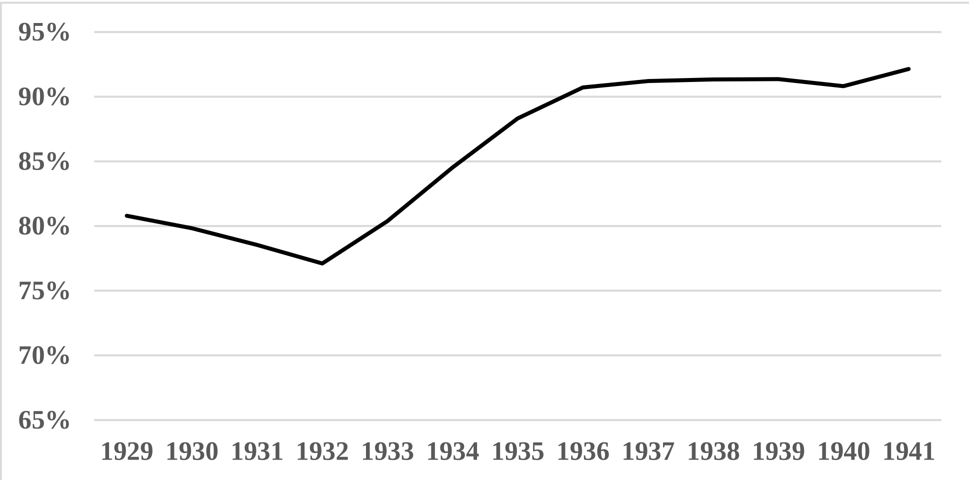


Figure 1-2 Overall Trend for λ (1929-1941)

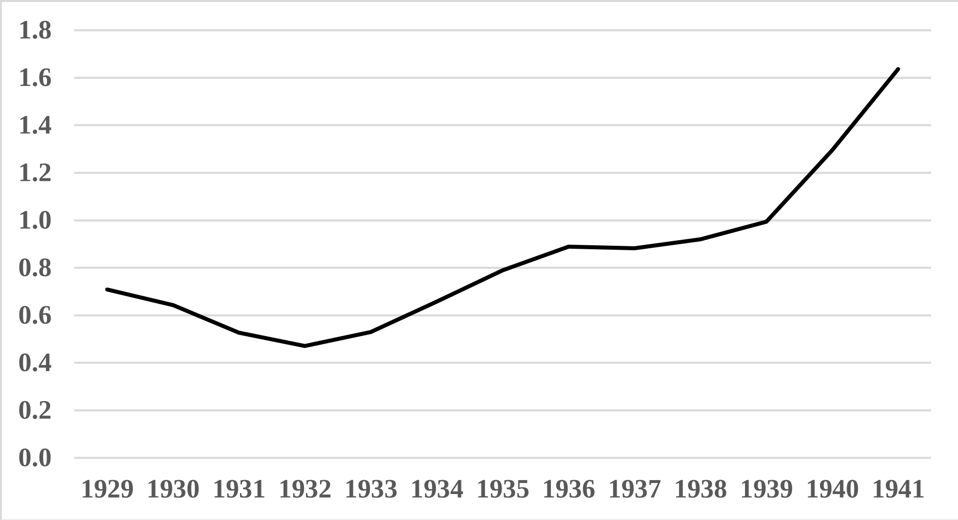


Figure 1-3 Overall Trend for A^M (1929-1941)

Figure 1-4 (data are in Table D1-1 in Appendix D) plots the contribution of TFP in manufacturing (A^M), TFP in non-manufacturing (A^N) and bank innovation (λ) to realized output growth over 1929-1941, while Figure 1-5 (data are in Table D1-2 in Appendix D) plots the contribution of A^M, A^N and λ to estimated output growth over 1929-1941. Both bank innovation and non-manufacturing TFP have mostly consistent positive contributions to output growth, while the contribution of manufacturing TFP is insignificant. The contribution of bank innovation, λ, to output growth is 26.30 percent and 27.36 percent, respectively, very close to Greenwood, Sanchez, and Wang's (2013) 29 percent contribution to output based on Townsend's (1979) costly state-verification model.

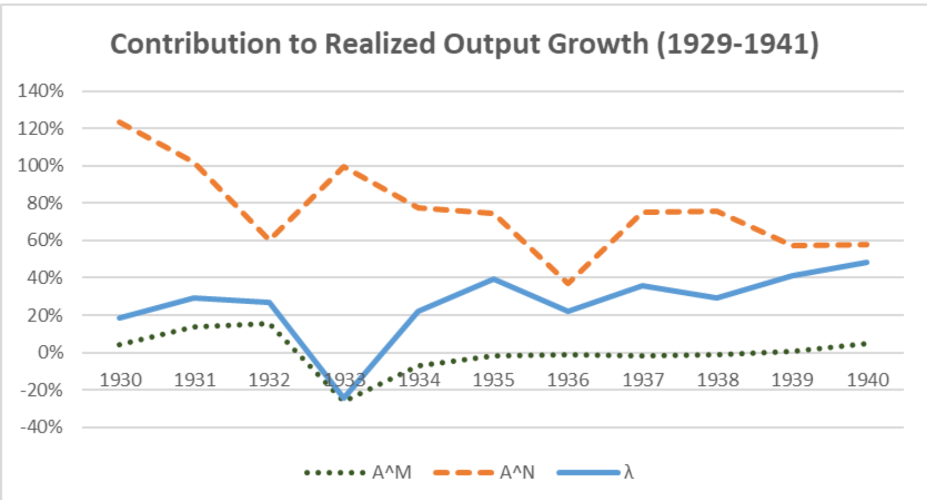


Figure 1-4 Contribution to Realized Output Growth (1929-1941)

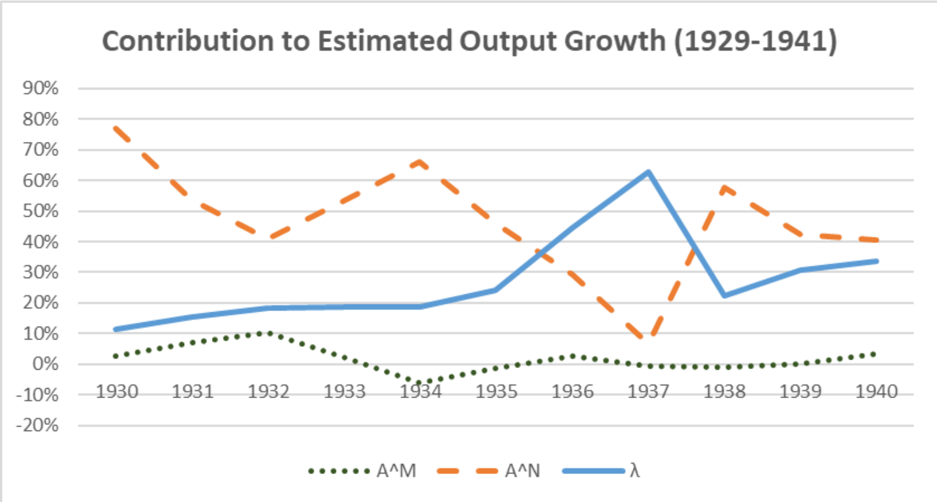


Figure 1-5 Contribution to Realized Output Growth (1929-1941)

How well does our estimated and calibrated model do in matching the path of real output growth? Figure 1-6 provides the answer. Our estimated output growth path and the realized path of output growth have a correlation of 0.71.

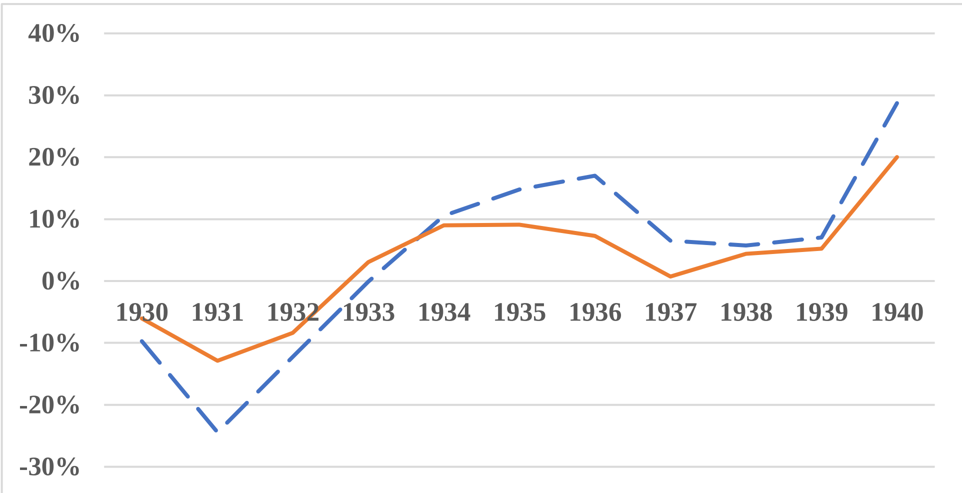


Figure 1-6 Realized Output Growth vs. Estimated Output Growth, Correlation = 0.71 (1929-1941, the Realized Output Growth is in the solid line)

b. The Period 1987-2016

For this period the parameters used are: $\underline{p}$ = 24.52%, $\alpha = 0.968$, $\bar{\tau} = 1.97$. As before, Figures 2-1 and 2-2 show the calibrated paths for p_t^* and λ. The overall trend for p_t^* is upward, but not as smooth as the previous period.

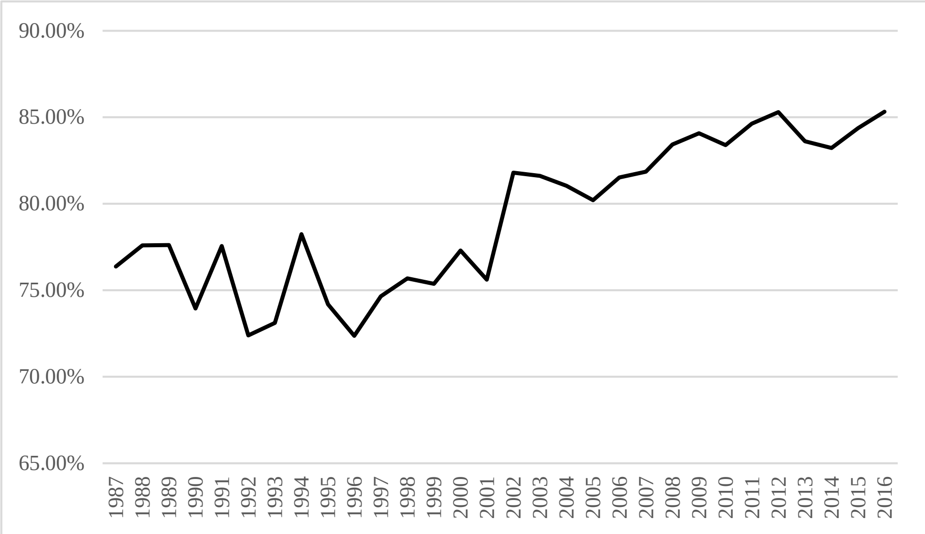


Figure 2-1 Overall Trend for p^* (1987-2016)

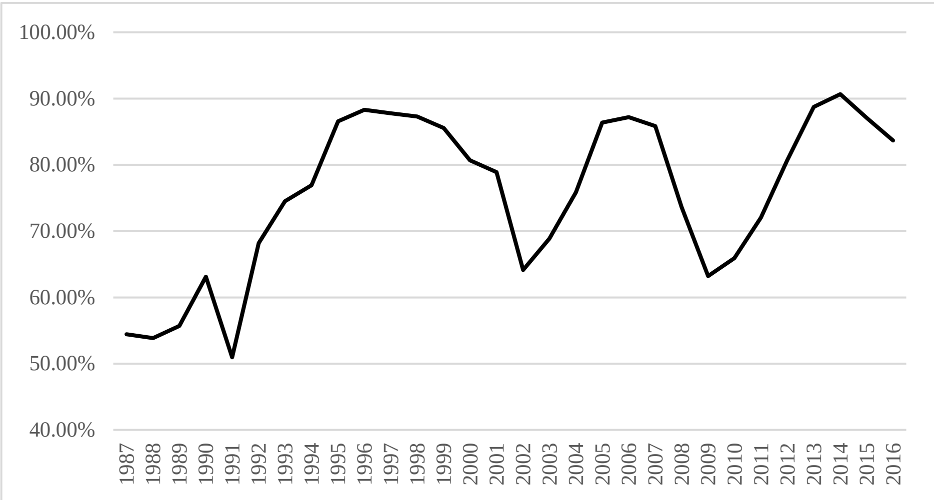


Figure 2-2 Overall Trend for λ (1987-2016)

The trend for λ shows dips in the recession starting in 2001 and in the financial crisis. The reduction in λ is interesting. Bank innovation is not permanent. For example, if during a recession banks can no longer off-load loans and so must keep them, this would appear as a reduction in λ. That is what happened as shown in Figure 2-3 below.

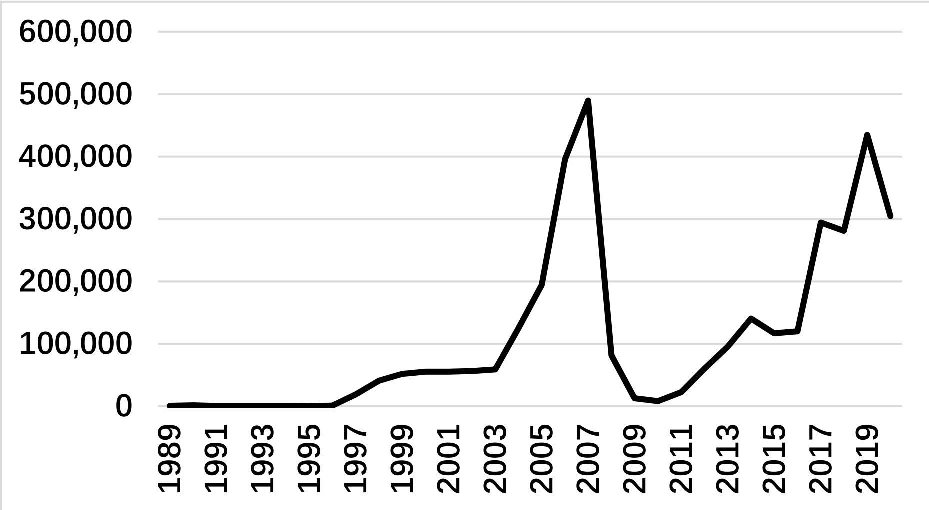


Figure 2-3: Collateralized Loan Obligations, Issuance ($ millions, Source: SIFMA)

The figure for mortgage-backed securities is similar. Figure 1 shows average loan maturity shrinking during and just after the financial crisis. Our interpretation is that bank innovation reversed, and then later starts to recover.

Figure 2-4 shows the path of TFP in the sector we have called "manufacturing". It shows the often commented on productivity slowdown; see, e.g., Crafts (2018).

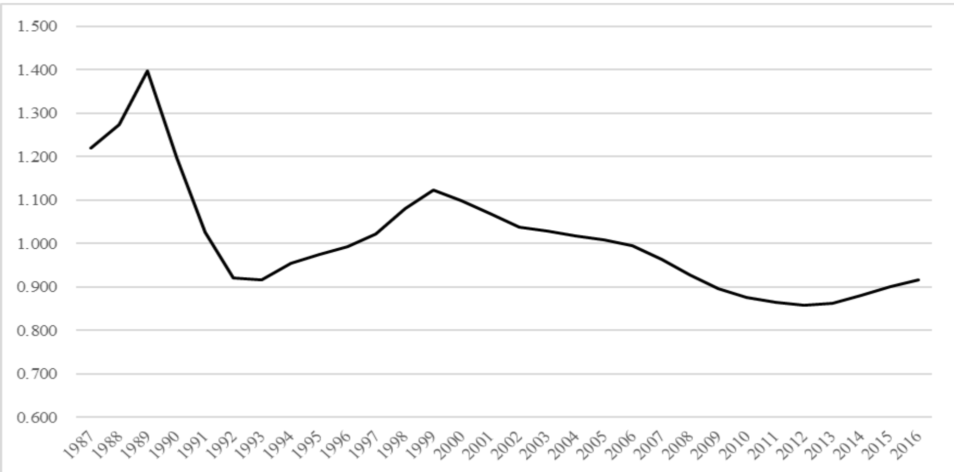


Figure 2-4 Overall Trend for A^M (1987-2016)

As before, Figure 2-5 plots (data are in Table D2-1 in Appendix D) the contribution of TFP in manufacturing (A^M), TFP in non-manufacturing (A^N) and bank innovation (λ) to realized output growth over 1987-2016. Figure 2-6 plots (data are in Table D2-2 in Appendix D) the contribution of A^M, A^N and λ to estimated output growth over 1987-2016. Again, both bank innovation and non-manufacturing TFP have more significant contributions to output growth than manufacturing TFP. The contribution of bank innovation, λ, to output growth is 78.78 percent and 35.32 percent, respectively.

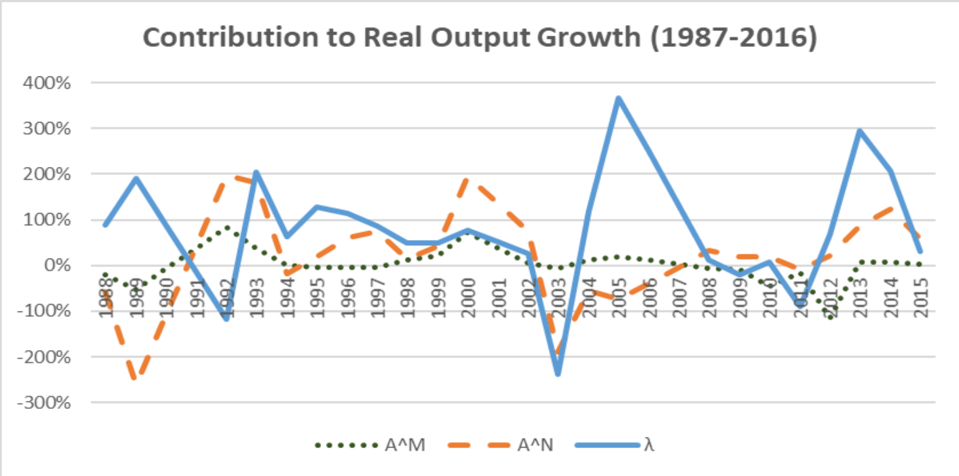


Figure 2-5 Contribution to Real Output Growth (1987-2016)

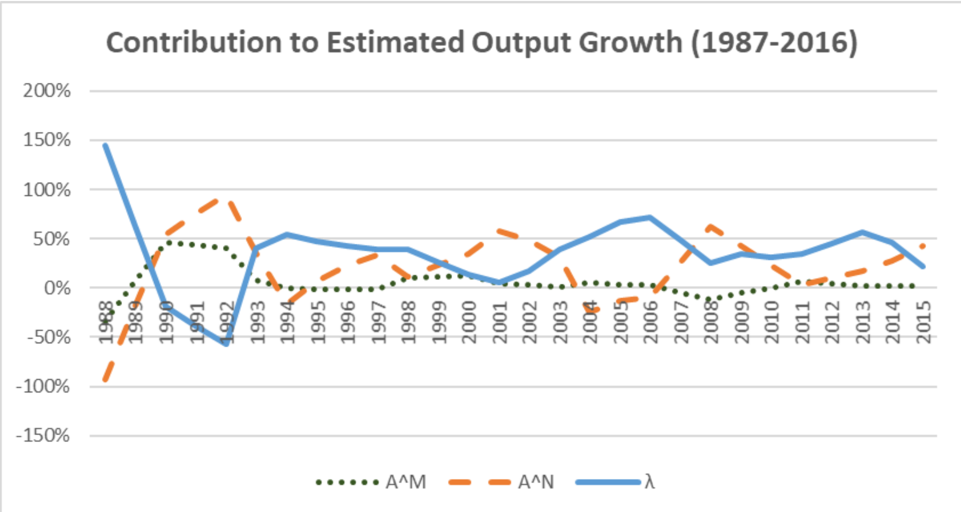


Figure 2-6 Contribution to Real Output Growth (1987-2016)

Again, how well does our estimated and calibrated model do in matching the path of real output growth? Figure 2-7 provides the answer. Our estimated output growth path and the realized path of output have a correlation of 0.58.

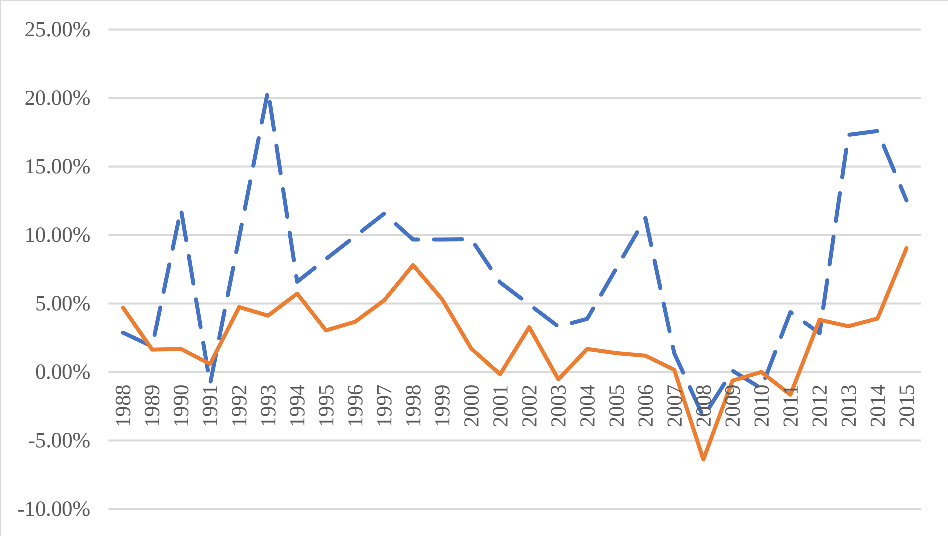


Figure 2-7 Realized Output Growth vs. Estimated Output Growth, Correlation = 0.58 (1987-2016, the Realized Output Growth is the Solid Orange Line)

We were less successful matching the path of real output in the second period, a longer period than the first period and with more economic ups and downs. In Figure 1 there are two dots during the period 1987-2016 which are below trend. Those are the years 2009 and 2010, the aftermath of the financial crisis.

8. Discussion

Banks are the heart of the savings-investment process, an integral part of a market economy. Since the invention of the term loan in the mid-1930s, the maturity of bank business loans has been increasing, first as banks innovated with credit analysis and covenant design and then as banks have been able to off-load loans in the capital markets. The increase in the maturity of business loans shows how the systemic risk of loss due to default of firms in recessions is allocated. In the early period, risk was moved from firms to banks and in the latter period such risk was moved from banks to institutional investors. Bank innovation that has resulted in these reallocations of risk are a very significant contributor to economic growth.

Appendix A: Loan Maturity Data

1. Data for the Period 1929-1941

The loan maturity data for this period comes from bank archives as listed below.

Archive Sources for Individual Loan Data, 1780-1940

Bank Name	**Hartford National Bank and Trust**	**Merchants National Bank**	**National Whaling Bank**	**Braddock National Bank**
Bank City	Hartford	New Bedford	New London	Braddock
Bank State	CT	MA	CT	PA
Record Beg	1792	1825	1866	1936
Records End	1792	1932	1930	1949
Library Name 1	University of Connecticut Library	New Bedford Whaling Museum	Mystic Seaport Museum	Heinz History Center
Library Name 2	Thomas J. Dodd Research Center	Research Library	G. W. Blunt White Library	Detre Library & Archives
Library City	Storrs	New Bedford	Mystic	Pittsburgh
Library State	CT	MA	CT	PA
Collection Year: Beg	1792	1825	1833	1890
Collection Year: End	1976	1939	1943	1970

Many other bank archives were examined, but none of the others that we found had loan books. Bank archives seem to mostly have the minutes of directors' meetings.

2. Data for the Period 1987-2016

The loan maturity data for this period comes from the Federal Reserve's E.2 Survey of the Terms of Lending. The survey includes both secured and unsecured loans. The Fed asked banks to report what percent was secured, but the maturity data is only reported in total, no breakdown of maturity by secured or not. However, as mentioned above (in footnote 2), the trend is collateralized lending is basically flat. The full set of the Federal Reserve data can be found here: Survey of Terms of Business Lending.

The Board of Governors has discontinued the Survey of Terms of Business Lending (STBL) and the associated E.2 release. The final survey was conducted in May 2017, and the final E.2 was released on August 2, 2017. The old survey has been replaced by a new Small Business Lending Survey that started in February 2018. The new survey is being managed and administered by the Federal Reserve Bank of Kansas City. For background see: https://www.federalreserve.gov/reportforms/formsreview/FR2028A_FR2028B_FR2028S_20120620_omb.pdf

Appendix B: Macro Data

1. Data sources

In this section, we give detailed data sources for our calibration analysis.

a. 1987-2016

Our macro data are mainly from aggregate St. Louis Federal Reserve Bank FRED database and federal's official institutions Bureau of Economic Analysis.

- Total employees: All Employees, Total Private, Thousands of Persons, Monthly, Seasonally Adjusted from FRED.
- Service employees: All Employees, Private Service-Providing, Monthly, Seasonally Adjusted from FRED.
- Manufacturing employees: All Employees, Manufacturing, Thousands of Persons, Monthly, Seasonally Adjusted from FRED.
- Total output: Real Gross Domestic Product, Quarterly, Seasonally Adjusted from FRED.
- Service Output: Real gross domestic product: Services, Billions of Chained 2012 Dollars, Quarterly, Seasonally Adjusted Annual Rate from FRED.
- Manufacturing output: Real gross domestic product: Goods, Billions of Chained 2012 Dollars, Quarterly, Seasonally Adjusted Annual Rate from FRED.
- Total Capital, manufacturing capital and service capital: detailed Current-Cost Net Capital Stock of Private Non-residential Fixed Assets from BEA. (summing up the sectors)
- Risk-free interest rate: Effective Federal Funds Rate
- Bond Yield: Moody's Seasoned Aaa Corporate Bond Yield, retrieved from FRED, Federal Reserve Bank of St. Louis
- Default rate: Delinquency Rate on Commercial and Industrial Loans, All Commercial Banks, Quarterly, Seasonally Adjusted from FRED.

b. 1929-1941

- Employment, capital, long-term and short-term Treasury rates, Historical Statistics of the United States

- Total output and manufacturing output, National Income and Product Accounts of the United States, Table 6.3, p. 256.
- AAA bond yield, Moody's seasoned Aaa bond yield, retrieved from FRED.
- PPP, Wholesale and producer price indices, Bureau of Labor, Table Cc66-83.

2. Data Processing

For all data series, we use the 3-year moving average to reduce the possible random errors in macro statistics. When calculating average output growth share of all factors we Winsorize the extreme values. Specifically, we calculate the absolute value of the difference between realized output growth and estimated output growth:

$$\epsilon = |Growth_{realized} - Growth_{estimate}|$$

For the data points above 90% quantile or below 10% quantile, the replace the data points with:

$$Growth_{estimate,t} = \frac{(Growth_{real,t-1} + Growth_{real,t+1})}{2}$$

Appendix C: Calculation of Differentials

For the differentials that cannot be analytically solved from the model, we use Newton Interpolation method to estimate them. Specifically, the Newton's first-order and second-order difference quotients are as follows:

$$f[x_i, x_j] = \frac{f(x_i) - f(x_j)}{x_i - x_j}, i \neq j \;\&\; x_i \neq x_j$$

$$f[x_i, x_j, x_k] = \frac{f[x_i, x_j] - f[x_j, x_k]}{x_i - x_j}, i \neq j \neq k \;\&\; x_i \neq x_j$$

The second-order Newton Interpolation formula is:

$$f(x) = f(x_0) + f[x_0, x_1](x - x_1) + f[x_0, x_1, x_2](x - x_0)(x - x_1)$$

Then in the model, knowing (x_0, x_1, x_2) and (y_0, y_1, y_2), with $x_0 < x_1 < x_2$ and $y_0 < y_1 < y_2$, we have:

$$\frac{\partial y}{\partial x} = f[x_0, x_1] + (2x - x_0 - x_1)f[x_0, x_1, x_2] = f[x_0, x_1] + (2x - x_0 - x_1)\frac{f[x_2, x_1] - f[x_1, x_0]}{x_2 - x_0}$$

$$= \frac{(x_1 + x_2 - 2x)f[x_0, x_1]}{x_2 - x_0} + \frac{(2x - x_0 - x_1)f[x_2, x_1]}{x_2 - x_0}$$

$$= \frac{(x_1 + x_2 - 2x)(y_1 - y_0)}{(x_2 - x_0)(x_1 - x_0)} + \frac{(2x - x_0 - x_1)(y_2 - y_1)}{(x_2 - x_0)(x_2 - x_1)}$$

$$= \frac{(2x - x_1 - x_2)y_0}{(x_2 - x_0)(x_1 - x_0)} + \frac{(2x - x_0 - x_1)y_2}{(x_2 - x_0)(x_2 - x_1)} + \frac{(x_1 + x_2 - 2x)y_1}{(x_2 - x_0)(x_1 - x_0)} - \frac{(2x - x_0 - x_1)y_1}{(x_2 - x_0)(x_2 - x_1)}$$

Plug in $x = x_1$, and we have:

$$\frac{\partial y}{\partial x}|_{x_1} = \frac{y_0(x_1 - x_2)}{(x_0 - x_1)(x_0 - x_2)} + y_1\frac{2x_1 - x_0 - x_2}{(x_1 - x_0)(x_1 - x_2)} + \frac{y_2(x_1 - x_0)}{(x_2 - x_1)(x_2 - x_0)}$$

Appendix D: Calibration Tables

	A^M	A^N	K	L	λ
1930	4.20%	123.37%	-31.77%	45.86%	18.60%
1931	13.67%	101.69%	-5.57%	50.84%	29.09%
1932	15.36%	59.98%	6.06%	38.48%	26.83%
1933	-26.34%	99.65%	-56.40%	3.53%	-24.20%
1934	-7.00%	77.22%	-18.66%	43.46%	22.03%
1935	-1.96%	74.38%	-10.66%	61.12%	39.39%
1936	-1.22%	36.83%	-11.97%	43.08%	22.17%
1937	-1.65%	74.86%	-1.81%	44.43%	36.09%
1938	-1.02%	75.81%	15.90%	11.05%	29.49%
1939	0.40%	57.24%	17.36%	18.31%	41.42%
1940	4.71%	57.97%	7.04%	25.45%	48.34%
AVG	-0.08%	76.27%	-8.23%	35.06%	26.30%

Table D1-1 Contribution to Realized Output Growth (1929-1941)

Note: Some of the extreme values due to close-to-zero-denominator are replaced by the average of the values before and after them.

	A^M	A^N	K	L	λ
1930	2.62%	76.98%	-19.82%	28.62%	11.60%
1931	7.21%	53.60%	-2.94%	26.80%	15.33%
1932	10.47%	40.88%	4.13%	26.23%	18.29%
1933	2.25%	53.43%	-5.91%	31.68%	18.56%
1934	-5.98%	65.98%	-15.95%	37.13%	18.82%
1935	-1.21%	45.84%	-6.57%	37.67%	24.27%
1936	2.84%	29.39%	0.10%	23.15%	44.52%
1937	-0.67%	6.60%	8.03%	23.38%	62.66%
1938	-0.78%	57.77%	12.12%	8.42%	22.47%
1939	0.30%	42.48%	12.89%	13.59%	30.74%
1940	3.28%	40.39%	4.91%	17.73%	33.69%
AVG	1.85%	46.67%	-0.82%	24.95%	27.36%

Table D1-2 Contribution to Estimated Output Growth (1929-1941)

Note: Some of the extreme values due to close-to-zero-denominator are replaced by the average of the values before and after them.

	A^M	A^N	K	L	λ
1988	-20.78%	-56.74%	24.61%	25.51%	88.65%
1989	-52.54%	-261.26%	121.45%	115.42%	190.75%
1990	-7.08%	-108.66%	91.10%	81.81%	87.70%
1991	38.38%	43.93%	60.74%	48.20%	-15.34%
1992	83.84%	196.52%	30.39%	14.58%	-118.39%
1993	37.48%	181.37%	36.88%	41.76%	203.41%
1994	-0.54%	-19.02%	26.44%	46.31%	62.05%
1995	-3.16%	19.23%	55.25%	73.05%	126.83%
1996	-4.39%	61.45%	50.38%	48.97%	113.57%
1997	-4.32%	74.92%	38.52%	26.22%	85.50%
1998	12.56%	14.12%	29.03%	19.42%	48.76%
1999	20.73%	41.47%	44.72%	27.37%	47.95%
2000	71.90%	194.26%	146.22%	81.88%	75.85%
2001	38.55%	133.95%	99.83%	37.65%	50.57%
2002	5.20%	73.65%	53.43%	-6.58%	25.29%
2003	-5.68%	-190.29%	-249.87%	81.92%	-238.91%
2004	13.08%	-55.43%	104.03%	50.66%	118.69%
2005	19.54%	-74.10%	145.44%	93.98%	366.64%
2006	11.01%	-38.77%	90.61%	73.16%	248.75%
2007	2.49%	-3.45%	35.78%	52.35%	130.86%
2008	-6.04%	31.88%	-19.05%	31.53%	12.97%
2009	-9.65%	18.34%	-36.71%	-4.02%	-21.50%
2010	-45.24%	19.12%	-9.43%	16.53%	8.02%
2011	-16.86%	-8.75%	-72.04%	-75.12%	-90.44%
2012	-116.42%	20.67%	45.14%	57.62%	67.06%
2013	8.01%	87.01%	58.75%	71.27%	294.62%
2014	7.29%	123.53%	53.48%	60.62%	206.04%
2015	2.48%	58.62%	23.12%	24.34%	29.92%
AVG	2.85%	20.63%	38.51%	43.44%	78.78%

Table D2-1 Contribution to Real Output Growth (1987-2016)

Note: Some of the extreme values due to close-to-zero-denominator are replaced by the average of the values before and after them.

	A^M	A^N	K	L	λ
1988	-33.93%	-92.64%	40.18%	41.65%	144.74%
1989	6.33%	-18.95%	27.07%	22.55%	63.00%
1990	46.60%	54.74%	13.97%	3.45%	-18.75%
1991	43.56%	74.85%	14.33%	5.25%	-37.98%
1992	40.51%	94.96%	14.68%	7.05%	-57.21%
1993	7.48%	36.21%	7.36%	8.34%	40.61%
1994	-0.47%	-16.51%	22.95%	40.18%	53.85%
1995	-1.17%	7.09%	20.37%	26.94%	46.77%
1996	-1.63%	22.76%	18.66%	18.14%	42.06%
1997	-1.96%	33.93%	17.44%	11.87%	38.71%
1998	10.14%	11.40%	23.43%	15.67%	39.36%
1999	11.38%	22.75%	24.54%	15.02%	26.31%
2000	12.61%	34.07%	25.65%	14.36%	13.30%
2001	4.71%	57.52%	32.31%	0.33%	5.13%
2002	3.44%	48.78%	35.39%	-4.36%	16.75%
2003	0.94%	31.57%	41.45%	-13.59%	39.63%
2004	5.66%	-23.99%	45.03%	21.93%	51.37%
2005	3.54%	-13.44%	26.37%	17.04%	66.48%
2006	2.81%	-9.79%	19.92%	15.35%	71.70%
2007	-4.48%	26.18%	-8.60%	38.41%	48.50%
2008	-11.77%	62.14%	-37.13%	61.47%	25.29%
2009	-4.65%	43.09%	-11.07%	55.25%	34.04%
2010	0.34%	22.93%	5.87%	39.52%	31.34%
2011	6.40%	3.32%	27.37%	28.54%	34.36%
2012	3.97%	10.03%	19.34%	21.13%	45.53%
2013	1.54%	16.74%	11.31%	13.71%	56.70%
2014	1.62%	27.39%	11.86%	13.44%	45.69%
2015	1.79%	42.33%	16.69%	17.58%	21.60%
AVG	5.55%	21.77%	18.10%	19.87%	35.32%

Table D2-2 Contribution to Estimated Output Growth (1987-2016)

Note: Some of the extreme values due to close-to-zero-denominator are replaced by the average of the values before and after them.

Appendix E: Calibration Results with Default Risk Calibrated with Bank Delinquency Rates (from FRED)

Results for 1987-2016, $\underline{p}$ = 24.52% $\alpha = 0.968$ $\bar{\tau} = 1.97$

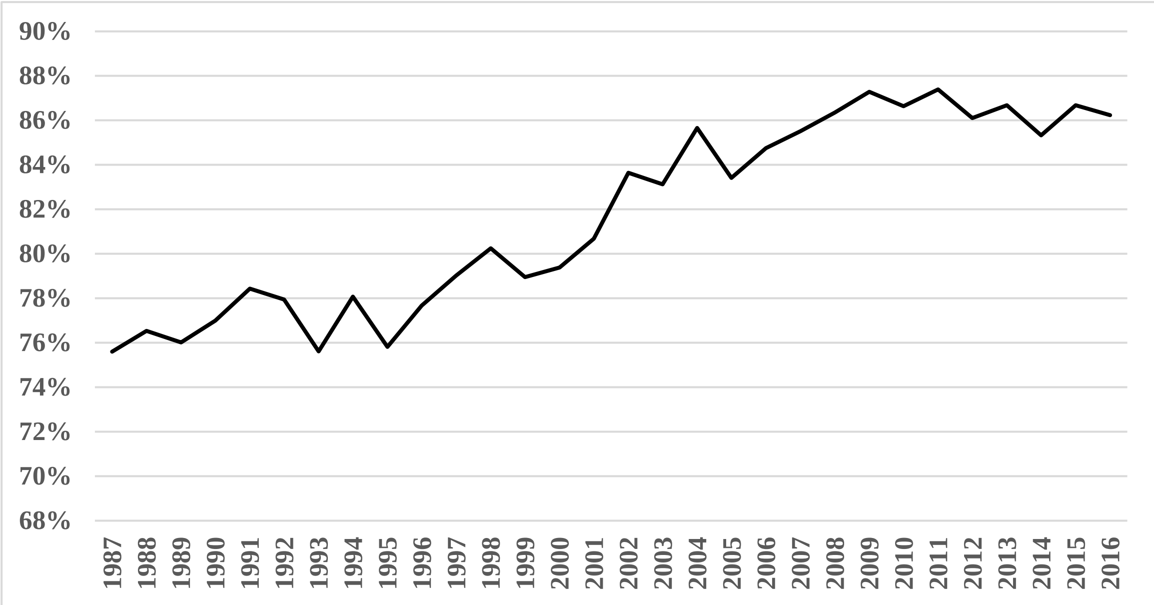


Figure E3-1 Overall Trend for p^* (1987-2016)

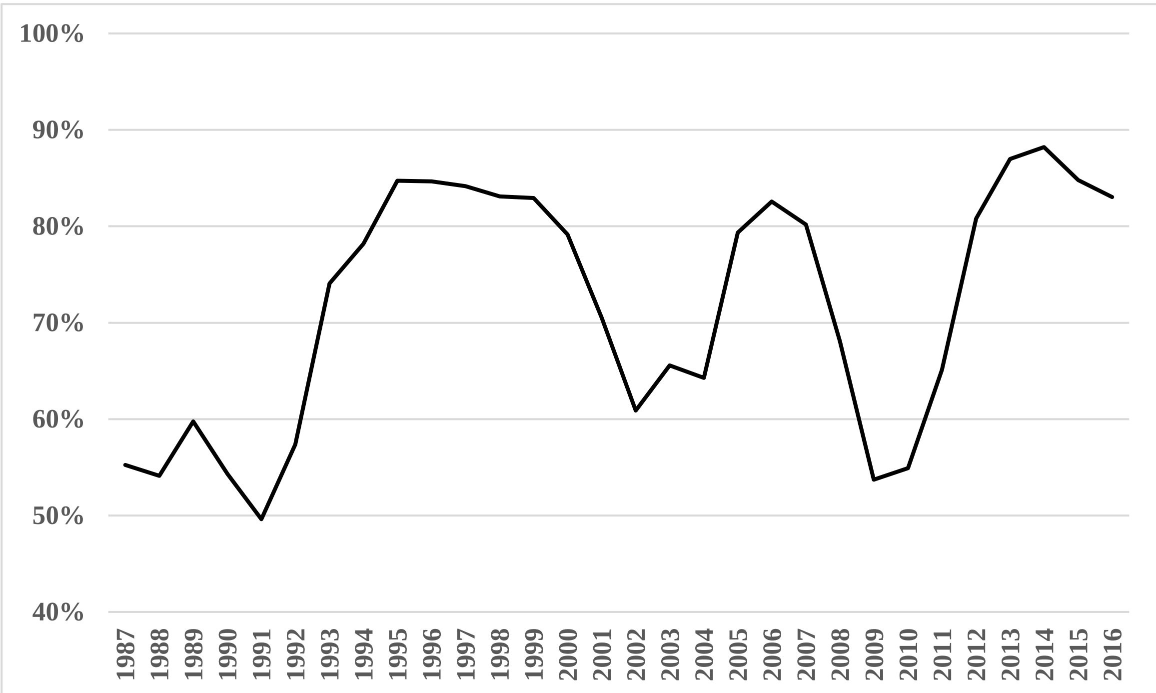


Figure E3-2 Overall Trend for λ (1987-2016)

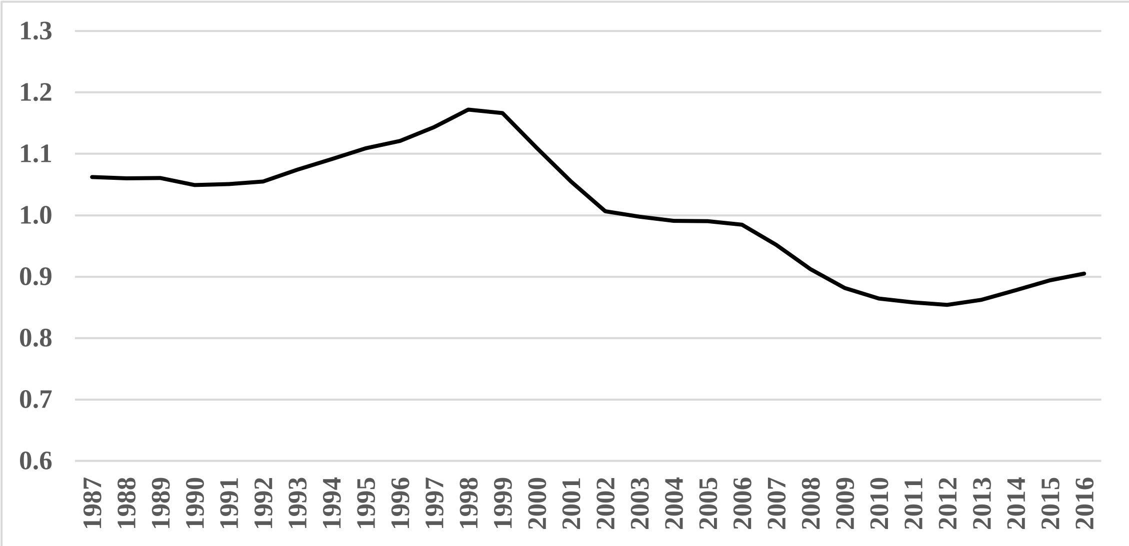


Figure E3-3 Overall Trend for A^M (1987-2016)

	A^M	A^N	K	L	λ
1988	29.55%	-83.99%	61.89%	25.51%	95.66%
1989	-50.97%	-108.20%	140.39%	49.06%	175.92%
1990	-183.27%	23.87%	101.56%	24.57%	76.30%
1991	-82.82%	42.18%	60.98%	12.51%	39.69%
1992	17.63%	60.49%	20.40%	0.44%	3.08%
1993	12.81%	66.13%	29.80%	32.50%	30.66%
1994	3.73%	44.65%	25.83%	46.31%	41.47%
1995	4.37%	109.10%	45.23%	84.69%	84.00%
1996	1.44%	111.28%	34.75%	68.25%	74.64%
1997	2.02%	101.51%	34.11%	26.22%	47.07%
1998	17.76%	73.98%	25.93%	17.84%	6.26%
1999	50.18%	117.17%	42.53%	26.53%	-28.05%
2000	112.13%	389.21%	154.39%	81.88%	6.90%
2001	60.43%	259.59%	93.99%	25.62%	-92.46%
2002	8.73%	129.97%	33.60%	-30.65%	-191.82%
2003	15.56%	8.61%	77.47%	10.00%	-14.42%
2004	22.39%	-112.74%	121.34%	50.66%	162.97%

2005	14.91%	-78.45%	85.27%	45.88%	125.70%
2006	7.44%	-44.16%	49.20%	41.09%	88.43%
2007	-0.03%	-9.87%	13.13%	36.31%	51.16%
2008	-7.51%	24.42%	-22.94%	31.53%	13.89%
2009	-7.75%	39.14%	-45.75%	-4.02%	-27.58%
2010	-8.00%	53.85%	-68.55%	-39.57%	-69.06%
2011	-8.24%	68.57%	-91.36%	-75.12%	-110.54%
2012	10.82%	2.78%	52.53%	57.62%	149.87%
2013	11.73%	77.72%	63.03%	68.38%	155.42%
2014	9.49%	130.01%	56.45%	60.62%	119.38%
2015	3.84%	63.98%	25.35%	24.34%	42.30%
AVG	2.44%	55.74%	43.59%	28.54%	37.74%

Table E3-1 Contribution to Realized Output Growth (1987-2016)

Note: Some of the extreme values due to close-to-zero-denominator are replaced by the average of the values before and after them.

	A^M	A^N	K	L	λ
1988	22.98%	-65.31%	48.12%	19.83%	74.38%
1989	13.00%	5.84%	30.85%	2.39%	47.92%
1990	17.99%	-29.73%	39.49%	11.11%	61.15%
1991	8.02%	41.41%	22.22%	-6.34%	34.69%
1992	17.28%	59.28%	19.99%	0.43%	3.01%
1993	7.45%	38.47%	17.34%	18.91%	17.83%
1994	2.30%	27.57%	15.95%	28.59%	25.60%
1995	1.33%	33.33%	13.82%	25.87%	25.66%
1996	0.50%	38.32%	11.97%	23.51%	25.71%
1997	0.96%	48.13%	16.17%	12.43%	22.32%
1998	12.53%	52.18%	18.29%	12.58%	4.42%
1999	24.08%	56.24%	20.41%	12.73%	-13.46%
2000	15.06%	52.28%	20.74%	11.00%	0.93%
2001	6.29%	62.67%	23.33%	0.20%	7.52%
2002	3.16%	23.48%	6.03%	2.22%	65.11%

2003	0.03%	-15.71%	-11.26%	4.24%	122.70%
2004	9.15%	-46.09%	49.60%	20.71%	66.62%
2005	3.89%	-14.08%	15.88%	4.84%	89.46%
2006	-1.37%	17.94%	-17.84%	-11.02%	112.29%
2007	2.94%	-4.20%	-1.32%	-37.67%	140.25%
2008	0.78%	6.87%	-9.58%	-24.35%	126.27%
2009	5.10%	-15.26%	6.93%	-51.00%	154.23%
2010	-3.95%	10.73%	-34.22%	95.65%	31.80%
2011	3.80%	-31.65%	42.16%	34.67%	51.01%
2012	3.95%	1.01%	19.20%	21.06%	54.77%
2013	3.12%	20.65%	16.75%	18.17%	41.31%
2014	2.52%	34.58%	15.02%	16.13%	31.75%
2015	2.40%	40.03%	15.86%	15.23%	26.47%
AVG	6.62%	16.04%	15.43%	10.08%	51.85%

Table E3-2 Contribution to Estimated Output Growth (1987-2016)

Note: Some of the extreme values due to close-to-zero-denominator are replaced by the average of the values before and after them.

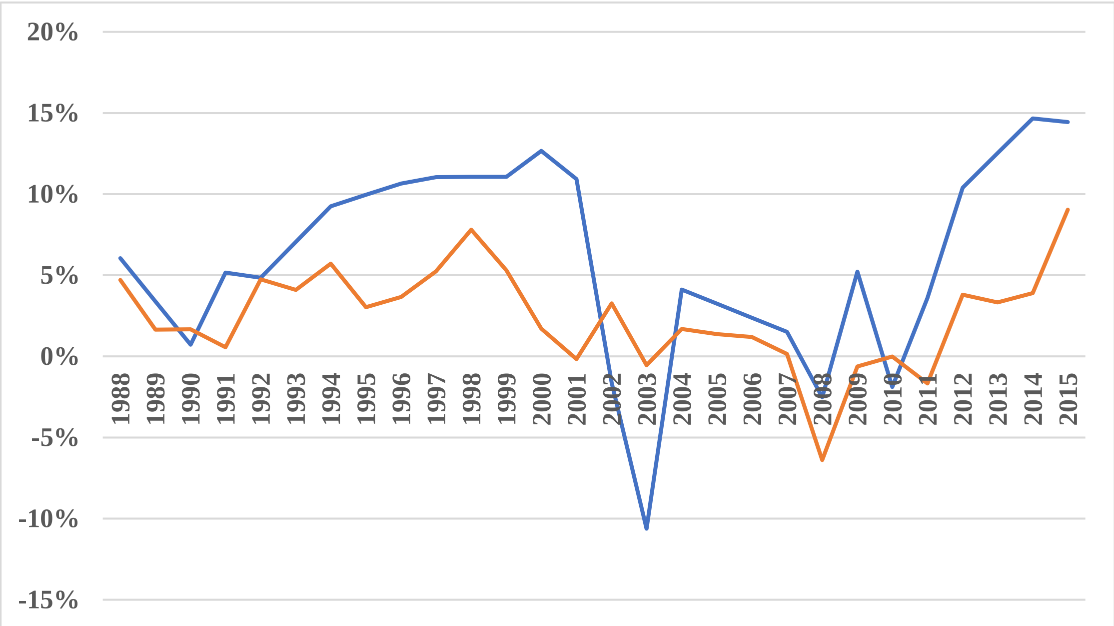


Figure 3-4 Realized Output Growth vs. Estimated Output Growth, Correlation = 0.63 (1987-2016, the Realized Output Growth is in Orange)

References

Amaral, Pedro S., and Erwan Quintin (2010), "Limited Enforcement, Financial Intermediation, and Economic Development: A Quantitative Assessment," *International Economic Review*, 51(3): 785–811.

Beam, Francis H. (1947) "Term Loans," Business Lawyer (American Bankers Association) 2, no. 3 (July), 9-15.

Benmelech, Efraim, Jennifer Dlugosz, and Victoria Ivashina (2012), "Securitization without Adverse Selection: The Case of CLOs," *Journal of Financial Economics* 106, 91-113.

Benmelech, Efraim, Carola Frydman and Dimitris Papanikolaou (2019), "Financial Frictions and Employment during the Great Depression," *Journal of Financial Economics* 133, 541-563.

Berg, Tobias, Anthony Saunders, and Sascha Steffen (2021), "Trends in Corporate Borrowing," *Annual Review of Financial Economics* 13, forthcoming.

Bernanke, Ben (1983), "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review*, 73, pp. 257-276.

Bord, Vitaly and João Santos (2015), "Does Securitization of Corporate Loans Lead to Riskier Lending?" *Journal of Money, Credit and Banking*, 47,415-444.

Buera, Francisco J., Joseph P. Kaboski, and Yongseok Shin (2011), "Finance and Development: A Tale of Two Sector," *American Economic Review* 101, 1964–2002.

Calomiris, Charles, Thekla Halouva, and Sandra Ospina. 1996. "Debt Maturity, Financial Asset Accumulation, and the Cost of External Finance: Evidence from the United States and Colombia." World Bank, Policy Research Department.

Chen, Hui, Yu Xu, and Jun Yang (2012), "Systematic Risk, Debt Maturity, and the Term Structure of Credit Spreads," *Journal of Financial Economics* 139, 770-799.

Chen, Sophia, Paola Ganum, Lucy Liu, Leonardo Martinez, and Soledad Martinez Peria (2018), "Debt Maturity and the Use of Short-term Debt," IMF Working Paper No. 19/03.

Crafts, Nicholas (2018), "The Productivity Slowdown: is it the 'New Normal'?" Oxford Review of Economic Policy, Volume 34, Number 3, 2018, pp. 443–460.

de Fontenay, Elisabeth (2014), "Do the Securities Laws Matter-- The Rise of the Leveraged Loan Market," *Journal of Corporate Law* 39, 725-768.

Demirgüç-Kunt, Asli and Vojislav Maksimovic (1999), "Institutions, Financial Markets, and Firm Debt Maturity," *Journal of Financial Economics* 54, 295-336.

Dennis, Seven and Donald J. Mullineaux (2000), "Syndicated Loans," *Journal of Financial Intermediation* 9, 404–426.

Drucker, Steven and Manju Puri (2009), "On Loan Sales, Loan Contracting, and Lending Relationships," *Review of Financial Studies* 22, 2835-2872.

Field, Alexander (2011), A Great Leap Forward: 1930s Depression and U.S. Economic Growth (Yale University Press).

Field, Alexander (2003), "The Most Technologically Progressive Decade of the Century," *American Economic Review* 93, 1399-1413.

Foley-Fisher, Nathan, Gary Gorton, and Stéphane Verani (2021), "Adverse Selection Dynamics in Privately-Produced Safe Debt Markets," SSRN Working Paper.

Foulke, Roy and Herbert Prochnow (1939), Practical Bank Credit (Prentice-Hall).

Friedman, Milton (1956), Studies in the Quantity Theory of Money, The University of Chicago Press.

Gadanecz, Blaise (2004), "The Syndicated Loan Market: Structure, Development and Implications," *BIS Quarterly Review* (December),75-89.

Giné, Xavier, and Robert M. Townsend (2004), "Evaluation of Financial Liberalization: A General Equilibrium Model with Constrained Occupation Choice," *Journal of Development Economics*, 74(2): 269–307.

Gopalan, Radhakrishnan, Fenghua Song, and Vijay Yerramilli (2014), "Debt Maturity Structure and Credit Quality," *Journal of Financial and Quantitative Analysis* 49, 817-842.

Gorton, Gary B. and Joseph G. Haubrich (1990), "The Loan Sales Market," in George Kaufman, ed.: *Research in Financial Services* 2, 85-135.

Gorton, Gary and Andrew Metrick (2013), "Securitization," Chapter 1 in the Handbook of the Economics of Finance, volume 2, Part A, edited by George Constantinides, Milton Harris, and René Stulz, Elsevier, 2013, p. 1-70.

Gorton, Gary, Stefan Lewellen and Andrew Metrick, "The Safe-Asset Share," *American Economic Review: Papers & Proceedings* 102 (May 2012), 101-106.

Gorton, Gary B. and George G. Pennacchi (1995), "Banks and Loan Sales: Marketing Nonmarketable Assets," *Journal of Monetary Economic*s 35, 389-411.

Gorton, Gary and Nicholas S. Souleles (2007), "Special Purpose Vehicles and Securitization," chapter in The Risks of Financial Institutions, edited by Rene Stulz and Mark Carey (University of Chicago Press; 2007), 549-602.

Greenwood, Jeremy, Juan M. Sanchez, and Cheng Wang (2013), "Quantifying the Impact of Financial Development on Economic Development," *Review of Economic Dynamics* 16, 194-215.

Griffin, Thomas P., Greg Nini, and David C. Smith (2019), "Losing Control? The 20-Year Decline in Loan Covenant Restrictions," SSRN Working Paper.

Jacoby, Neil and Raymond Saulnier (1942), Term Lending to Business (National Bureau of Economic Research).

Jaramillo, Fidel, and Fabio Schiantarelli. 1996. "Long-Term Debt in Ecuador: Access and Effect on Firms' Performance: Lessons from Ecuador." Policy Research Working Paper 1725. World Bank, Policy Research Department, Washington, D.C. Processed.

Jeong, Hyeok and Robert M. Townsend (2007): "Sources of TFP Growth: Occupational Choice and Financial Deepening," *Economic Theory*, 32: 179-221.

Jeong, Hyeok and Robert M. Townsend (2008), "Growth and Inequality: Model Evaluation Based on an Estimation-Calibration Strategy," *Macroeconomic Dynamics* 12. 231–284.

Kalemli-Ozcan, Sebnem, Luc Laeven, and David Moreno (2020), "Debt Overhand, Rollover Risk, and Corporate Investment: Evidence from the European Crisis," NBER Working Paper No. 24555.

Kpodar, Kangni and Kodzo Gbenyo (2010)," Short- Versus Long-Term Credit and Economic Performance: Evidence from the WAEMU [West African Economic and Monetary Union]," IMF Working Paper WP/10/115.

King, Robert and Ross Levine (1993), Finance and Growth: Schumpeter might be Right," *Quarterly Journal of Economics* 108, 717–736.

Knight, W. H. (1987), "Loan Participations Agreements: Catching Up with Contract Law," *Columbia Business Law Review*, Vol. 1987, 587-631.

Levine, Ross (2005), "Finance and Growth: Theory and Evidence," In: Aghion, P., Durlauf, S.N. (Eds.), Handbook of Economic Growth, vol. 1A. Elsevier B.V., Amsterdam, pp. 865–934.

Lucas, Robert (1977), "Understanding Business Cycles," Carnegie-Rochester Conference Series on Public Policy, vol. 5, 7-29.

Mints, Lloyd W. (1945). *A History of Banking Theory in Great Britain and the United States* (1945 ed.). Chicago & London: University of Chicago Press.

Moore, George (1959), "Term Loans and Interim Financing," Chapter 9 in Business Loans of American Commercial Banks, ed. By Benjamin Beckhart (The Ronald Press Company; New York),

Nadauld, Taylor and Michael Weisbach (2012), "Did Securitization Affect the Cost of Corporate Debt?," *Journal of Financial Economics*, 105. 332-352.

Nini, Greg (2017), "Institutional Investors in Corporate Loans," SSRN Working Paper.

Ongena, Steve and David Smith (2000), "Bank Relationships: A Review," in S. A. Zenios, and P. Harker (Eds.), Performance of Financial Institutions (pp. 221-258). Cambridge University Press.

Pavel, Christine and David Phillis (1987), "Why Commercial Banks Sell Loans: An Empirical Analysis," Federal Reserve Bank of Chicago *Economic Perspectives* (May-June), 3-14.

Peria, Maria Soledad Martinez and Sergio Schmukler (2017), "Understanding the Use of Long-term Finance in Developing Economies," IMF Working Paper WP/17/96.

Powell, Jerome (2019), "Business Debt and Our Dynamical Financial System," Speech at "Mapping the Financial Frontier: What Does the Next Decade Hold?," 24th Annual Financial Markets Conference, sponsored by the Federal Reserve Bank of Atlanta, Amelia Island, Florida.

Prochnow, Herbert (1949), Term Loans and Theories of Bank Liquidity (Prentice-Hall).

Rajan, Raghuram and Luigi Zingales (1998), "Financial Dependence and Growth," *American Economic Review* 88, 559-586.

Schiantarelli, Fabio, and Alessandro Sembenelli. 1996. "Form of Ownership and Financial Constraints." Policy Research Working Paper 1629. World Bank, Policy Research Department.

Schiantarelli, Fabio, and Vivek Srivastava. 1996. "Debt Maturity and Firm Performance: A Panel Study of Indian Public Limited Companies." Policy Research Working Paper 1724. World Bank, Policy Research Department.

Schneckenburger, Walter (1939), “Term Loans,” *Bankers’ Magazine*, May, 391-394.

Simons, Katerina (1993), “Why Do Banks Syndicate Loans?,” New England. Economic Review 45 (Jan.)., 45-46.

Thomas, Hugh and Zhiqiang Wang (2004), “The Integration of Bank Syndicated Loan and Junk Bond Markets,” *Journal of Banking & Finance* 28, 299–329.

Townsend, Robert M. (2010) *Financial Systems in Developing Economies: Growth, Inequality and Policy Evaluation in Thailand* (Oxford University Press).

Townsend, Robert M. (1979), “Optimal contracts and competitive markets with costly state verification,” *Journal of Economic Theory* 21, 256–293.

Wang, Chih-Wei, Wan-Chien Chiu, and Juan Ignacio Peña (2017), “Effect of rollover risk on default risk: Evidence from bank financing,” *International Review of Financial Analysis* 54, 130-143.

White, Eugene (2003), “The New Deal and Commercial Bank Lending,” in Makoto Kasuya, ed., Coping with Crisis: International Financial Institutions in the Interwar Period, Fuji Business History Series, (Oxford: Oxford University Press).